SOUTHWEST CHAPTER

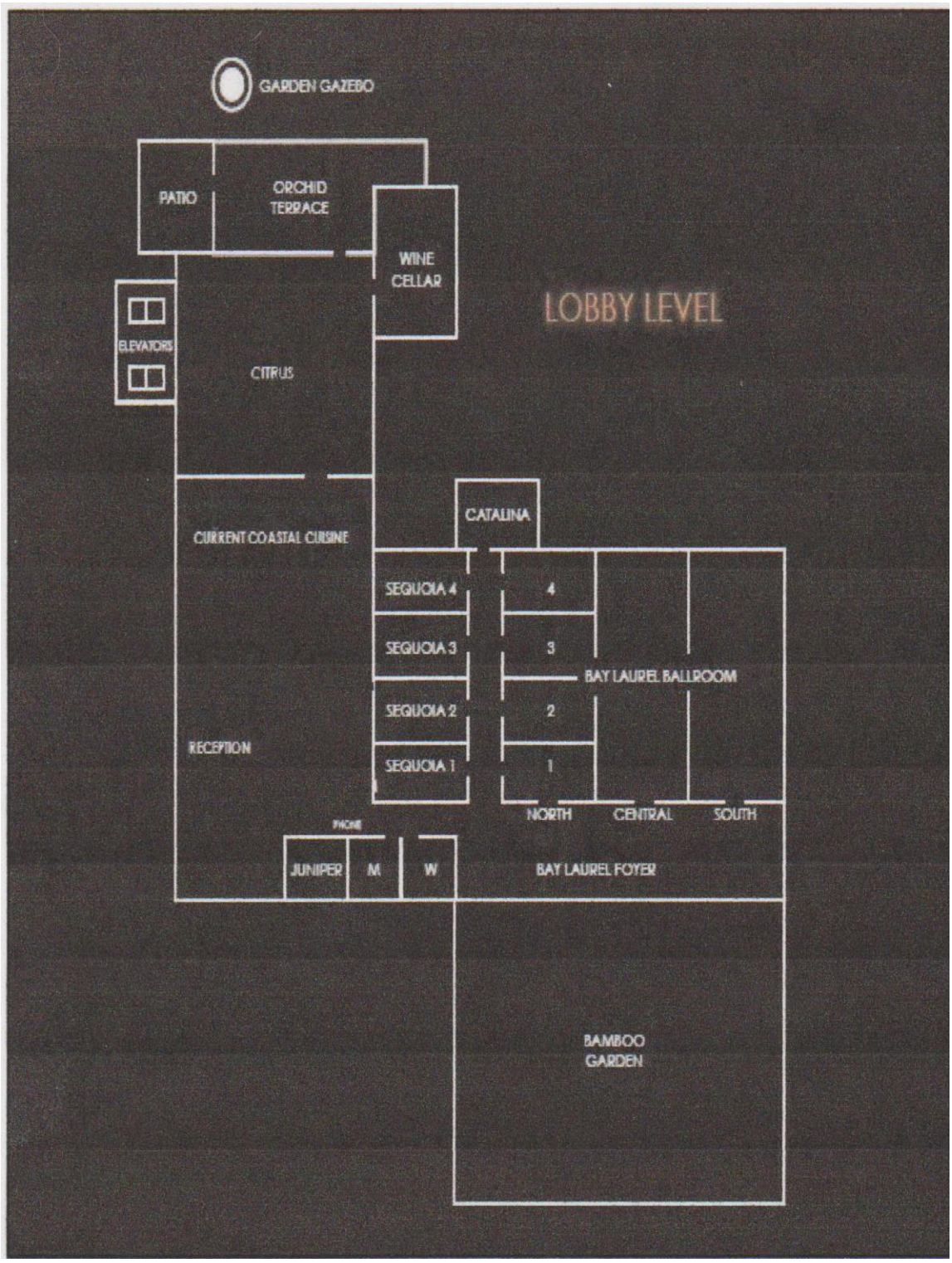
AMERICAN COLLEGE OF SPORTS MEDICINE

2019 ANNUAL MEETING

October 25-26, 2019

Renaissance Newport Beach Hotel
Newport Beach, California

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


GARDEN GAZEBO
PATIO
ORCHID TERRACE
WINE CELLAR
LOBBY LEVEL
ELEVATORS
CITRUS
CATALINA
CURRENT COASTAL CUISINE
SEQUOIA 4
4
SEQUOIA 3
3
BAY LAUREL BALLROOM
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RECEPTION
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NORTH
CENTRAL
SOUTH
PHONE
JUNIPER
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BAY LAUREL FOYER
BAMBOO GARDEN

Welcome to the

39th Annual Meeting

of the

Southwest Regional Chapter

of the

AMERICAN COLLEGE of SPORTS MEDICINE SM

October 25-26, 2019

Renaissance Newport Beach Hotel
Newport Beach, California

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

Sponsors – Thank you!!!

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The Southwest ACSM annual meeting has been approved for 13 Continuing Education Credits by the American College of Sports Medicine. There is no separate fee for CECs. Please retain the Certificate obtained at registration.

FRIDAY, 25 OCTOBER 2019

Registration **Bay Laurel Foyer** **7:30 am – 4:00 pm**

General Session **9:00 am – 10:30 am** **Bay Laurel CS**

Moderator: Todd Astorino, Ph.D., FACSM, President, SWACSM
California State University, San Marcos

SWACSM Recognition Award
Jack Young, Ph.D., FACSM
University of Nevada, Las Vegas

Preview of Meeting: Michele LeBlanc, Ph.D.
California Lutheran University

D.B. Dill Lecture
The Science Behind the Physical Activity Guidelines: Past, Present and Future
William Kraus, M.D., President, ACSM
Duke University

Undergraduate Student Research 10:45 am-12:15 pm Bay Laurel North

Link to Expanded Abstracts:
https://www.acsm.org/docs/default-source/default-document-library/swacsm-2019-progam-student-award-competition-expanded-abstracts.pdf?sfvrsn=9af2cd95_0
Moderator: Sarah Dunn, Ph.D., University of La Verne

10:45 **Impact of Physical Activity Trajectories on Colon Cancer Risk**
Christopher, Cami[1], Matthews, Charles[2], Saint-Maurice, Pedro[2], and Keadle, Sarah[1]
California Polytechnic State University, San Luis Obispo[1], National Cancer Institute[2]

11:00 **Similar Perceptual Responses to Reduced Exertion High Intensity Interval Training (REHIT) in Adults Differing in Cardiorespiratory Fitness**
Clausen, Rasmus, Marroquin, Joel, Arthur, Baliegh, and Stiles, Kevin
California State University San Marcos

11:15 **Optimal Distance for Normal Gait Speed Testing**
Saavedra, Rosalba[1], Bischoff, Brian[1], Weiss, Elijah[2], Kim, Steven[3], and Martin, Eric[1]
Kinesiology Department, California State University Monterey Bay [1], Department of Biology and Chemistry, California State University Monterey Bay [2], Department of Mathematics and Statistics, California State University Monterey Bay [3]

Concurrent Symposia 10:45 am – 12:15 pm

Physics and Physiology of Endurance Sports: Swim, Bike, and Run — **Sequoia 1-2**
Cordero Roche, MS
Boram Lim, MS,
AndrewCraig-Jones, MS
John Mercer, Ph.D.

Physical Activity and Osteoarthritis Theory & Practice — **Sequoia 3-4**
Virginia Byers Kraus, M.D., Ph.D.
Vaneet Sandhu, M.D.

LUNCH 12:30 PM- 1:45 PM

Graduate Student Research 1:45 pm – 3:15 pm Bay Laurel North

Link to Expanded Abstracts:
https://www.acsm.org/docs/default-source/default-document-library/swacsm-2019-progam-student-award-competition-expanded-abstracts.pdf?sfvrsn=9af2cd95_0

Moderator: Sarah Dunn, Ph.D., University of La Verne

1:45 **Validity and Inter-Rater Reliability of a Customized Submaximal Cycle Ergometer Test**
Fretti, Sarah, M.S., Kantor, Michael, M.S., Gubler, Coral, PT, Ph.D, and Pettitt, Robert, Ph.D, FACSM Rocky Mountain University of Health Professions

2:00 **High Intensity Intervals Expands Plasma and Improves Cycling Performance in Acute Hypoxia**
Gorini Pereira, Felipe, Berkemeier, Ariana, Venegas, Javier, Avery, Summer, Wilson, Carey, and Gillum, Trevor Ph.D. California Baptist University

2:15 **Kinematic Analysis and Neuromuscular Performance in Shooting and Fleeing Scenarios Against Law Enforcement Officers**
Kantor, Michael, M.S., Garg, Hina, Ph.D., Lau, Jeff, Ph.D., Tenbrink, Joel, Ph.D., and Pettitt, Robert, Ph.D., FACSM Rocky Mountain University of Health Professions

2:30 **Kinematic and Real-World Performance Implications of Acquiring a Novel Dart-Throwing Skill in Virtual Reality**
Lachica, Isaiah J., Drew, Stefanie A., Ph.D., Awad, Madelyn F., Armendariz, Jazlyn A., Gabay, Bar, Hinkel-Lipsker, Jacob W., Ph.D. California State University, Northridge

2:45 **Effect of Gas Compression Artifact on Expiratory Flow Limitation Assessment in Children with and without Obesity**
Strozza, Danielle[1], Wilhite Daniel P[2], Ph.D., Babb, Tony G[2], Ph.D., and Bhammar, Dharini M[2,3], Ph.D., M.D.
School of Medicine, University of Nevada, Las Vegas[1], Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital Dallas and UT Southwestern Medical Center, Dallas, TX[2], Department of Kinesiology and Nutrition Sciences, University of Nevada, Las Vegas[3]

3:00 **The Effects of 4 Weeks of Time Restrictive Feeding on Exercise Performance, Metabolism, and Recovery in Competitive Male Runners**
Tovar, Ashley, M.S. R.D.[1], Richardson, Christine, M.S.[1], Casazza, Gretchen, Ph.D.[2], and Keim, Nancy, Ph.D. R. D.[1]
[1]Department of Nutritional Biology, UC Davis, [2]Department of Neurobiology, Physiology and Behavior, College of Biological Sciences, UC Davis

Concurrent Symposia **1:45 pm – 3:15 pm**

Biomechanics: Sport Performance and Clinical Perspectives **Sequoia 1-2**

Travis Peterson, Ph.D.
Jo Armour Smith, Ph.D.
Tyler Standifird, Ph.D.

Understanding Autism Spectrum Disorder and the Effect of Exercise **Sequoia 3-4**

Areum K. Jensen, Ph.D.
Tracey Chew-Bullock, M.S.

Concurrent Symposia **3:30 pm – 5:00 pm**

Multifactorial Contributors to Knee Articular Cartilage Health in Normal and Injured Knees **Sequoia 1-2**

Michael N. Vakula, M.S.
Matthew K. Seeley, Ph.D., ATC
Derek N. Pamukoff, Ph.D.

Skeletal Muscle Blood Flow During Exercise and Blood Flow Restriction **Sequoia 3-4**

Jayson Gifford, Ph.D.
Pat Vehrs, Ph.D.

SOCIAL EVENT

Bay Laurel Ballroom **5:00 -7:00 PM**

Poster Presentation I

No Host Wine/Cheese Reception

SPECIAL EVENT

Sequoia Ballroom **7:00 - 8:30 PM**

Student Jeopardy Bowl

SATURDAY, 26 OCTOBER 2019

Registration **Bay Laurel Foyer** **7:30 am - 9:30 am**

Gatorade Sports Science Lecture

8:00 am – 9:00 am **Sequoia 1-2**

Bridging the Gap: How to Apply Sports Science as a Tool in Youth Athlete Development

Khalil Lee, Ph.D.
Gatorade Sports Science Institute

Colloquium **8:00 am – 9:00 am**

Absolute Rest May Not Be Best - How Specific Physical and Cognitive Activity Recommendations Can Foster Concussion Recovery **Sequoia 3-4**

Chris Koutures, M.D.

General Session **9:15 am – 10:45 pm** **Sequoia Ballroom**

Moderator: Todd Astorino, Ph.D., FACSM President, SWACSM
California State University, San Marcos

Student Awards – Sarah Dunn, Ph.D., University of La Verne

Recognition of Host School:
California State University, Northridge

Business Meeting

Founders Lecture

The Effect of Food-based Supplements and Intermittent Fasting on Athletic Performance

Stella Volpe, Ph.D.
Drexel University

SOCIAL EVENT

Bay Laurel Ballroom 11:00 AM -1:00 PM

Poster Presentation II

SOUTHWEST ACSM RECOGNITION AWARD

1982	D.B. Dill
1983	Albert Behnke
1984	Steve Horvath
1985	Fred Kasch
1986	John Boyer
1987	Herbert de Vries
1988	Charles Tipton
1989	G. Lawrence Rarick
1990	Lawrence Morehouse
1991	William Haskell
1992	Ralph Paffenbarger
1993	Franklin Henry
1994	George Brooks
1995	James Skinner
1996	Christine Wells
1997	Lawrence Golding
1998	Ken Baldwin
1999	Robert Conlee
2000	Gail Butterfield
2001	R. James Barnard
2002	Gene Adams
2003	Vivian Heyward
2004	Fred Roby
2005	Marta Van Loan
2006	Jack Wilmore
2007	Larry Verity
2008	Steven Loy
2009	Lorraine Turcotte
2010	William Beam
2011	Priscilla MacRae
2012	Barbara Ainsworth
2013	J. Richard Coast
2014	Michael Hogan
2015	Marialice Kern
2016	Lee Brown
2017	Alan Hargins
2018	Glenn Gaesser
2019	Jack Young

Southwest Regional Chapter of the American College of Sports Medicine

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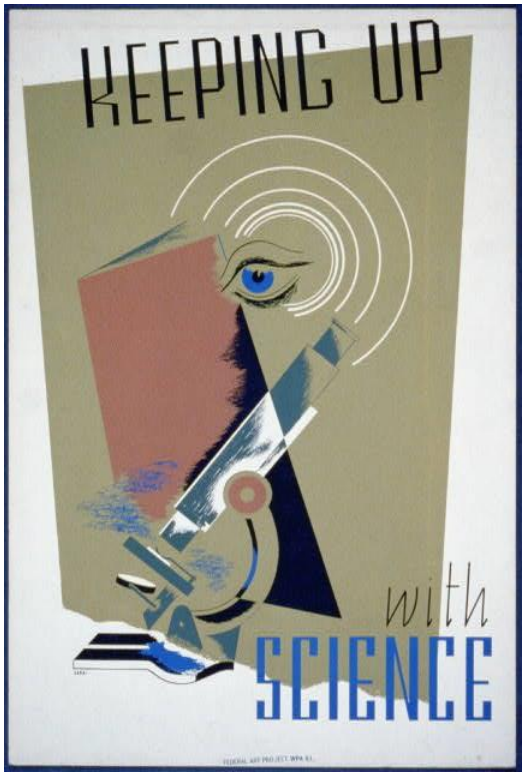
2019 SWACSM

Annual Meeting

ABSTRACTS

Poster Presentations



FRIDAY POSTER PRESENTATIONS

1. RELIABILITY OF ULTRASOUND PANORAMIC IMAGING OF MUSCLE SIZE FOR THE TRANSVERSUS ABDOMINIS

Adams, Lauren, Kho, Jade, Mitchell, Ulrike, Ph.D., and Johnson, A. Wayne, Ph.D.
Brigham Young University

Purpose: The transversus abdominis (TrA) is a key muscle in core stability. Measurements of its morphology might shed some light on structure, function and pathology of core muscles. A new ultrasound technique, panoramic imaging, could be used to visualize the whole length of the muscle in one image. The purpose of this study is to assess the degree to which this technique produces stable and consistent results. Methods: 6 female participants; age(years)= 21.3 ± 1.6; height(cm)= 167.5 ± 5.1; weight(kg) = 65.5 ± 11.0 volunteered for this study. With the participants in side-lying position, muscle length, muscle area and thickness were scanned using GE Logic S8 (6-15 MHz probe). The right and left TrA muscles were imaged twice on each subject at spinal levels L1, L3 and L5 and later measured by two separate investigators. Test-retest reliability was calculated using interclass correlation coefficient (ICC) (random subjects and fixed raters) along with the Standard Error of Measurement (SEM). Results: Our panoramic measures showed excellent intertester reliability for length, area and thickness measurements (ICC=0.981, 0.982, 0.985, respectively). In addition, the SEM for length, area and thickness were SEM= 0.178, 0.078, 0.046, respectively. Conclusion: Our method of assessing TrA morphology showed excellent reliability in the three dimensions measured and had low error rates that were equal to or better than those associated with other muscles previously measured. Panoramic imaging seems to be a reliable technique that could be used to visualize the whole TrA muscle in one image. Comparison to MRI images would further help establish its validity.

2. FOOD ACCESSIBILITY AND EATING PATTERNS IN ELITE COLLEGIATE ENDURANCE RUNNERS

Agans, Dylan[1], Fredericson, Michael MD, FACSM[2], Barrack, Michelle, PhD, RD[1], Gravani, Kristen, MS, RD[2], Papanos, Lauren, MS, RD[2], Hernandez, Chris[1], Grohmann, Erik[1], Brotman, Catherine[1], Nattiv, Aurelia MD, FACSM[2]
California State University, Long Beach[1], Stanford University[2], University of California, Los Angeles[3]

PURPOSE: This study aimed to evaluate factors relating to food accessibility and eating patterns among elite collegiate endurance runners. METHODS: From Fall 2015- 2018, runners from two NCAA Division I Cross-Country teams were invited to participate in a study designed to optimize the health of endurance runners. All runners were non-injured and training regularly. The runners met with a team sports dietitian for a 15 to 30-minute counseling appointment. In these sessions, the dietitians conducted a standardized assessment to evaluate any outcomes relating to food accessibility and eating patterns among collegiate endurance runners. RESULTS: The sample size involved 158 NCAA Division I collegiate athletes (47.1% male; 52.9% female). Runners reported training an average mileage of 66.2 ± 2.1 (males) and 49.0 ± 9.4 (females) miles per week. A total of 120 (79.5%) runners reported living in the dorms; 34.2% (n=54) reported no access to a kitchen; 3.8% (n=6) reported no access to a microwave or refrigerator; 2.5% (n= 4) reported no access to a kitchen, microwave, or refrigerator. Runners without access to a kitchen (n=54) vs. those with access to a kitchen (n=104) reported eating fewer snacks per day, 2.4 ± 1.0 vs. 3.0 ± 1.2, p=0.001. A higher proportion of runners without access to a kitchen reported eating <3 meals per day (22.2% vs. 9.6%, X2= 4.7, p=0.03). Runners living in the dorms (n=120) vs. those not living in the dorms (n=31) reported eating fewer meals per day, 2.9 ± 0.5 vs. 3.1 ± 0.5, p=0.04 and fewer snacks per day, 2.5 ± 1.1 vs. 2.9 ± 0.9, p=0.05. CONCLUSIONS: Collegiate runners living in the dorms and those without access to a kitchen reported consuming fewer meals and/or snacks per day. This may increase their risk of energy and nutrient deficits.

3. GOLF BALL KINEMATICS PLAYED FROM SLOPED ADDRESS POSITIONS

Aguilar, Jesus, Zamora, Janelle, and Peterson, Travis, Ph.D. California Lutheran University

Introduction: During the course of play, golf players must often hit shots from address positions that are different than playing shots off flat ground. Proper ball flight trajectory must be achieved for successful shot placement. Previous research has found that golf ball trajectory is affected by kinematic measurements such as: ball speed, launch angle, backspin and lateral spin (Wallace et al. 2007). Purpose: The goal of this study was to determine the changes of ball kinematics at impact when hitting golf shots from different sloped address positions. Methods: Eight skilled golf players (handicap: 5.125 ± 4.123) volunteered for this study in accordance with the local institutional review board. Players performed 10 golf shots toward a target downrange with their own 6-iron at their preferred distance when playing shots from the Flat, Uphill, Downhill, Incline and Decline conditions. A launch monitor calculated golf ball launch angle, lateral spin, and carry distance. Custom ramps oriented the force plates into the sloped address positions (increments of 5°). The hitting surface was covered with a thin layer of artificial turf to mimic conditions on the course and allow players to use their own spiked golf shoes. Differences across the group between conditions were determined using repeated measures ANOVA (α= 0.05). Results: Launch angle was significantly greater in the Uphill condition (19.32° ± 3.32°, $p < 0.029$) than all other conditions and significantly smaller in the Downhill condition (12.69° ± 2.59°, $p < 0.024$) compared to Flat, Uphill and Incline conditions. In the sagittal plane there was a significant difference in lateral spin between Incline (-289.43 rpm ± 613 rpm) and Decline conditions (378.78 rpm ± 701.51 rpm, p = 0.008). There was no significant difference in ball speed (p = 0.775) or carry distance between conditions (p = 0.179). Conclusions: Golfers were more likely to hit with a greater launch angle in an Uphill condition and a lower launch angle in a Downhill condition. Players also hit shots that spun more to the left in an Incline condition and spun to the right in a Decline condition. It may be advantageous for golfers to adjust their swing to accommodate shots played from sloped address conditions with the knowledge of the potential effects on golf shot outcome.

4. ELECTROMYOGRAPHY OF THE QUADRICEPS AND HAMSTRINGS DURING THE CONVENTIONAL DEADLIFT IN TWO SHOE CONDITIONS

ALVARADO, FANY[1], WALTERS, KELLIE[1], AVILA, ELIZABETH[1], CAMACHO, ALEXIS[1], BENNETT, HUNTER[2], AND VALENZUELA, KEVIN[1]
[1]CALIFORNIA STATE UNIVERSITY LONG BEACH, [2]OLD DOMINION UNIVERSITY

The conventional deadlift is a widely used strength exercise and barefoot lifting has become a more prominent style of training. Currently there is a lack of research comparing electromyography activity between shoe and barefoot styles of training. Purpose: The purpose of the study was to compare the difference in vastus medialis and biceps femoris muscle activity during the concentric phase of the conventional deadlift. Methods: Five subjects were recruited with at least six continuous months of deadlifting experience, 1-2 days/week of strength training, no surgeries and no low back/lower extremity injuries within the last six months. Day one consisted of 1RM testing based on the NSCA protocol. On Day two, the subject was fitted with two EMG sensors (biceps femoris, vastus medialis), MVIC testing was performed, and the subject completed two sets of five randomized repetitions (with shoes and barefoot) at 70% of their 1RM. Raw EMG data were imported into Visual 3D, EMG data were bandpass filtered (240Hz-450Hz), full-wave rectified, linear enveloped, and smoothed using a moving RMS (window size of 25 frames). A paired-samples t-test was performed to compare EMG activity of the biceps femoris and vastus medialis during two different shoe conditions. Results: The percentage of biceps femoris recruitment was significantly greater (p=0.04) in the barefoot (M=44.77, SD=36.95) vs. shoe condition (M=39.86, SD=25.77) and there was no significant difference in percentage of vastus medialis recruitment (p=0.07) between the barefoot (M=34.97,SD=16.14) and shoe (M=42.54, SD=23.50) condition. There was no significant difference between biceps femoris and vastus medialis recruitment in the shoe (p=0.91) and barefoot condition (p=0.59). Conclusions**:** Using a barefoot approach in the conventional deadlift does not appear to have an effect on percent peak muscle activation of the biceps femoris and vastus medialis muscles.

5. TRANSIENT QUADRIPARESIS IN AN ELITE RUGBY PLAYER

Anders, Alpha B.A. and Kenneth, Vitale M.D.
UCSD School of Medicine

History: A 27 year-old female elite rugby player experienced neck pain and transient all-extremity numbness after hyperextending her neck in a collision with a teammate. After 30-40 seconds, she was able to move her extremities and got up, but had residual burning and numbness of her arms and chest. She did not report the injury and decided to return to play.
Physical Exam: She presented to clinic 3 days later with bilateral arm numbness and pain. Her initial exam was remarkable for mild cervical spine tenderness at C5-6 with left paraspinal fullness and limited neck range of motion due to guarding. The patient's motor exam, reflexes, and gait were normal.
Differential Diagnosis:
1. Cervical spinal fracture
2. Stinger/burner
3. Spinal cord injury
4. Transient Quadriparesis

Test and Results: X-rays showed no acute osseous abnormality. MRI 4 days post injury showed C4-5, C5-6, and C6-7 shallow disc bulges superimposed on congenital narrowing of the spinal canal. There was no evidence of cord compression. EMG was normal without evidence of brachial plexopathy (stinger) or radiculopathy.
Final/Working Diagnosis: Transient Quadriparesis
Treatment and Outcomes: The patient was withheld from all contact/collision sports and weightlifting for 6 weeks and treated with gabapentin and physical therapy. She progressed to full speed non-contact drills after 2 months symptom free and full contact after 3 months symptom free. With guidelines based on expert opinion and clinical experience rather than well designed studies, management of transient quadriparesis remains controversial without absolute criteria to guide clinical decision making. Given her congenital spinal canal stenosis, the greatest risk factor for catastrophic injury, she had a relative contraindication for return to play (RTP) after her first episode of transient quadriparesis. However, her brief sensory-limited symptoms with complete resolution, elite status, and personal preferences guided management to permit RTP with vigilant surveillance. This case report elaborates on an elite rugby athlete's symptomatology, exam, diagnostic studies, RTP decision making, and controversy of the RTP guidelines in the medical literature.

7. FLUID LOSS IN RECREATIONAL SURFERS

Atencio, Jessica[1], Furness, James[2], Climstein, Mike[3], Mach, Leon[4], Armenta, Richard[1], Nessler, Jeff[1], Schubert, Matthew[1], Newcomer, Sean[1]
[1]Department of Kinesiology, California State University San Marcos, CA, [2]Water Based Research Unit, Bond Institute of Health and Sport, Bond University, Gold Coast, QLD, Australia, [3]School of Health and Human Sciences, Southern Cross University, Gold Coast, QLD, Australia, [4]Center for Tropical Island Biodiversity Studies, The School for Field Studies, Beverly, MA

Purpose: Surfing is an activity that provides a unique challenge to thermoregulation and hydration. The purpose of this study was to quantify fluid loss in recreational surfers, and to analyze the effects of water temperature, air temperature, exercise intensity, duration, and garment thickness on the total amount of fluid lost during a surf session. Methods: Male (n=255) and female (n=53) recreational surfers were recruited from San Diego, Costa Rica, and Australia to participate in the study. Subjects' fluid loss during surfing was assessed by comparing the average of three measurements of nude body mass pre- and post-surf session using a portable scale (SECA, CA, USA). Heart rate (HR) was measured throughout the session using a Polar FT1 receiver and T32 transmitter. Environmental conditions and surf characteristics were obtained prior to each subjects' surf session at their beach location using information directly from the National Oceanic and Atmospheric Administration's buoys located offshore (Surfline.com). Results: Post-surf weight was significantly lower than pre-surf weight with an average of 0.60 ± 0.55kg (0.82% body weight loss) decrease in body weight during a surf session. In multivariable regression, water temperature and surf session duration were associated with fluid loss. For every 5 degree Celsius increase in water temperature, there was a 0.23 kg (SE=0.014; p<0.001) increase in fluid loss and for every 10 minute increase in session duration, there was a 0.06 kg (SE=0.001; p<0.001) increase in fluid loss. Air temperature, HR, and garment thickness were not independently associated with fluid loss. In multivariable regression, water temperature, air temperature, session duration, HR, and garment thickness accounted for 27% of the variability in fluid loss among surfers. Conclusion: The findings of this study suggest that prolonged surfing at high environmental temperatures can result in significant body water deficits. Given that there are limited opportunities to rehydrate during the sport, surfers must properly hydrate before surfing to avoid the detrimental effects of dehydration.

6. CAN A WARM-UP ALTER INTRINSIC MUSCLE STIFFNESS OF A MUSCLE AT VARIOUS MUSCLE LENGTHS

Anderson Nathan, Valentine Dru, Hutchison Courtland, Risk Tanner and Feland, J. Brent Ph.D
Brigham Young University

INTRODUCTION: Shear wave elastography (SWE) is noted for its ability to determine intrinsic tensile (stiffness) changes in muscle. SWE studies have looked at resting stiffness values for particular muscles at single joint angles with fewer studies showing changes with different joint angles. To date research is limited on how a warm-up affects SWE in muscle and no studies report on how a warm-up can alter muscle stiffness through its range of motion.
PURPOSE: The purpose of this study was twofold: A) determine if a warm-up alters intrinsic muscle stiffness of the vastus lateralis (VL); and B) determine if this effect is present at different knee joint angles. SUBJECTS & METHODS: 18 people (10 M; 8 F) participated in the study (mean 22.11 ± 2.0 yrs, 69.39 ± 4.2 inches, 154.5 ± 29 lbs). All subjects wore shorts and were positioned treatment table with the hip angle at 45 degrees. Baseline SWE measurements of the vastus lateralis (VL) using a GE Logiq S8 ultrasound were taken at knee angles of 0, 45, and 90 degrees. Subjects then alternated 25 yds of 7 typical sport warm-up exercises for five minutes, from which we found increases VL temp by 1.6 degrees C in a previous study. SWE measurements were then repeated after a rest period.
STATS & RESULTS: ANOVA showed significant findings of decreased muscle stiffness of (VL) after warm-up for a knee angle 0 degrees (P<.005) and 45 degrees (P<.021) with no significant difference at 90 degrees (p=.824). Paired T-tests were then used to determine differences between pre-warm up and post warm up SWE values for each knee angle. There was a significant decrease of muscle stiffness of (VL) after warm- up from pre-knee at 45 degrees compared to post knee at 90 degrees (**P<.015).** Pre-knee at 90 degrees compared to post knee at 90 degree there was a no significant muscle stiffness change after warm-up (P<.002). Conclusion: Our findings corroborate another study reporting decreased stiffness in the hamstrings after a cycling warm-up. Based on our results this warm-up changes the intrinsic tensile stiffness as measured by ultrasound for knee movement up to a 45 degree angle but did not overcome the increase in intrinsic stiffness at 90. Future studies should determine if an extended warm-up could overcome the increased stiffness that accompanies a stretched (VL) muscle at 90 degrees or greater.

8. KINEMATIC AND KINETIC DIFFERENCES DURING A CONVENTIONAL DEADLIFT WITH AND WITHOUT SHOES

Avila, Elizabeth[1], Walters, Kellie[1], Camacho, Alexis[1], Alvarado, Fany[1], Bennett, Hunter[2], & Valenzuela, Kevin[1]
[1]California State University, Long Beach, [2]Old Dominion University

Despite the popularity of deadlifting without shoes, little research has examined the kinematic and kinetic differences during a conventional deadlift when performing the exercise barefoot. Excess joint torque in the frontal plane can be indicative of injury. Purpose: To examine the differences in frontal plane mechanics of the lower extremity and force development during a conventional deadlift with and without shoes. Methods: Participants who have been consistently deadlifting for six or more months and strength training at least two days per week were brought in to determine their one repetition maximum (1RM) on day one using the NSCA's protocol. Each participant was brought in for a second collection day at least 72 hours or more after the 1RM testing. Kinematic and kinetic data were collected using a 15-camera Qualisys Oqus system (240Hz) and two Bertec force plates (1200Hz). Participants performed five consecutive reps at 70% of their 1RM in random order (shoes and barefoot). Visual 3D was used to process raw marker and force data and to calculate frontal plane joint moments at the hip, knee, and ankle during the concentric phase. A one-way MANOVA (p<0.05) was run to investigate the different footwear conditions. Results: There was a statistical significant difference between shoes (M=-0.28 ± 0.11) and no shoes (M=-0.38 ± 0.14) during internal ankle eversion moments (p=0.018). No significant differences were detected for knee and hip abduction moments and peak vertical ground reaction force. Conclusion: The frontal plane movement had an effect on the ankle moments, but there was no change in vertical force characteristics. The increased internal ankle eversion moments did not have an effect on the peak knee or hip abduction moments, which possibly indicates that the effect did not travel up the kinetic chain.

9. RE-EXAMINING THE ENERGY EXPENDITURE OF DRIVING

Barnett, Rachel and Keadle, Sarah Ph.D.
California Polytechnic State University, San Luis Obispo

PURPOSE: Sedentary behaviors are commonly defined as having an energy expenditure <1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture. However, the Compendium of Physical Activities (Compendium), a widely used resource, assigns a MET value of 2.5 for driving, which would not meet the consensus definition of sedentary. This MET value is based on outdated automobile and metabolic technology, thus the purpose of this study is to re-examine the MET value of driving and compare driving to other sedentary behaviors and light-intensity walking (Compendium = 2.8 METs).
METHODS: Participants (n=13, average age = 32 y, 8 females) wore a portable metabolic system (Cosmed K5) during five different conditions that include sitting quietly, lounging while watching TV, sitting while working, driving, and walking at 2.0 mph. We compared mean measured MET values to the corresponding value from the Compendium using one-sampled t-test. We also ran a repeated measures ANOVA to determine whether there was any significant difference in MET values across each condition.
RESULTS: The mean MET value for driving was 1.50, which is significantly lower than the Compendium value of 2.5 ($p<0.001$). Driving yielded significantly higher MET values than quiet sitting (1.1 METs $p=0.03$) but was similar to sitting while watching TV and sitting while working. Although driving and walking at 2.0 mph have similar Compendium MET values, driving produced significantly lower MET values.
CONCLUSION: Existing MET-value estimates in the Compendium may not accurately quantify the energy expenditure of driving. Measured MET values for driving more closely correspond to sedentary behaviors than light-intensity walking. Since the average American spends 46 min/day in the car, there is a need to update the Compendium to reflect these new findings.

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10. CAN EEG EXPLAIN OBESITY-RELATED COGNITION DURING EXERCISE?

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There are currently 35% of American young adults that are obese. The consequences on the brain are just started to attract attention of the scientific community. What has been established in the literature is that obese individuals are more at risk for cognitive impairment and dementia, to an extent that some scientist believe that Alzheimer's disease is the new "type 3" diabetes [2] . However, it is still unknown if exercise has a beneficial effect on obesity-related cognition and brain activity. Purpose: (i) To determine if obese individuals brain activity (measured by electroencephalography (EEG)) differs from lean, (ii) To assess the effect of exercise on obese-related brain activity. We hypothesized that healthy-obese (OB) will have a unique brain activity pattern in response to a cognitive task (Stroop test) as compared to healthy non-obese (NO) individuals. We also suggested that a moderate intensity exercise will differentially affect brain EEG activity of OB compared to NO. Methods: Participants were split into two groups obese (OB) and non-obese (NO). Experimental protocol: The experimental timeline for the second day required participants to perform: a resting condition with eyes closed, followed by stroop test at rest (Strp 1), cycled for 20 minutes at 50% of their maximal peak power during the 10th minute of exercise a second stroop was administered (Stp2), and post exercise a last stroop test (strp3). Preliminary Stroop data suggest that NO demonstrated a significant difference for RT and ER during Strp2 vs Strp1 (236.472sec vs 289.819 sec; $p=.021$ and 1.5 vs 4.3errors; $p=.01$). There is a current trend towards significance for Strp2 vs Strp3 for RT (236.472sec vs 256.833sec) and ER (4.3 vs 3errors; $p=.01$). Conclusion: Our results are promising and further study is warranted to increase the number of the subjects to determine statistical significance in the difference found.

11. ANALYZING AND STANDARDIZING FAST GAIT SPEED TESTS USING COLLEGE STUDENTS

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Background. Functional independence, likelihood of hospitalization, and health deterioration are some of the predictions that can be gathered from utilizing a walking speed test. Literature shows that walking tests are very useful, but the literature also shows that there is much variability among test protocols. Most test protocols instruct patients to walk at their normal speed. The term normal is subjective and can be interpreted differently between different subjects. Standardizing walking studies is imperative in order to reduce variance in results and enhance clinical validity. In order to fix this, clinicians could use a fast walking speed trial as this may be more of a universal term. Purpose. The purpose of this study was to analyze fast walking speed trials and standardize the protocol for fast walking speed tests. Methods. A sample of 57 California State University of Monterey Students were told to walk 50 meters as fast as they could. The data was recorded using Brower timing gates located at 0m, 5m, 10m, 20m and 50m. Recorded data was then input into SPSS v 25.0. We utilized a repeated measures ANOVA with Bonferroni post-hoc tests to compare the individual segments. Results. A significant difference ($p< 0.001$) was found between distance segments. Based on the post-hoc tests, the speed walked in the 0-5 meters segment was significantly slower than the speed walked in the other segments. Comparing the other segments (5-10m, 10-20m, 20-50m), there was no difference in speed found ($p=0.999$). Discussion. Results suggests that when performing a fast walk test, young adults are still accelerating within the first 5 m. This may mean previous studies are primarily measuring acceleration rather than speed. Conclusions. Clinicians should account for room for acceleration in fast walk tests by having patients walk a total of 15m and analyze the speed from 5-10m. Measuring at this distance allows for acceleration from 0-5m, giving us a more accurate gauge of their fast walking speed.

12. FIBER TYPE-SPECIFIC S6 KINASE EXPRESSION IN WELL-TRAINED MEN AND WOMEN

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Purpose: Previous research suggests metabolic signaling protein concentrations are dependent upon both sex and muscle fiber type. However, it is unclear if a similar phenomenon exists in the anabolic cascade. Thus, the purpose was to assess the relative expression of the anabolic signaling substrate ribosomal protein S6 kinase (S6K) in fast and slow-twitch fibers from well-trained men and women.
Methods: Segregated pools of myosin heavy chain (MHC) I (slow) and MHC IIa (fast) fibers were obtained from resting vastus lateralis biopsies of high intensity-interval (HIIT) trained (3x per week of aerobic exercise and 1x per week of maximal HIIT for the past 12 months) men (n = 9, age = 30 ± 1 years, height = 179 ± 3 cm, body mass = 84.5 ± 3.3 kg, maximal cycling aerobic capacity = 52.4 ± 1.7 ml*kg-1*min-1) and women (n = 9, age = 27 ± 1 years, height = 165 ± 2 cm, body mass = 63.9 ± 1.8 kg, cycling maximal aerobic capacity = 45.2 ± 1.5 ml*kg-1*min-1) at rest. Expression of S6K was analyzed via capillary nano-immunoassay using tubulin as a loading control.
Results: S6K expression did not differ between MHC I and IIa fibers for either sex. Furthermore, no differences were identified between men and women for MHC I, although a trend existed ($p = 0.088$) towards more S6K expression in women vs. men for MHC IIa.
Discussion: These findings improve our understanding of the myocellular anabolic environment across sex and fiber type. Future research should implement a similar approach in other anabolic signaling proteins, in addition to their relative phosphorylation in response to exercise, to further explore this important topic.

13. A PILOT ANALYSIS INVESTIGATING EFFECTS OF LOAD CARRIAGE ON MUSCLE TRAINING LOAD DURING A SIMULATED RUCK MARCH

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INTRODUCTION: Soldiers are often required to carry equipment for extended time periods, with typical military load being ~46 kg. To condition soldiers, training officers conduct loaded marches, or ruck marches. The Reserve Officer Training Corps (ROTC) is a college program that prepares enrolled students to become officers. Ruck marches are performed by ROTC cadets, and can be physically demanding due to increased external load. Surface electromyography (sEMG) wearable technology can measure tactical tasks in a practical environment, providing a measure of training load (TL) during tasks such as a ruck march. PURPOSE: To determine the effects of load carriage on muscle TL in a simulated ruck march. METHODS: One college-aged female cadet in the ROTC program and one college-aged civilian male completed an unloaded (ULM) and loaded (LM; 6.57-kg pack) ruck march. Participants completed a 4.82-km march in 45 mins for both conditions. Prior to marching, participants were fitted with compression shorts or leggings embedded with sEMG sensors to measure the vastus lateralis and medialis (quadriceps; Q), biceps femoris (hamstrings; H), and gluteus maximus (gluteals; G) of both legs. The sEMG signal for each muscle was measured as a percentage of maximal voluntary contraction to calculate TL. The variables included the overall TL (sum of all muscles) for both participants, and ratios of muscle contribution anterior:posterior [A:P], Q:H, and G:H for the female cadet. TL was compared between ULM and LM days for both participants, and ratios were only analyzed for the cadet. RESULTS: Higher overall TL was observed for the LM compared to the ULM in both participants (female ULM = 2080.46 arbitrary units [AU], LM = 2303.09 AU; male ULM = 1524.73 AU, LM = 2036.02 AU). Muscle ratios changed from the ULM (A:P = 0.61; Q:H = 0.71; G:H = 0.82) to the LM (A:P = 0.57; Q:H = 0.61; G:H = 0.70). CONCLUSIONS: The addition of external load during the ruck march resulted in increased TL in the ROTC cadet and civilian. The load utilized in this study was much lighter (6.57-kg) compared to typical military load (46-kg), so TL could be even higher with a combat load. Additionally**,** changes in muscle ratios could be further impacted if a full combat load is carried, and this information could be used for training prescription or injury prevention. There is potential for the use of sEMG wearable technology to monitor military-specific tasks.

15. EFFECTS OF VESPA AMINO ACID MIXTURE ON SUBMAXIMAL AND MAXIMAL CYCLING PERFORMANCE

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Introduction: The ability to increase fat utilization during exercise and VO2max could dramatically improve exercise performance, especially among endurance athletes. Prior research suggests that the chronic use of a Vespa Amino Acid Mixture (VAAM) may increase fat metabolism and VO2max among elderly women (Sasai 2011). VAAM consumption provides a unique combination of amino acids (tyrine, phenylalanine, proline, and alanine) that are effective at increasing Kreb's Cycle activity, thereby facilitating increased aerobic metabolism. Purpose: The purpose of this study was to determine if a single pre-exercise dose of VAAM increased fat metabolism, VO2max, or ventilatory threshold during cycling exercise. Methods: In this single-blind pilot study, three highly active male cyclists (age 37.3 + 10.1 years) completed two exercise tests separated by one week. Prior to each exercise test, in single-blind random order, subjects consumed either an 8 ounce drink containing 100mg of naturally derived VAAM (Vespa CV-25. Vespa Power Products LLC, Davis CA) or an 8 ounce isocaloric placebo. On a cycle ergometer subjects completed four 5-minute submaximal exercise stages, followed immediately by a VO2max test. Fat metabolism (FM, kcal/min), maximal oxygen uptake (VO2max, ml/kg/min), and ventilatory threshold intensity (VT, Watts) were measured. Results: The results of these tests demonstrated an increase in submaximal FM, VO2max, and VT following the consumption of VAAM. Conclusion: The findings of this study indicate a potential improvement in aerobic exercise performance through increased fat metabolism, VO2max, and VT intensity when consuming a single 100mg dose of VAAM prior to exercise compared to a placebo. Future investigations are needed with a greater number of subjects and women to better understand the effectiveness of VAAM as an ergogenic aid.

14. WHAT GOOD IS RESEARCH IF IT IS NOT PUT INTO PRACTICE? AN EXAMINATION OF THE MOST FREQUENTLY REPORTED RESOURCES FOR GATHERING EXERCISE INFORMATION.

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Purpose: Over 80% of U.S. adults fail to meet guidelines for aerobic activity and muscle-strengthening activities (USDHHS, 2018). This number is alarming; it suggests that individuals may not be accessing evidence-based information related to initiation and/or maintenance of regular physical activity (PA). Indeed, it is imperative to identify ways to effectively share evidence-based PA recommendations with the general public, but first, accurate understanding of where individuals currently get their exercise information is required.
Methods: Our study had two aims: 1) To identify the most frequently used exercise information resources, and, 2) To determine whether differences exist in resource use between age groups. One-thousand-and-seven participants (Mage = 35.65; SD = 11.91) completed an online survey.
Results: Results of a single-group RM-ANOVA (RQ1; n = 793) indicated a significant effect of resource ($F(10.17, 8056.00) = 209.95$, $p = 0.001$, $eta^2 = 0.21$). Post hoc tests revealed that various social media (SM) resources and exercisers were reported as most frequently used to gather knowledge about exercise. Research-, government-, and exercise organization-publications were rated significantly lower than SM resources and exercisers. Results of a 3(group) x 14(resource) MANCOVA (RQ2; n = 759) indicated that, after controlling for gender, education, previous PA or kinesiology experience, and PA frequency, significant differences in resource ratings existed between age groups (i.e., 18-29; 30-49; 50+ year olds; $F(28, 1476) = 3.24$, $p = 0$ .001, $eta^2 = 0.06$). Post hoc tests revealed that the two youngest age groups reported significantly greater use of SM, exerciser, and kinesiology degree-holder resources compared to the 50+ age group.
Conclusion: Results of this study support the need for researchers to consider going beyond "traditional" knowledge dissemination methods, and for kinesiology professionals to find ways to vet exercise information that is freely available on SM platforms.

16. VALIDATION OF THE HUMON HEX LACTATE THRESHOLD ESTIMATE

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Purpose: Fitness trackers are evolving to be able to track a range of fitness and physiological metrics, including muscle oxygen saturation and lactate threshold (LT). The Humon Hex (HH) is a low-cost wearable device that uses continuous-wave NIRS to determine muscle oxygen saturation. The HH is unique in its ability to estimate a person's LT based on the muscle oxygen saturation during a threshold test. Therefore the purpose of this study was to determine the validity and accuracy in predicting a person's LT compared to lab based measurements.
Methods: 10 healthy, recreational runners (3 male, 7 female, 25 ± 4yrs, 67.0 ± 15.4kg, 172.37 ± 8.84cm, 24.4 ± 17.6km/week) participated in a single threshold test on a treadmill. The protocol was dictated by the HH device ("Threshold Test" in the app) and involved increasing the speed by 0.22 m/s (0.5 mph) every 3 minutes until volitional exhaustion was achieved. After each 3 minute stage was completed, participants would straddle the treadmill belt while researchers collected and analyzed the blood lactate levels using the Lactate Scout Analyzer. The HH LT estimate was provided by the Humon website. The measurements from the blood lactate levels were recorded and graphed, and LT was derived by identifying the point where lactate levels had a greater than 1mmol/L jump from the previous stage that also placed the total lactate concentration above 4mmol/L. A 2-tailed, paired t-test, mean absolute percentage error (MAPE), single measures Intraclass Correlations (ICC), and Bland-Altman analysis with accompanying bias and Limits of Agreement were performed, calculated and plotted. Results: The HH overestimated LT velocity on average by 0.77km/hr (HH = 12.23 ± 1.06km/hr, derived LT = 11.46 ± 0.92km/hr, $p = 0.044$). There was a MAPE of 7.88% and an ICC of 0.358 with a 95% confidence interval of -0.152 to 0.769 ($F(10,10) = 2.612$, $p = 0.084$).
Conclusion: The HH overestimated LT compared to laboratory tests ($p < 0.05$), has a MAPE of above 5% in a laboratory setting, and an ICC well below 0.7 with no significant relationship. Although the sample size is small, this data suggests that the HH does not produce a valid estimate of LT compared to lab based tests. Therefore, lab based measurements are still the preferable method for determining LT**.**

17. INFLUENCE OF RESISTANCE TRAINING ON STRENGTH AND GAIT KINETICS IN INDIVIDUALS WITH ACL RECONSTRUCTION

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Purpose: Individuals with anterior cruciate ligament reconstruction (ACLR) demonstrate reduced hip and knee extensor strength in their injured limb. Previous research suggests strength imbalances reduce an individuals' ability to propel themselves forward during gait as indicated by the impulse of the anterior ground reaction force (propulsive force; pGRF). As resistance training increases muscular strength, it may improve any propulsion deficits. Therefore, the purpose of this study was to compare hip and knee extensor strength as well as pGRF characteristics between individuals with ACLR who resistance train (RT) and ones who do not (NRT). Methods: Hip and knee extensor strength and gait were measured in 16 individuals (22.4±4.2 yr, 1.7±0.1 m, 73.8±15.1kg) with unilateral ACLR via isokinetic dynamometry and force platforms, respectively. The RT group had individuals who resistance trained according to the American College of Sports Medicine guidelines consistently after completion of physical therapy. The NRT group included individuals who did not resistance train at all. Independent samples T-tests were used to compare peak hip and knee extensor strength (Nm/kg-1), peak pGRF (N/kg-1), and pGRF impulse (N•s/kg-1) between the RT and NRT groups. Bivariate correlations were used to identify if hip and knee extensor strength were related to pGRF and pGRF impulse. Results: The RT group had greater peak knee extensor torque at 60o/sec-1 (KE60) and 180o/sec-1 (KE180) compared to the NRT group. No differences were observed between groups in peak hip torque, pGRF, or pGRF impulse. There was a negative correlation between KE60 and pGRF during walking (r = -0.531, p=0.034). No correlations were found between pGRF impulse and hip or knee torque. Conclusion: Results confirm our hypothesis that in ACLR, individuals in the RT group exhibited greater knee extensor torque than the NRT group. Additionally, greater KE60 was related to less pGRF during walking. An exploratory analysis found no differences in walking or running velocities, indicating the RT group accomplishes the same goal with less force. This may demonstrate greater movement efficiency resulting from resistance training above the improvements in strength alone.

19. EFFECT OF A 2-KM SWIM ON THE CYCLING POWER-DURATION RELATIONSHIP

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Purpose: Triathlon combines three sports (swimming, cycling, and running) into a single race and, because triathletes must cycle after the swimming, it is important to understand how cycling power may be affected by prior swimming. Therefore, the purpose of this study was to determine the effects of a 2-km swim at a self-selected race pace intensity on the cycling power-duration relationship measured during a 3-min all-out cycling test (3MT). Methods: Eighteen trained triathletes (12 M, 6 F; 37.1 ± 10.6 years, VO2max 54.8 ± 10.1 ml·kg^{-1}·min-1) performed two 3MTs on separate days with one 3MT immediately following a 2-km swim (swim-bike; SB) and one without prior swimming (bike only; BO). The power-duration relationship was expressed as the total work done and subdivided into the end-test power (EP) and work done above EP. To assess swimming intensity, heart rate (HR) was continuously monitored during the swim and blood lactate was assessed immediately following the 2-km swim. Results: End-swim lactate was 4.2 ± 1.8 mM and mean swimming heart rate was 147 ± 18 bpm. The 2-km swim decreased total work done during the 3MT by 6% (BO: 62.8 ± 12.7 kJ; SB: 58.9 ± 13.4 kJ; p = 0.001) though neither EP (BO: 281 ± 65 W; SB: 269 ± 68 W; p = 0.102) nor work done above EP (BO: 12.1 ± 3.8 kJ; SB: 10.5 ± 4.2 kJ; p = 0.096) differed between trials. Peak power was also assessed during the 3MT and did not differ between trials (BO: 552 ± 142 W; SB: 541 ± 147 W; p = 0.097). The change in EP was inversely correlated to the change in work above EP (r = -0.624; p = 0.006). Conclusions: Total work done while cycling decreases following a 2-km race pace swim, although neither EP nor work above EP changed significantly. Triathletes may want to determine race cycling power following swimming because prior swimming affects performance during the 3MT. Future studies should look at how different swim pacing strategies affect the cycling power-duration

18. CRITICAL SPEED THROUGHOUT AGING: INSIGHTS FROM THE WORLD MASTERS TRACK AND FIELD CHAMPIONSHIPS

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Purpose: Critical speed (CS), an analog of critical power, derived from the inverse relationship between running speed and exercise duration, represents the threshold of sustainable running speeds, with speeds above CS leading to non-steady state conditions and fatigue. Distance' (D') represents the finite amount of work or distance that can be run above critical power The purpose of this study was to determine the effect of aging on CS and D' Methods: Race times from the 2018 Masters Track and Field World Championships were gathered for the top 8 male and top 8 female finishers for the 100, 200, 400, 800, 1500, 5000 and 10000m races for the 35, 45, 55, 65, 75 and 85 year old age groups. Being the top finishers in the world championships, it was assumed that these racer represent the best possible scenario for aging and exercise. Therefore, theoretical maximum CS and D' for each age group and sex was derived from the top 8 finishers for the 800, 1500, 5000 and 10000m events with 1/time method. The effect of age on race times for each event and CS and D' was assessed with a one-way ANOVA. Results: As one would expect, there was a main effect of age and sex on race time, such that slower race times were associated with older age and the female sex (P<0.05). Age also exhibited a significant main effect on CS and D' among males and females, such that CS decreased with age (P<0.05), while D' tended to increase with advancing age (P<0.05). Interestingly, the decline in CS appeared to accelerate after 55 years, with the 20 year span between 55 to 75 years being associated with a greater decline in CS than the 20 span from 35 to 55 years (P<0.05). Conclusion: Aging is associated with a progressive decline in CS, that is even present among some of the fittest individuals in the world. Importantly, the negative impact of age on CS appears accelerate past age 55 years.

20. EVALUATING THE VALIDITY OF HEART RATE MEASURED BY THE GARMIN FENIX 5 DURING TRAIL RUNNING

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The prevalence of wearable activity trackers and their use in gauging exercise intensity via heart rate (HR) warrants an investigation of their validity in a setting outside of a laboratory. Purpose: The primary aim of this study was to determine if HR measured during trail running via the Garmin Fenix 5 activity tracker was statistically comparable to HR measured via the criterion measure, the Polar H7 sensor. Methods: Twenty-one participants (males = 11, females = 10, 31 ± 2 yrs, 173 ± 2 cm, 76 ± 3 kg) served as their own controls while completing 2 self-paced, 1-mile running trail runs at one of three trails (Mt. Charleston in Clark County, Nevada; Three Peaks Trail in Cedar City, Utah; or McCullough Hills in Henderson, Nevada). Participants ran 1 mile away from the trailhead for a net altitude gain and 1 mile back toward the trailhead for a net altitude loss. Each run was separated by 15 minutes of seated, passive rest (until HR returned to baseline). Uphill and downhill second-by-second HR data were compared separately using mean absolute percent error (MAPE), a Bland-Altman analysis with limits of agreement (LoA), and an intraclass correlation (ICC, two-way mixed-effects model, single rater, absolute agreement). Prior to testing, the benchmark for validity was established as a MAPE < 10% and an ICC > 0.7 ($p < .05$), with the lower limit of the ICC 95% confidence interval (CI) > 0.7. Results: During uphill running, the MAPE was 13.70%, and the lower and upper LoA were -16.10 and 55.47 beats per minute (BPM), respectively. The single measures ICC coefficient was 0.45 with a 95% CI of -0.03 to 0.70 ($F(5510, 5510) = 4.541$, $p < 0.001$). During downhill running, the MAPE was 13.35%, and the lower and upper LoA were -35.69 and 56.41 BPM, respectively. The single measures ICC coefficient was 0.38 with a 95% CI of 0.26 to 0.48 ($F(5881, 5881) = 2.468$, $p < 0.001$). Conclusions: There was poor agreement between HR measured by the Garmin Fenix 5 and Polar H7. Collectively, the MAPE, LoA, and ICC coefficients indicate that the Garmin Fenix 5 may not be a valid measure of HR during trail running. Continued research is necessary to determine the degree to which wearable activity trackers can validly measure HR in applied settings outside of a laboratory.

21. VISUAL TRAINING IMPROVES PERIPHERAL VISION AND ACTION OBSERVATION STRATEGIES IN ADULT COLLEGIATE SOCCER PLAYERS

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PURPOSE. For a soccer player to perform well and avoid injury, they must utilize their peripheral vision in order to perceive multiple sources of information. In a stressed state, such as a high-pressure soccer match, individuals undergo peripheral narrowing, or a tunnel vision effect where athletes can only see what is in their central gaze. This study aims to determine whether a longitudinal peripheral vision training program can help mitigate the effects of peripheral narrowing in controlled stressed conditions for elite soccer players. METHODS. Collegiate women's soccer players were asked to complete a 4-week peripheral vision training program. Prior to and after training, they were asked to watch first-person videos (action observation) of various situations during a simulated soccer game in relaxed and stressed states. In addition, they underwent perceived visual field tests for peripheral visual field size in relaxed and stressed states. During the action observation task, participants wore eye-tracking glasses that allowed for fixation as well as area of interest metrics to be recorded. A visual field size of 360 degrees was utilized to quantify peripheral narrowing. RESULTS. Preliminary results from this study (n = 6) indicate that following training, participants spent more time fixating on objects during action observation while relaxed. However, for this task there are no clear differences before or after training in a stressed state. In terms of perceived visual field measurements, the results indicated a visual field area increase in both relaxed and stressed states for both eyes following training. CONCLUSIONS. The peripheral vision training program appeared to increase participants' visual field size in both relaxed and stressed states following training. Following training, participants spent more time fixating on objects (including the ball) while in a relaxed state during action observation, which may be indicative of a greater reliance on peripheral vision. However, in the stressed condition, the peripheral narrowing induced by the secondary cognitive task may have not allowed participants to utilize peripheral vision. While these preliminary results indicate some promise in terms of the efficacy of the training program, a greater sample is needed to further support these conclusions.

22. MUSCULAR FORCE AND POWER OUTPUT DIFFERENCES BETWEEN FREE WEIGHT AND PNEUMATIC RESISTANCE IN THE SQUAT EXERCISE

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Pneumatic resistance (PR) is an alternative to free weight resistance (FW) that is believed to have advantages for developing muscular strength and power. A primary reason is PR has little mass associated with it, which minimizes the effects of inertia and momentum during high-velocity movements. PURPOSE: This study investigated the muscular force and power output differences between FW and PR in the squat exercise. METHODS: Ten male college students with resistance training experience were first tested to estimate one-rep max (1-RM) in the squat movement with both an Olympic bar/weights and a commercially available pneumatic resistance squat machine (Keiser Air300 Squat). On a separate day, subjects completed both FW and PR trials; both trials consisted of 3 reps each at 4 different load sets- 30, 45, 60, and 75% of the respective FW or PR 1-RM. The concentric phase of each rep was completed as fast as possible. Trials (FW vs. PR) were randomized, but load sets within trials were performed sequentially based on %1-RM. Rest intervals consisted of 1 min between reps, 3 min between sets, and 15 min between trials. Peak and mean values for concentric muscular force and power were determined for each rep; 3-rep averages per load were statistically analyzed. RESULTS: Repeated measures ANOVA determined significant differences between loads for muscular force and power-all peak and mean values were significantly different ($P < .05$). However, there were no significant differences between FW and PR force and power across loads-no peak or mean values were significantly different ($P > .05$). CONCLUSIONS: These results suggest no advantage of PR over FW for the development of muscular force and power. These data do not provide force and power measures at the beginning and ending of the concentric movement, which is where the effects of inertia and momentum, respectively, occur. Also, due to differences in the resistance equipment, there were differences in the FW and PR movements and 1-RM results; these were limitations of this study.

23. EFFECTS OF ACUTE GRAPE SEED EXTRACT SUPPLEMENTATION ON ARTERIAL STIFFNESS IN OBESE MALES

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Purpose: Obesity can lead to the development of high aortic stiffness (AoS) and blood pressure (BP), which can be improved by an increase in production of nitric oxide (NO). Recently, it has been reported that dietary supplementation with grape seed extract (GSE) enhances NO bioavailability. Thus, we investigated if elevated BP and AoS observed in obese males at rest are attenuated following acute dietary supplementation with GSE. Methods: Twenty male subjects (high BMI =10; normal BMI = 10) participated in this study. Effects of placebo (PL) and GSE (600 mg) on systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), stroke volume (SV), cardiac output (Q), total peripheral resistance (TPR), and AoS were compared 2 h after ingestion of GSE or placebo on different days, one week apart. Results: Compared with pretreatment conditions and PL supplementation, GSE supplementation in the obese group significantly decreased SBP (111.5 ±3.46 vs 116.9±3.81 mmHg) and MAP (83.8±2.96 vs 86.9±2.96mmHg), while there were no differences in the non-obese group. Neither PL or GSE supplementation had differences in AoS in both groups. In addition, GSE supplementation tended to decrease Q in the obese group ($P = 0.09$). When compared to pretreatment conditions, no differences were observed in TPR in neither PL or GSE in both groups. Conclusions: Our study indicates that acute supplementation with GSE dropped both SBP and MAP mainly due to a reduction in Q in high BMI males. This observation is unexpected because we hypothesized that NO availability improved by GSE supplementation reduces peripheral vasoconstriction and in turn BP. Further studies are needed in order to reveal the mechanism by which the GSE supplementation decreases Q in obese individuals.

24. SWIMMING WITH A SNORKEL DESIGNED FOR METABOLIC TESTING LIBERATES RESPIRATORY RATE FROM STROKE RATE

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Purpose: Arm cadence and breathing rate are inherently linked during front-crawl swimming because swimmers must turn their heads to breathe during the recovery phase of the arm stroke. The use of a snorkel for metabolic measurements during swimming breaks the inherent linkage between stroke and respiratory rates because swimmers can breathe with their faces submerged. Therefore, the purpose of this study is to determine if swimmers still entrain their breathing rates with their stroke rates despite not needing to turn their heads to breathe. Methods: Eight trained swimmers (3 M, 5 F; 21.6 ± 2.9 years) with a swimming VO2max of 50.6 ± 11.5 ml·kg-1·min-1) swam in the flume at increasing speeds while wearing a dual snorkel built from a 2-way non-rebreathing valve. The snorkel system connected to a mixing chamber on a metabolic cart that measured respiratory rate. The subjects swam for 2 min at each speed and the respiratory rate for the last 30 s of each stage was used for analysis. Subjects were also video recorded for the last 30 s of each swimming speed. Stroke rate was determined by analysis of the video recordings. Results: One subject breathed every 5th stroke at the slowest speed, every 4th stroke on the second slowest speed, and took between 1.14 and 1.50 strokes per breath at the faster speeds. The other seven subjects ranged between 1.17 and 2.35 strokes per breath for all speeds and these ratios were variable, suggesting a disconnect between breathing and stroke rates. Conclusions: Swimmers breathe more frequently and independent of arm cadence when using a snorkel designed for metabolic testing compared to without a snorkel. Therefore, researchers should be cognizant of this difference when making metabolic measurements on swimmers, especially when extrapolating their findings to pool or open-water swimming.

25. THE IMPACTS OF COLLEGE DINING ON STUDENT BODY COMPOSITION: A TEN-YEAR COMPARISON

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Introduction: Tertiary education institutions provide an opportunity to influence the eating behaviors of students which often persist beyond graduation. Furthermore, increases in obesity are among the highest in America within the 18-24 year age group, therefore making dietary choices during this stage of life ever more important (ACHA, 2018). Limited data exists on the eating habits and their impact on college students, especially when evaluating the dietary choices made at on-campus dining facilities. Purpose: The purpose of this study was to analyze and evaluate on-campus institutional dietary choices and demographic data of college students over a ten year period. Methods: Data was collected during the 2008-2009 (n = 1005), and 2018-2019 (n = 299) academic years from undergraduate students at a private university in northern California during meal time hours. Body mass index (BMI), weight, and percent body fat was measured along with the components of their meal which was subsequently analyzed for nutritional make-up. Comparisons of the demographics and dietary analyses between the groups were made. Results: The data revealed that BMI, weight, percent body fat and caloric intake were significantly ($p<0.05$) increased among females in 2018. For the males, results demonstrated no significant change in percent body fat, weight, or BMI nor in calories between the ten years, however, their diets are significantly ($p<0.05$) higher in fat in 2018 compared to 2008. Conclusion: The main findings of our data demonstrate the body fat percent did not increase among male subjects, which is not consistent with the American male population. However, the increase in percent body fat among female subjects was consistent with the American population. These results may be explained by trends of an increase in daily caloric intake among the women in the 2018 data set.

27. SERUM MOTS-C CONCENTRATIONS ARE HIGHER IN OLDER FEMALES COMPARED TO OLDER MALES BUT IS NOT AFFECTED BY PHYSICAL ACTIVITY STATUS OR CARDIORESPIRATORY FITNESS IN YOUNG AND OLDER ADULTS

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Recently, a mitochondrial-derived peptide was discovered, mitochondrial open reading frame of the 12S rRNA-c (MOTS-c) and represents a new class of circulating mitochondrial peptides associated with function and attenuation of age-related diseases. However, it is unknown whether cardiorespiratory fitness and/or age alters blood-borne concentrations of MOTS-c or if sex differences exits. PURPOSE: The aim of this study was to discern if serum MOTS-c concentrations were different between physically active and inactive young and older adults and affected by age, and cardiorespiratory fitness and to discern if sex difference exist between populations. METHODS: Forty-one healthy subjects Young (18 - 30 yrs; n=26) and Older (55 - 70 yrs; n=15) adults participated in the study. Young and Aged groups were further divided into Active and Inactive groups. Maximum oxygen consumption (VO2max), body composition, hemoglobin A1c (HbA1c), and serum MOTS-c concentrations were measured. Serum MOTS-c concentrations were detected using a specific enzyme-linked immunosorbent assay kit. RESULTS: There were no differences in MOTS-c levels between Young and Older subjects, between Young Active and Young Inactive or Older Active and Older Inactive subjects. Serum MOTS-c was also not correlated with VO2max, percent body fat, lean body mass, fat mass or HbA1c which were in normal ranges. When sexes were analyzed separately, MOTS-c levels in Aged females were significantly higher than Older males (419.9±43.3 vs 354.0±63.7 ng/mL, respectively; $p=0.03$). These findings suggest circulating MOTS-c concentrations are not affected by physical activity status, cardiorespiratory fitness, or normal HbA1c in healthy young and older adults, however, vary between sexes in older adults.

26. AUTOPHAGY RESPONSE TO HIGH-INTENSITY INTERVAL TRAINING AND MODERATE-INTENSITY CONTINUOUS EXERCISE IS DISSIMILAR IN SKELETAL MUSCLE AND PERIPHERAL BLOOD MONONUCLEAR CELLS

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Autophagy is an evolutionary conserved cellular degradation system implicated in maintaining health and promoting longevity. Few human data exist investigating the autophagic response to exercise; however, acute moderate-intensity, continuous exercise (MICT) has been shown to stimulate autophagy in numerous tissues including skeletal muscle and peripheral blood mononuclear cells (PBMCs). Presently, the relationship between post-exercise autophagy following acute exercise including high-intensity interval training (HIIT). PURPOSE: The purpose of this study was to compare the autophagy response of in skeletal muscle and PBMCs following an acute bout of HIIT exercise (treadmill running) and MICT exercise. METHODS: Using a crossover design, ten recreationally-active males (n=5) and females (n=5) performed a bout of MICT (60 minutes at 55% of max velocity [Vmax]]) and HIIT (6 bouts of 1 minute at 100% Vmax and 1 minute at 3 MPH, followed by 5 minutes at 3 MPH, followed by 6 bouts of 1 minute and 100% Vmax and 1 minute at 3 MPH). Muscle biopsies from the vastus lateralis and PBMCs were collected pre- and 3 hours post-exercise. Exercise bouts were separated by 72 hours and performed after abstaining from alcohol for 24 hours and food and caffeine for 8 hours. Subjects also refrained from food, energy-containing beverages, and caffeine during the 3-hour post-exercise period prior to the muscle biopsy. Muscle tissue and PBMCs was analyzed for protein expression of markers of autophagy LC3I, LC3II, and p62 via western blot analysis. RESULTS: No differences were detected in LC3I, LC3II, and p62 protein content 3 hours post-exercise compared to pre-exercise in both HIIT and MICT bouts in skeletal muscle of PBMCs ($p>0.05$). LC3II:I ratio increased 3 hours post-exercise in HIIT (108.1 ±: 54.5%), which was significantly higher than MICT at 3 hours post-exercise which decreased from pre-exercise (64.26± 47.3; $p<0.05$). CONCLUSION: Our findings show that HIIT and MICT exercise results in distinct changes in autophagy flux as suggested by LC3II:I human skeletal muscle, but not in PBMCs. Our data suggest, the autophagy response to acute exercise in skeletal muscle and PBMCs are dissimilar.

28. A COMPARISON OF SOFTWARE FOR ANALYZING ISOMETRIC STRENGTH TESTS

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In an isometric squat test, a subject is in a standardized squat position and pushes with maximum force against an immovable barbell while standing on a force plate. The forces produced by the subject are recorded on a computer and are later analyzed by using custom software, providing insight into the subjects individual maximum-effort force production. The software packages used for this analysis are generally proprietary and expensive. The free, open source software package “Isometric Analyzer” is designed to analyze force-time data from this test but has not yet been tested for accuracy. Purpose: The purpose of this study is to compare the accuracy of analyzed data from the Isometric Analyzer software against an Excel Spreadsheet of known accuracy. Methods: 14 injury-free collegiate rugby players performed two maximum-effort isometric squat trials. From the 28 maximum effort trials, 14 trials were selected at random for analysis. These trials were analyzed in the Isometric Analyzer program and the commonly used and previously validated Excel Spreadsheet, and outputted values were later compared for agreement. These values were compared using visual inspection and with descriptive statistics. Results: Of the trials that could be correctly analyzed with the spreadsheet, the values between the two softwares were almost identical with just a few rounding errors. During the analysis, 5 trials in the Isometric Analyzing Software did not match the values in the spreadsheet, this was later determined to have been caused by the analysis spreadsheet having a larger start of contraction threshold than the Isometric Analyzer. After analysis, a few trials were not used for comparison due to the spreadsheet not being robust to highly variable baseline data. Conclusion: The Isometric Analyzer proved to be accurate for analyzing isometric squat trials.

29. ACUTE PREFEMORAL FAT PAD IMPINGEMENT: A REVIEW OF THE LITERATURE AND CASE REPORT

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Purpose: Fat pad impingement syndrome is being increasingly recognized as a cause of anterior knee pain, most frequently as infrapatellar fat pad impingement syndrome, or Hoffa's disease. There have been only a few reports of prefemoral fat pad (PFP) impingement as a cause of knee pain in the literature, and one radiologic study of the entity. With the limited amount of literature on PFP abnormalities there is likely underdiagnosis, both clinically and radiologically, leading to underestimation of PFP pathology. To date, all of the documented cases are chronic in nature. Our case of PFP impingement is unique in that it is an acute, transient process that has not been previously described in the literature. Here we describe an atypical case of a self-limiting acute PFP impingement due to a hyperextension injury in a young athlete.
Methods: The patient's case was analyzed after consent was obtained by the family. Radiologic imaging was reviewed and annotated for disease process. An extensive review of the English-language literature was also performed on PFP impingement.
Results: We describe the case of a 10-year-old skeletally immature male who presented with acute knee pain, swelling, and limited motion following a hyperextension injury. Magnetic resonance imaging demonstrated edema and hemorrhage within the PFP, a large effusion, as well as an impaction injury to the apex of the patella. This constellation of injury pattern and imaging findings was consistent with acute PFP impingement. The patient was treated conservatively and was able to return to full sporting activities after four weeks of rest.
Conclusion: There is limited literature on PFP pathology, especially in the acute setting. With our case description and analysis, we conclude that this novel case is a model for an acute PFP impingement injury. This case report is of value because it demonstrates that impingement of the PFP can be clinically significant, that it can be an acute process, and that it can occur in the pediatric population. This type of injury should be included in the differential diagnosis in those with anterior knee pain following a hyperextension injury pattern. In addition, the fat pad impingement and inflammation syndromes of the knee as a whole are underdiagnosed and should be subject to further investigation.

31. AN EVALUATION OF PHYSICAL HEALTH, NUTRITION KNOWLEDGE, DIETARY HABITS, AND QUALITY OF LIFE IN COLLEGIATE ATHLETES

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Purpose: To evaluate nutrition knowledge, dietary habits, physical health and quality of life among college athletes at Point Loma Nazarene University (PLNU). Methods: 11 players from PLNU's women's soccer team participated in this study. Each participant completed a lab visit that consisted of body composition, blood pressure, blood glucose, and lipids assessments. Participants also completed three questionnaires that determined their general and sports-specific nutrition knowledge, dietary habits, and quality of life. Results: Mean ± SD for body mass index was 23.5 ± 0.9 and for body fat percent was 24.1 ± 5.3. Means values for blood pressure (115/70, ± 6.8/9.2 mmHg), total cholesterol (150 ± 51.0 mg/dL), HDL (56 ± 9.9 mg/dL), LDL (85.5 ± 10.1 mg/dL), and triglycerides (60 ±17.7 mg/dL) were within normal ranges. Mean fasting blood glucose was 100 ± 9.0 mg/dL (recommended <100 mg/dL). Some participants had values out of normal ranges (systolic blood pressure: n=2, diastolic blood pressure: n=2, fasting glucose: n=5, HDL: n=4). A food frequency questionnaire indicated that participants consumed less energy than estimated needs (1756 ± 457 vs. 2432 kcal/day). Participants did not achieve adequate carbohydrate intake based on recommendations for athletes participating in sports with intermittent activity, but protein and fat intake was achieved on average. Mean intakes were below recommendations for iron (15 ± 4.8 vs 18 mg) and vitamin D (0.125 ± 0.06 vs 600 IU), but five of eight met calcium needs (1136 ± 3.77 vs 1000 mg). Mean score on the nutrition knowledge questionnaire was 36%, indicating less than adequate nutrition knowledge. Physical health was the lowest reported average score on the quality of life questionnaire**.** Conclusion: Female soccer players in this study did not meet the necessary micro and macronutrient needs, which can be contributing factors to perceived impaired health. Nonetheless, physical health biomarkers were within normal ranges for most athletes**.**

30. THIRD DEGREE BLACK BELT WITH OSTEONECROSIS OF THE KNEE

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History: A 61-year-old female presented with right knee pain for the past year. Avid martial arts athlete training for 3rd degree black belt in Soo Bahk Do. Past medical history of osteoporosis, prior fibula fractures. No improvement with Physical Therapy. During training and sparring she experienced lateral knee pain with side-stepping and lateral movements.
Physical Examination:
Positive lateral joint line tenderness. No swelling or effusion. ROM 0-130 degree with crepitus. Neurovascular exam unremarkable. Right lateral knee pain with lateral movement during ambulation.
Test and Results:
X-rays revealed osteoarthritis changes and an ill-defined mottling of the normal trabecular pattern of the proximal tibia with mild sclerosis. MRI showed an irregular circular serpiginous peripheral dark and inner bright signal on T2, consistent with osteonecrosis of the proximal tibial metaphysis without articular collapse, tricompartmental osteoarthritis, medial and lateral meniscal tearing.
Treatment and Outcomes:
Osteoarthritis and meniscal tears treated with hyaluronic acid injection. Avoided cortisone injection due to risk with osteonecrosis. Modified training to avoid excess pivoting and twisting. Recommended follow-up x-rays and MRI to monitor for articular involvement and risk of fracture. May continue martial arts if she can tolerate the black belt training; unknown if repetitive tibial trauma during martial arts training may increase risk.
Discussion:
This is a rare case of osteonecrosis in the knee. Osteonecrosis directly due to martial arts-related trauma is not well reported in the literature; we feel this is separate from a "SONK" lesion, or her osteoporosis. The etiology of osteonecrosis can range from a variety of circumstances including trauma, glucocorticoid usage, alcoholism, rheumatological disease, and other causes. With our patient, trauma may have been the main contributor due to her history of competitive martial arts and prior lower leg injuries. Interestingly, our patient expressed no weightbearing pain and catching the osteonecrosis was fortunate and may prevent progression and need for surgery. Osteonecrosis should be included in the differential diagnosis in those competing in contact martial arts.

32. CAN FITNESS STAVE OFF THE DELETERIOUS IMPACTS OF COLLEGE WEIGHT GAIN?

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Purpose: Roughly 15-21% of college students are categorized as hypertensive (HTN). Additionally, the transition from high school to college is a transitional point in life where risk for weight gain is higher than at other periods. Also, high levels of fitness have been shown to be protective to cardiovascular (CV) health. The role of college weight gain and cardiorespiratory fitness on the development of HTN is unknown. The purpose of this study was to assess the role of college weight gain and CV fitness on blood pressure (BP) and arterial stiffness.
Methods: Healthy young adults ages 18-30 were recruited from the Grand Canyon University campus. Each subject came to the lab for a single visit and had resting BP, augmentation pressure (AP), augmentation index (AIx), pulse wave velocity (PWV), and a VO2peak test completed. Subjects were then asked to complete the WALI to assess college weight gain. The WALI has been shown reliable in reporting number of diets (R=0.77) and amount of weight gained or lost (R=.87 both P values <0.001).
Results: Seventy-one male and 61 female subjects aged 21.1±2.7 yr. with a mean BMI of 25.9±4.8 kg/m2 completed this study. Average college weight gain was 13.3±16.3 lbs. Hierarchical regression analysis with age and BMI entered into the first model and college weight gain and fitness into the second model was completed. Model one significantly predicted systolic BP (SBP) (R=0.265, P=0.009). Model two added significantly to model one (R=0.351, P=0.024) with college weight gain being a unique contributor to SBP (P=0.032). Model one did not predict diastolic BP (DBP) while model two significantly added to model one (R=0.318, P=0.012). Model one significantly predicted AP (R=.265, P = 0.009) while model two did not explain any more variance (P=0.116). VO2peak was however a unique contributor in the overall MODEL (R=-.235, P=0.038). Model one did not significantly predict AIx (P=0.150) while model two did significantly explain more variance (R=.376, P<0.001) with VO2peak being a unique contributor (P<0.001). Model one significantly explained PWV (R=.441, P<0.001) while model two did not add to the variance (P=0.723).
Conclusion: In conclusion, in addition to BMI status and age, both college weight gain and cardiorespiratory fitness may play a role in CV health of college students.

33. SKELETAL MUSCLE FIBER TYPE IN OLDER PATIENTS RECEIVING MAINTENANCE HEMODIALYSIS TREATMENT

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Purpose: Metabolic abnormalities and increased sedentary time in maintenance hemodialysis (MHD) patients lead to unfavorable skeletal muscle adaptations and reduced exercise tolerance. Muscle function is affected by the proportion of "pure" myosin heavy chain (MyHC) fiber type isoforms (Type I, IIa, and IIx) and prevalence of co-expressing "hybrid" fibers (Type I/IIa, IIa/IIx, I/IIa/IIx, and I/IIx) which display unique functional/metabolic properties associated with disease and inactivity. Previous investigations have utilized ATPase fiber typing methods in MHD patients, but this technique lacks fidelity to identify hybrid fibers. The purpose of this study was to 1) more accurately measure MyHC fiber type distribution in older men undergoing MHD and 2) compare the MyHC fiber type profile of these MHD patients to the literature. Methods: Six subjects (5 males and 1 female) receiving MHD treatment (age: 62.2 ± 4.2y; MHD duration range: 0.8 - 10y) underwent resting vastus lateralis muscle biopsies. Individual muscle fibers were mechanically isolated (492 total fibers) for MyHC fiber typing via SDS-PAGE. Results: MyHC fiber type distribution was 31% I, 4% I/IIa, 21% IIa, 27% IIa/IIx, 3% I/IIa/IIx, 2% I/IIx, and 12% IIx. Rarely identified MyHC I/IIx fibers were found in two MHD patients. Conclusion: These data suggest that older individuals undergoing MHD express elevated proportions of hybrid fibers (~36%). In comparison, hybrids typically represent ~5-29% of fibers in healthy older adults (69-81y) and ~30-60% of fibers in individuals with chronic disease/physical disability. Additionally, the MHD muscle expressed 43.62% MyHC IIx containing fibers (IIx, IIa/IIx, I/IIa/IIx, or I/IIx), which is similar to older individuals with chronic disease. Healthy older adults typically have only ~4-34% of these super-fast/fatigable isoforms. The MyHC I/IIx fibers found have been identified in few studies and their physiology properties are unexplored. Future research should 1) utilize this sensitive single fiber SDS-PAGE approach for MyHC fiber typing in this population and 2) study the effects of exercise and diet on muscle quality characteristics in MHD patients.

34. GLUTE ACTIVATION DURING A RESISTANCE BAND SIDESTEP IN YOUNGER AND OLDER ADULTS

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Purpose: The resistance band sidestep (RBSS) is known to preferentially activate the gluteus maximus (GMax) and gluteus medius (GMed) muscles over the tensor fasciae latae (TFL). Most studies only evaluate activation levels during a single band placement in younger adults (YA). The purpose of this study was to compare peak activation levels of the GMax, GMed, and TFL during a RBSS with four band placements in YA and older adults (OA).
Methods: Stance leg GMax, GMed, and TFL electromyographic data of 31 resistance trained females (15 YA, 22.8+2.8 yrs; 16 OA, 67.81+5.17 yrs) were collected during a RBSS with four randomized band placements: thighs (Th), knees (K), ankles (A), and toes (T). Participants completed one set of five strides in the direction of the dominant leg, with two minutes of rest between placements. Average peak amplitude for each repetition, muscle, and placement were expressed as a percentage of maximum voluntary isometric contraction (%MVIC). One-way repeated measures ANOVAs with Bonferroni adjustments were used to assess differences in mean %MVIC in both groups. IBM Analytics, SPSS v24 was used for all statistical analyses, with significance set at $p<0.05$.
Results: There was a significant difference in GMed activity between all placements in YA & OA ($p<0.05$). There was a significant difference in TFL activity between all placements in OA, and all but one placement (Th compared to K, $p=0.19$) in YA ($p<0.05$). There was a significant difference in GMax activity between the Th compared to A and Th compared T in OA ($p<0.05$).
Conclusion: GMed and TFL activity progressively increase as band placement moves towards the T, introducing a method that provides progressive overload to these muscles. Transitioning the band to the A or T also provides progressive overload to the GMax but only in OA. This suggests that a RBSS with an A or T placement is an effective way to simultaneously activate the GMax, GMed and TFL in OA. YA should, however, incorporate GMax specific exercises into their hip-strengthening programs.

35. MYOSIN HEAVY CHAIN FIBER TYPE DISTRIBUTION OF AN ELITE FEMALE MIXED MARTIAL ARTIST

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Purpose: Success in mixed martial arts (MMA) relies on a combination of speed, strength, power, and endurance. Fiber type distribution (i.e. the amount of "slow" vs. "fast-twitch" fibers within the muscle) determines a significant portion of whole muscle function. However, little research has described the fiber type distribution (FT) of MMA athletes. The purpose of this study was to determine the myosin heavy chain (MHC) distribution of an elite female MMA athlete.
Methods: A muscle biopsy was performed on the right vastus lateralis of an elite female (EF, age: 28, height: 165 cm, body mass: 60 kg) fighter. The MHC distribution of 104 single muscle fibers was determined via SDS-PAGE. FT was then compared to previously presented work of an elite male (EM, age: 33, height: 189 cm, body mass: 102 kg) and an amatuer female (AF, age: 26, height: 165 cm, body mass: 66 kg) fighter. Both elite athletes had won multiple medals at World Championship events in other combat sports and held top 5 (EF) and top 10 (EM) ranking in the Ultimate Fighting Championship at the time of the biopsy. AF participated in NCAA athletics and two amatuer MMA competitions. All three were highly physically active at the time of the biopsy.
Results: EF was 49% MHC I, 5% I/IIa, 45% IIa, 2% IIa/IIx while EM was 29% I, 4% I/IIa, 66% IIa, 1% IIa/IIx and AF was 58% I, 5% I/IIa, 37% IIa, 0% IIa/IIx. No pure MHC IIx or I/IIa/IIx were found for any of the athletes.
Conclusion: EF contained more fast-twitch (IIa) fibers than AF (45 vs. 37%), but noticeably less than EM (66%). MHC IIa in EF was also much lower than previous research on elite female weightlifters (~74%). The limited hybrids (MHC I/IIa, IIa/IIx, I/IIa/IIx) and pure MHC IIx in all three athletes supports the concept that these cell types are uncommon in highly-trained individuals. Further comparisons are difficult as few studies have utilized high-fidelity methods to analyze FT in female athletes, or MMA athletes in general. This case study provides initial insight into the muscle physiology of elite female MMA fighters. Future research should continue investigating the relationship between myocellular characteristics and whole muscle performance of these unique athletes to further our knowledge of elite human muscle physiology.

36. PASSIVE HALLUX ADDUCTION DECREASES POSTERIOR TIBIAL ARTERY BLOOD FLOW LESS THAN IN THE LATERAL PLANTAR ARTERY.

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Due to the vital role that blood flow (BF) plays in maintaining tissue health, compromised BF can affect tissue healing. A passively adducted hallux (PHA), as often seen inside a narrow shoe, was found to decrease BF in the lateral plantar artery (LPA). This was thought to be due to compression of the LPA between the calcaneus and the abductor hallicus (AH) muscle as it tenses with PHA. The posterior tibial artery (PTA) is proximal to and supplies the LPA and should allow for a more accessible detection site to measure a similar decrease in BF.

PURPOSE: The purpose of this study was to compare the decrease in blood flow within the PTA produced by PHA to that previously measured in the LPA.

METHODS: Twenty-four healthy volunteers (Female n=11, age = 24.8 ± 6.8 yr; height = 1.7 ± 0.1 m; body mass = 73.4 ± 13.5 kg) participated in this study. Blood velocity and vessel diameter measurements were obtained using ultrasound imaging (L8-18i transducer, GE Logiq S8) and used to calculate BF volume. The PTA was imaged at the medial malleolus for 120 seconds: 60 seconds at rest followed by 60 seconds of PHA, while the LPA was imaged at the location of the AH. Maximal PHA was performed by applying pressure to the medial side of the proximal phalanx of the hallux. Measurements were calculated before PHA, right after PHA, and 40 seconds after PHA. A repeated measures ANOVA was run to determine the change in BF within the PTA. The change in BF at PTA was then compared to the LPA data descriptively.

RESULTS: The BF decreased by 30% immediately after PHA ($p<0.0001$), then increased 16% following 40 seconds of adduction ($p=0.020$), but still remained lower than baseline values ($p=0.006$). In contrast, in the LPA the BF decreased 60% with a recovery of 30%.

CONCLUSION: There is an immediate, significant decrease in BF following PHA in both the PTA and LPA. This was followed by a proportionally similar recovery in both arteries. However, the relative change in BF was lower in the PTA, likely due to the contribution of the medial malleolar complex. Therefore, the LPA is a potentially more sensitive measure.

37. DIETARY INTAKE PATTERNS AND RISK OF ENERGY DEFICIENCY IN NCAA ENDURANCE RUNNERS

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PURPOSE: This study assessed dietary intake patterns among elite collegiate runners administered through a one-on-one counseling session with the team sports dietitian. METHODS: During the Fall sports seasons of 2015 to 2018, endurance runners from two NCAA Division I Cross-Country teams were asked to participate in a prospective study that focused on optimizing the health of the athletes. A 15 to 30-minute nutritional assessment involving the team sports dietitian was conducted. Runners in the current, sample were non-injured. In the one-on-one nutrition counseling session, a standardized assessment evaluated the runner's dietary intake patterns and nutritional risks. Data was analyzed using chi-square and independent-samples t-tests. RESULTS: Final analyses yielded data from 158 male and female runners (47.1% male; 52.9% female), averaging 66.2 ± 2.1 (males) and 49.0 ± 9.4 (females) miles per week. A total of 23.4% of runners reported not eating for >4 hours on 4 or more days of the week, while 92.4% reported eating within 30 minutes upon completing exercise. Average meals/day and snacks/day among the sample were 2.9 ± 0.50 and 2.6 ±1.1, respectively. Females, compared to males, were more likely to report eating <3 meals per day (23.2% of females vs. 2.7% of males, X2= 13.8, p<0.001), follow a vegetarian or vegan diet (6.3% of females vs. 0% of males, X2= 4.7, p= 0.03), avoiding a food component or food group (31.6% of females vs. 11.0% of males, X2= 9.6, p= 0.002); Based on the one-on-one meeting/nutrition assessment, the sports RD noted higher proportion of female runners with an energy deficiency risk (48.1% of female vs. 19.7% of males, X2= 12.1, p< 0.001).
CONCLUSIONS: Most endurance runners reported eating a post-workout snack, which may aid in recovery and optimize performance. Increasing meals eaten per day may aid female runners in lowering the risk of energy deficiency.

38. STEP COUNT ACCURACY AND PRECISION OF ACTIVITY MONITORS

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Purpose: Steps are objective and easy to understand, making them a useful tool to translate physical activity recommendations to the general public. Both 'Consumer-grade' products, such as smartphones and fitness activity trackers and 'research-grade' monitors (e.g., ActiGraph) estimate steps. However, the accuracy of different step counters may vary by type of device, wear location, and the type of activity being performed. The purpose of this study is to determine the accuracy and precision of Fitbit monitors, Charge 3 (FC) and Zips (FZ), and ActiGraph (AG) in recording steps in treadmill conditions, driving, and free-living conditions compared to direct observation (Criterion).
Methods: Participants were asked to wear nine different activity monitors: FZ (hip, chest), FC (wrist), AG (hip), ActivPal (thigh), ActiLink (wrist). All participants completed five 5-minute treadmill conditions that included various speeds, inclines and carrying objects, and either three 6-minute self-paced walks in a free-living environment or driving a pre-planned route. The criterion measure used was direct observation, in which researchers filmed participants with a GoPro Hero 5 and manually coded steps from the footage. We compared correlations and equivalence of each device to the criterion.
Results: A correlation of 1 found between FZ (hip, chest) and criterion, while a .99 correlation of coefficient between FC and AG (worn on the hip) compared with criterion. AG worn on the wrist had the lowest correlation (r=.83). All the monitors were statistically equivalent to the criterion, except for the AG-wrist, which was significantly different. All of the monitors, except for the FZ hip and chest, recorded steps during most of the driving conditions when no steps should have been recorded.
Conclusion: False-positive steps were recorded during driving regardless of wear location. Compared to consumer devices, research grade devices were less accurate in tracking steps. Future research is needed to develop algorithms for wrist-worn research devices that improve step count accuracy, especially during driving.

39. RELATIONS BETWEEN EXERCISE ENJOYMENT AND APPETITE

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People sometimes overconsume calories after exercising. This can impact weight management and weight loss goals. It is possible that overconsumption is influenced by perceived need to be awarded for exercise, which may be related to the pleasure and enjoyment of exercise.
Purpose: The purpose of this exploratory study was to examine if the pleasure and enjoyment of exercise is related to ratings of appetite following a road race.
Methods: Participants (N = 21; Mean age [SD]: 38 [16] years; 12 men) engaged in a 5k or 10 fun runs. After they finished their respective run, we recruited participants to complete a survey that measured their enjoyment of the race, feelings of pleasure during the race, and feelings of pleasure after the race. To measure enjoyment, we used a four-item enjoyment scale and it demonstrated acceptable internal consistency (Cronbach's α = .80). Feelings of pleasure were measured using two bipolar response scales ranging from "very positive" to "very negative" and "very good" to "very bad". In addition, appetite ratings were made using a visual analogue scale, ranging from 0 (not hungry at all) to 10 (extremely hungry).
Results: Enjoyment was negatively correlated with appetite ratings (r = -.404). Participants who felt more pleasant during (r = -.370) and after the race (r = -.323) also reported lower appetite ratings.
Conclusion: We found that the more enjoyable participants found exercise the less hungry they felt after the exercise bout. This indicates that creating more pleasurable exercise experiences may be a promising method for reducing appetite and overconsumption in response to bouts of exercise. These data require replication in a larger sample that will help yield more reliable estimates of effect sizes.

40. RECESS SNAPSHOT: POPULATION-LEVEL PLAY PREFERENCES IN SCHOOLYARD ZONES WITH OR WITHOUT GREEN SPACE

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Purpose: The purpose of this study was to analyze the effects of schoolyard size, green space (e.g. woodchips, grass, plants, trees, logs and/or boulders), and specific design features on physical activity levels as well as schoolyard zone and activity preference during free play in urban elementary schoolchildren. Methods: Population-level recess behaviors were recorded with the SOPLAY observation tool over the course of one week at four different Title 1 urban elementary schools: 1) 1.5% green space, 10 zones; 2) 0% green space, 8 zones; 3) 28% green space, 10 zones; 4) 50% green space, 8 zones. Data was analyzed with linear mixed models at a significance value of 0.05. Results: The most popular zones were the grass field (14-29%) and play structure (13-17%) in green schoolyards whereas the asphalt field (12-17%) was the most popular zone in asphalt schoolyards. A positive correlation was found between the square footage per student in an individual zone and the percent of students sedentary ($r = .139$, $p < .05$). The percent of younger (1st - 3rd grade) students sedentary was significantly lower at green schoolyards compared to asphalt schoolyards and lower than older (4th - 6th grade) students at sites with fewer play areas regardless of green space square footage ($F3,175 = 4.35$, $p < .01$). Additionally, the percent of students engaged in moderate-to-vigorous physical activity was related to activity preference ($F5,299 = 25.34$, $p < .001$). More students were active at one time while playing tag or engaged in gymnastics/climbing/jumping/dance (activities performed in green space or on play structures) compared to traditional playground games (e.g. handball, 4-square, tetherball played on asphalt). Conclusions: Results suggest that overcrowding may decrease activity benefits associated with schoolyard green space access. Additionally, green space alone may not be adequate to address population-level physical inactivity and obesity concerns for low-income urban schoolchildren. In order to narrow the activity gap between ages, a greater diversity of play options may be necessary.

41. IMPACT OF A NOVEL WETSUIT VELCRO CLOSURE ON FOREARM SKIN TEMPERATURE DURING SURFING

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Purpose: Surfing is a worldwide sport that often requires a wetsuit assist in thermoregulation. In a recent study, forearm skin temperature decreased by approximately 3°C while wearing a wetsuit during surfing. The purpose of this study was to test the hypothesis that cuffing the wetsuit at the wrist, with a novel velcro closure system, would result in greater forearm skin temperature while surfing. Methods: One hundred and twelve (93 male, 19 female) recreational surfers between the ages of 18-50 participated in this study. Forearm skin temperature was measured at 1-minute intervals across the surf session in both arms with four wireless iButton thermal sensors located two inches from the styloid process (wrist) and olecranon process (elbow). Following instrumentation, all subjects had one of their wrists randomly cuffed with a one-inch wide velcro strap that was tightened to 2cm less than the circumference of the wrist plus wetsuit. Subjects were then instructed to engage in regular recreational surfing activities for a minimum of 30 minutes. Data were collected at seven beaches in San Diego County between the months of October and April. Results: No significant differences were found between the average cuffed wrist skin temperature (27.14 ± 1.85°C) and the average uncuffed wrist skin temperature. (26.79 ± 2.19°C)(p=0.06). However, average cuffed forearm skin temperature (29.73 ± 2.09°C) was significantly higher than average uncuffed forearm skin temperature (29.34 ± 2.3°C)(p=0.01). Conclusions: Results from this study suggest that cuffing the wrist of wetsuits is a simple technique that can be utilized by surfers to significantly improve forearm skin temperature during surfing. These findings may also have an implication on future wetsuit designs.

42. RELIABILITY OF AND CORRELATIONS BETWEEN HAND-HELD AND FIXED DYNAMOMETER MEASUREMENTS WHEN ASSESSING TRUNK STRENGTH

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Purpose: The purpose is to assess if a hand-held dynamometer produces reliable results when hand-held versus fixed on a wall with the participant in sitting position.
Methods: Isometric trunk flexor and extensor strength were measured on 12 young adults (32.4y+12.5y, 6 men) using peak force with a MicroFET 2 hand-held dynamometer (Hoggan Scientific LLC, Salt Lake City). The fixed dynamometer strength assessment was always first. A belt that connected to a fixed dynamometer was placed around the participants with them facing away from it for flexor strength and facing towards it for extensor strength measurements. The testing order (flexion/extension) was randomized. The participants performed a set of 3 isometric contractions in each direction with 20 second pauses in between trials. After 1 minute the participants performed the same set of contractions against hand-held resistance. The dynamometer was placed on the sternum for flexion strength, and in between the scapulae for extension strength assessment. For all testing a research assistant observed the hip flexion angle and pelvic rotation to ensure that it stayed relatively constant.
Results: Strength measurements for extension with dynamometer fixed: 17.6 (6.6), hand-held 18.5 (4.1); mean difference 0.9 kg, p=0.67; for flexion with dynamometer fixed: mean kg (SD) 18.1 (8.5), hand-held 18.7 (5.6); mean difference 0.6 kg, p=0.84. The extension/flexion ratio is 0.97 for fixed and 0.99 for hand-held data.
Test-retest reliability
With dynamometer fixed, extension: ICC=.991, CI .984 - .996, flexion: ICC=.992, CI .986 - .996
Hand-held dynamometer, extension: ICC=.974, CI .942 - .991, flexion: ICC=.981, CI .957 - .994
Correlations
fixed dynamometer to hand-held extension testing: r= 0.70 (p=0.011)
fixed dynamometer to hand-held flexion testing: r= 0.90 (p<.0001)
Conclusion: Hand-held dynamometry has excellent test-retest reliability. The correlations between measurements with the dynamometer hand-held and fixed were high; they were even higher for flexion than for extension testing. Isometric extension data in the literature show great variability (9.9 to 23.7kg) and our results lie somewhat in the middle. However, our flexion data are higher than usually seen in the literature (6.2 to 9.8kg), which renders our extension/flexion ratio <1.

43. A COMPARISON OF THE BLOOD FLOW RESPONSE TO AEROBIC AND RESISTANCE EXERCISE OF EQUAL POWER OUTPUTS

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Purpose: While the hemodynamic response to aerobic exercise has been thoroughly studied, the hemodynamic response to resistance exercise has not been thoroughly described. The purpose of this study was to compare the blood flow response to aerobic exercise (low weight, high frequency) and two types of resistance exercises performed with the quadriceps femoris. Methods: Six subjects performed graded knee extension tests (3 minutes per power output) on 3 different occasions. On the first visit, subjects performed a traditional, dynamic single leg knee extension exercise with a modified cycle ergometer (60 rpm). On the second and third visits, subjects performed a weighted, knee extension exercise (contraction speed: 90°/s) on a weighted pulley system with differing amounts of rest between contractions (continuous: no rest between contractions, intermittent: 2 seconds between contractions). Leg blood flow was measured during all exercises with Doppler ultrasound of the common femoral artery. Results: Despite performing the same muscle action at the same power output, blood flow during both forms of resistance exercise was significantly less than blood flow during the traditional dynamic knee extension (Peak Flow: Dynamic: 4271±213, Continuous Resistance: 2213±173, Intermittent Resistance: 2828±174, P<0.05). Furthermore, blood flow during the continuous resistance exercise was significantly (P<0.05) lower than flow during the intermittent resistance exercise at 20 watts (2025±188 vs 2365±156 ml/min) and peak flow (2213±172 vs 2828±177 ml/min). Notably, leg blood flow was substantially reduced during concentric resistance exercise, with the majority of the flow occurring during recovery or eccentric actions. Conclusion: Blood flow during resistance-type exercise is about 40% lower than dynamic exercise of the same power output. Blood flow during resistance exercise is severely reduced during concentric contractions. Greater recovery time between contractions increases blood flow, which may potentially improve exercise tolerance to a given weight.

44. EFFECT OF SHORT TERM RESISTANCE TRAINING ON MUSCULAR FUNCTION AND POSTURAL STABILITY IN ADULTS WITH CEREBRAL PALSY

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Cerebral Palsy (CP) is a non-progressive neurological disorder due to damage in the brain leading to musculoskeletal dysfunction and immobility. Physical deconditioning of individuals with CP appears to accelerate muscle atrophy and osteoporosis; thus, adults with CP are more prone to fall and fracture. Postural instability is also related to the higher risk of fall in the general public, and resistance training is known to improve overall muscular strength followed by balance. However, equivocal results were reported whether resistance training has a positive effect on muscular function and balance in CP population.
Purpose: To determine the influence of short term resistance training to muscular strength and balance in adults with CP who already developed muscle atrophy and/or osteoporosis.
Methods: Twenty-two adults with and without CP were recruited. Nine CP participants completed post exercise experiments after performing resistance training twice a week for three months. Muscular strength (torque, work, and power) from the lower extremity were assessed at 90, 150, and 210 °/sec using the Humac Norm Isokinetic Dynamometer. Postural stability was assessed from the Berg Balance Test, and limits of stability test using the Biodex Balance System.
Results: CP group had significantly lower knee extensor peak torque (e.g., 35.8±11.1 CP vs. 85.7±12.2 control, ft-lbs, P=0.009), and lower knee flexor peak torque (e.g., 14.8±5.5 CP vs. 55.2±6.8 control, ft-lbs, P=0.000) compared to control. After 3 months of training, CP group did not show statistical differences in muscular strength [e.g., extensor peak torque (35.8±11.1 pre vs. 40.3±13.3 post, ft-lbs, P=0.796), and flexor peak torque (14.8±5.5 pre, vs. 20.0±7.4 POST, FT-LBS, P=0.579], or balance [e.g. overall score (34.9±8.1 pre vs. 32.9±6.6 post p=0.850) on limit of stability test, total score (25.4±7.5 pre vs. 28.4±8.1 post p=0.794) on Berg Balance test. However, individuals who improved peak torque in knee flexors and extensors also improved postural stability via the Berg Balance Test.
Conclusion: These preliminary findings suggest that muscular strength influences postural stability in adults with CP only if muscular strength is improved after exercise training.

45. ELITE ULTRA-ENDURANCE RUNNING EVENT (161.3KM) CAUSES HEMOLYSIS AS INDICATED BY URINALYSIS: A CASE STUDY

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Purpose: Ultra-endurance running, classified as any distance greater than a marathon (42.2km), is strenuous on the body. These extreme distances may include difficult weather conditions or terrain (e.g., heat, cold, altitude, trails, etc.) and could lead to changes in urine biomarkers resulting from damage to essential organs (e.g., liver, kidney, and heart). The purpose of this study was to determine the effects of running a grueling 161.3km trail race on general characteristics, presence of blood, and other molecules in the urine of an elite ultra-endurance runner (EUR). Methods: Urine specimens were collected from a 32y male EUR (170cm, 64.5kg, age-ranked 98.7% [ultrasignup.com]), before and after completing the 2019 Western States Endurance Run (WSER). Samples were analyzed using 11-parameter urinalysis strips (Med Lab Diagnostics, Laguna Beach, CA) one day pre-race and ~2h post-race. Results: EUR finished the WSER 8th place overall with a time of 15:54:31. Main findings showed red blood cell (RBC) count increased from 0 to 200 cells/µl (indicated hemolysis), bilirubin increased from 0 to 17 mmol/L (biproduct of hemoglobin), and urobilinogen increased from 0 to 3.2 mmol/L (indicated RBC destruction) post-race. Urine proteins and ketone abundance increased while ascorbate decreased post-race. Conclusion: Elevated urinary levels of red blood cell derivatives post-WSER highlight the formidable hematologic implications of ultramarathon running. Modalities to mitigate this phenomenon as well as an improved understanding of the systemic consequences of and time to recover from this exercise-induced hemolysis are of interest.

47. ACCURACY OF WEARABLE TRACKING DEVICES IN DETERMINING RESTING ENERGY EXPENDITURE

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Wearable fitness trackers are increasingly popular. Active people commonly want to know the effectiveness of their training. One of the measurements calculated by these devices is caloric expenditure at rest and during physical activity. Accurate measurements of resting energy expenditure (REE) are important for a variety of reasons including determining intakes for appropriate energy balance and better performance. PURPOSE: This study considered the accuracy of REE measurements from two wearable fitness trackers compared to REE measurements obtained from laboratory measures of gas exchange through indirect calorimetry. A secondary purpose was to determine if there was any impact of fitness (VO2max) on the accuracy of REE measures from these devices. METHODS: Twenty participants (n=5 women, n=15 men, age 21.9±2.2 yrs), completed a graded exercise test to determine VO2max (Bruce protocol). In a second session, measures of REE were determined using indirect calorimetry as well as REE estimates from each wrist-worn device. Participants were fitted with a FitBit Ionic and Garmin Vivoactive 3, on separate wrists, with a Polar heart rate monitor as the criterion measure of heart rate. A thirty-minute REE test was completed with measured REE compared to estimated REE from each wearable fitness tracker. RESULTS: The FitBit Ionic significantly underestimated REE compared to indirect calorimetry (p=.003). The Garmin Vivoactive 3 did not significantly over or underestimate REE as compared to indirect calorimetry (p=.305). Training status (VO2max) was not correlated with any differences in REE estimates (Fitbit, p=.476; Garmin, p=.514). However, among the highest tertile of participants, the Garmin estimated REE with greater accuracy to measured REE from indirect calorimetry than did the FitBit. CONCLUSIONS: Although both devices tend to underestimate REE to some extent, the Garmin Vivoactive 3 was much more valid and reliable in estimating REE, particularly in highly fit individuals.

46. THE EFFECT OF NON-FUNCTIONAL OVERREACHING ON β_2-ADRENERGIC RECEPTOR EXPRESSION, PHOSPHORYLATION, AND EPINEPHRINE RESPONSES IN TRAINED MEN

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Stressful training with insufficient recovery may influence resting and exercise-induced epinephrine (EPI) responses. β_2-Adrenergic Receptors (β_2AR) are down-regulated after overtraining, and may become less sensitive following overreaching. The β_2AR can be phosphorylated at ser355 (p-β_2AR^{355}) and influence intramuscular cell signaling, but this has not been investigated in humans following stressful training. PURPOSE: To determine if resting total expression and exercise-induced phosphorylation of β_2AR are influenced by stressful training with insufficient recovery. METHODS: Sixteen resistance-trained males were matched on one-repetition maximum back squat (1RM) and randomized into a control group ($\bar{X}$±SD; CON; n=8, age=20.7±1.2yrs, ht=180±10.6cm, body mass=83.9±10.7kg, 1RM=137.2±18.4) or a nonfunctional overreaching group (NFOR; n=8, age=21.3±2.3yrs, ht=155±62.5cm, body mass= 77.8±11.3kg, 1RM=140.6±18.6). CON performed three speed-squat training sessions on nonconsecutive days, while NFOR performed 15 training sessions over 7.5 days. Resting and post-exercise skeletal muscle biopsies were collected, prior to (T1) and after the training period (T2). Blood was drawn at rest (PRE), after back squats (MID), & 5 min post-exercise (POST) at T1 and T2. Plasma samples were analyzed for EPI via ELISA. Muscle samples were analyzed via western blotting for total β_2AR and p-β_2AR355. RESULTS: Resting total β_2AR expression did not change following the intervention in either group. At T1 p-β_2AR^{355} increased in CON and NFOR ($p<0.05$) with no differences between groups ($p>0.05$). At T2 p-β_2AR^{355} did not change post-exercise in either group ($p>0.05$). Total β_2AR decreased from PRE and POST at T1 in both groups (CON; p=0.008, NFOR; p=0.016). At T2 β_2AR expression decreased in NFOR (p=0.016), and tended to decrease post-exercise in CON (p=0.055). EPI increased post-exercise (exercise main effect; $p<0.05$) in both groups similarly, but overall these responses were attenuated at T2 compared to T1 (396 ± 284 pmol/L vs. 333 ± 257 pmol/L; p=0.019). CONCLUSION: Total β_2AR expression was similar in both groups except NFOR at POST only at T2. These data suggest that NFOR may down-regulate β_2AR expression post-exercise, despite having similar EPI responses to non-stressfully trained controls.

48. GESTATIONAL HIGH-ALTITUDE HYPOXIA AND METABOLOMIC TRANSFORMATION FROM FETAL SHEEP

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Gestational high-altitude hypoxia increases the risk of myriad diseases in human infants including pulmonary hypertension of the newborn. Fetal sheep are susceptible to long-term intrauterine hypoxia, with the lung structure and function exhibiting characteristics associated with the development of pulmonary hypertension. There is a thickening of the pulmonary arterial medial wall, dysregulation of arterial reactivity, and reduced right ventricular output. To further explore the mechanisms associated with hypoxia-induced aberrations in the fetal sheep lung, we examined the premise that metabolomic and proteomic changes are associated with phenotypic transformation and intrauterine hypoxia. To address this hypothesis, we performed metabolomic and proteomic analysis on pulmonary arteries isolated from near term fetuses that were exposed to intrauterine high-altitude hypoxia for the latter 100+ days of gestation or that gestated near sea level. There is a glycolytic shift, reduced fatty acid oxidation, oxidative stress, and elevated pentose phosphate metabolism, illustrative of increases in nucleotide synthesis. The proteomic analyses show there are changes in the extracellular matrix and associated proteins along with depression in smooth muscle myosin along with other cell signaling molecules. The metabolic and proteome changes in response to gestational hypoxia are suggestive of a shift towards proliferative and synthetic smooth muscle cells, providing insight into the mechanisms related to gestational hypoxia-mediated pulmonary hypertension. However, further research is needed to understand the underpinnings associated with the observed metabolomic and phenotypic transformations.

49. EFFECTS OF CYCLING CRANK LENGTH ON KNEE AND HIP JOINT RANGE OF MOTION AND COMPRESSIVE FORCES

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Purpose: Crank length (CL) on a bicycle may affect knee and hip joint compressive forces and range of motion (ROM). The relationship between knee/hip joint forces, moments, and ROM can have an influence on hip and knee joint health (i.e. osteoarthritis, patellofemoral disorder, ligament damage, etc.). Reducing knee joint forces lowered lower limb injury risk (Bini, Hume & Croft, 2011). 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 hip and knee. Methods: 9 non-cyclists (4M, 5F, aged 18-55) participated in a single blind randomized cross-over experiment with four crank lengths. 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 crank length 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 frequency of 6 Hz). Kinetic data was filtered using MATLab (MathWorks, MA, USA). All data was averaged from the last 30 seconds of each trial. Results: During submax cycling, 155 mm CL have a smaller hip ROM compared to 185 mm CL (ROM 39 deg vs. 43 deg). 155 mm CL have a smaller knee ROM compared to 185 mm CL (ROM 69 deg vs. 73 deg). At 70 rpm, 155 mm CL have a higher peak hip compressive force (1.4 N/kg) compared to 185 mm CL (0.9 N/kg). 155 mm CL also have a higher peak knee compressive forces (3.0 N/kg) compared to 185 mm CL (2.6 N/kg). At a constant PS of 1.47 m/s, the peak hip compressive forces at 155 mm CL (0.6 N/kg) was lower than at the 185 mm CL (0.7 N/kg). In the knee, the peak compressive forces are lower in the 155 mm CL (2.2 N/kg) than the 185 mm crank (2.5 N/kg). Conclusion: Hip and knee ROM were greater with longer crank arms. The 155 mm crank resulted in higher peak compressive forces at the hip and knee at a cadence of 70 rpm, while at a constant PS 155 mm had lower hip/knee compressive force compared to 185 mm. More extensive statistical analysis comparing knee/hip joint loads between the four different crank lengths needs to be

51. GAIT ANALYSIS OF KNEE LOADS WITH DIFFERENT FOOTWEAR CUSHIONING

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Purpose: The objective of this experiment was to conduct a dynamic analysis of walking gait and compare knee compressive force and the varus/valgus knee moment for different footwear cushioning levels. The hypothesis is that the knee loads would be greater for walking barefoot than walking with medium or high cushioning shoes, while the moments would increase as the amount of cushion from the footwear increases.
Methods: Protocols were approved by Cal Poly's IRB. Kinematic data were collected for 32 markers using the Enhanced Helen Hayes Protocol and a 12-camera motion analysis system with Cortex software (Motion Analysis, CA). Kinetic data were collected using four ground force plates (AMTI, MA). Female collegiate athletes (n=7) between the ages of 18 to 24 with a shoe size of eight participated in this study. Participants performed dynamic gait trials with the three footwear conditions at random, collecting four trials of each condition. Kinematic and kinetic data were processed in Cortex and filtered (4th order Butterworth, cutoff frequency 6 Hz). The dominant knee compressive force and the varus/valgus moment were analyzed. EMG data was also collected using Delsys (Natick, MA) with sensors placed on the biceps femoris, gastrocnemius, vastus lateralis, and tibialis anterior of the dominant leg. The participant's maximum voluntary contraction (MVC) was collected for each muscle to normalize the EMG data. One-way repeated measures ANOVA were performed on the maximum dominant knee compressive force and the right knee maximum absolute value of the varus/valgus moment.
Results: Maximum average compressive loads and magnitude moments between barefoot, medium, and high cushioning shoes were nearly identical, yielding no significant difference. Statistical analysis with the average EMG MVC percentages for the gastrocnemius also showed no significant difference.
Conclusions: The results suggest that shoes may not have an impact on knee compressive loads and knee varus/valgus moments during walking. Further study

50. RELATIONSHIPS BETWEEN TRAINING LOAD DEMANDS MEASURED BY SURFACE EMG WEARABLE TECHNOLOGY AND THE MILITARY CASUALTY DRAG

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INTRODUCTION: An essential job task for military personnel is a casualty drag, where a fellow soldier must be dragged from a hazardous environment. A simulation that measures the capacity to perform this task involves dragging a 123-kg dummy (equivalent weight to a soldier wearing a combat load) backwards over a 15-m distance. A casualty drag can be demanding, and execution of this task could affect subsequent tasks a soldier may need to perform (e.g. moving under direct fire). Surface electromyography (sEMG), a wearable technology that can measure tactical tasks in a practical environment, was used to measure the training load (TL) demands associated with the casualty drag. PURPOSE: To determine the relationships between muscle TL measured by sEMG wearable technology and casualty drag velocity. METHODS: A convenience sample of 36 college-aged participants (males = 25; females = 11) performed two trials of a 123-kg casualty drag over 15-m. A 91-kg dummy with 32-kg of additional load via a weighted vest was positioned on the ground. Participants grabbed the vest handles and dragged the dummy backwards over the required distance. Time was recorded to calculate drag velocity, with the fastest trial analyzed. Prior to testing, participants were fitted with compression shorts or leggings embedded with sEMG sensors to measure the vastus lateralis and medialis (quadriceps; QUAD), biceps femoris (BF), and gluteus maximus (GM) of both legs. The sEMG signal for each muscle was measured as a percentage of maximal voluntary contraction to calculate TL. The variables included the TL of each muscle and overall TL (sum of all muscles). Pearson's correlations ($p < 0.05$) calculated relationships between drag velocity and the sEMG variables; the sexes were analyzed separately. RESULTS: A slower drag velocity correlated with a greater overall TL for both sexes (males: $p < 0.01$, $r = -0.65$; females: $p = 0.03$, $r = -0.66$). Greater QUAD TL related to a slower drag velocity for both males ($p < 0.01$, $r = -0.68$) and females ($p = 0.01$, $r = -0.73$). No significant relationships were found for BF or GM. CONCLUSIONS: Performing a casualty drag slower will increase the TL demands, predominantly via greater QUAD stress. This could impact other activities where QUAD activity is also required, such as moving to cover. Training staff should ensure efficient performance of tasks such as the casualty drag to limit impact on other demanding tasks.

52. DIFFERENTIAL EFFECT OF RESISTANCE TRAINING ON BONE MINERAL DENSITY AND MUSCULAR STRENGTH IN ADULTS WITH CEREBRAL PALSY

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Cerebral Palsy (CP) is a neurological disorder caused by lesions in the brain and is characterized by impaired motor function, musculoskeletal deformity, and atrophy. Some individuals diagnosed with CP appear to develop osteoporosis at an earlier age compared to the general population. Bone weakness has adverse effects on the muscular system, which causes CP population to be more prone to fractures and further immobility. Bone mineral density (BMD) improves in the general population via resistance training. However, it is still uncertain whether resistance training alters skeletal strength in the CP population and whether it influences muscular strength.
PURPOSE: To determine the effect of resistance training on BMD and muscular strength in adults with CP.
METHODS: We studied nineteen adults with and without CP. CP participants went through 3 months of resistance training twice per week. Dual-energy X-ray absorptiometry was used to measure local BMD at the lumbar spine (L1-L4), proximal femur, and radial/ulnar regions. Structural deformities were identified by measuring various anatomical geometry (e.g., angles and lengths on the proximal femur). Muscular strength was measured during knee extension and flexion using the Humac Norm Isokinetic Dynamometer. To measure maximal isometric forearm contraction, the handgrip dynamometer was used.
RESULTS: There was a significant increase in BMD at the proximal femur in CP group after 3 month resistance training (0.6±0.09 CPpre vs. 0.88±0.04 CPpost g/cm^3; $P<0.05$). BMD at lumbar and forearm regions in CP group was similar to control group even though BMD in CP group seemed to improve after training ($P>0.05$). Skeletal geometry and muscular strength were significantly lower in CP compared to control, but both did not change after resistance training (angle: 65±2.94 CPpre vs. 70±1.24 CPpost degree; $P>0.05$). While control group showed a strong linear relationship between femoral neck BMD and knee extensor peak torque ($R^2=0.85$), CPpre showed no relationship ($R^2=0.24$). However, after 3 months of training, CP participants who exhibited greater BMD appeared to develop greater muscular strength.
CONCLUSION: These findings suggest that short term resistance training improved BMD in CP adults without any anatomical alterations or significant improvement in muscular strength. In addition, BMD appeared to play a role in enhanced muscular strength in adults with CP, specifically only those who significantly gained BMD after resistance training.

53. RELIABILITY OF SECA© MEDICAL BODY COMPOSITION ANALYZER (MBCA) IN HEALTHY YOUNG ADULTS

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Purpose: Bioelectrical impedance analysis (BIA) is an emerging method to measure body composition. The purpose of this study was to determine 1) baseline values of fat mass (FM), fat-free mass (FFM), skeletal muscle mass (SMM), total body water (TBW) extracellular water to total body water ratio (ECW/TBW), phase angle (PA), bioelectrical vector analysis (BIVA), and visceral adipose tissue (VAT), 2) any gender differences among measures, and 3) test-retest reliability on a newly obtained SECA© BIA device. Methods: 37 young adults [22 males and 15 females; mean±SD, age 24.4±3.5; BMI 25.6±4.1 kg/m^2] were measured in a single trial on the SECA© BIA machine having fasted overnight and abstaining from exercise for 12 hours. Multivariate analysis of variance was used to determine effects OF GENDER on measures. To determine test-retest reliability, a subset of participants (26 healthy young adults) were measured 48 hours after the initial visit under the same conditions. Interclass correlation coefficients (ICC) were used to determine reliability of measures. Results: Males had higher ($p<0.05$) FFM, SMM, TBM, and VAT, whereas females had higher ($p<0.05$) FM, and ECW/TBW ratio. Correlation analysis revealed that all variables except ECW/TBW and BIVA were highly correlated between visit 1 and visit 2 (ICC>0.9) indicating reliability of measurements. Conclusion: SECA© scale measurements have high test-retest reliability. Future investigations should determine the validity of the SECA© compared to standard methods.

54. HIGHER FAT OXIDATION DURING ROWING VERSUS CYCLING IN ACTIVE MEN AND WOMEN

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Substrate metabolism is related to optimizing exercise performance and weight control, and studies suggest that capacity for fat oxidation is associated with metabolic health. Cycling elicits lower fat oxidation versus running due to use of a smaller muscle mass, and it is unresolved if this result also exists compared to rowing, which like running uses a large muscle mass. PURPOSE: This study compared fat and carbohydrate oxidation (FOx and CHOOx) between progressive rowing and cycling. METHODS: Twenty two healthy, active men and women (age and physical activity = 27 ± 8 yr and 6 ± 2 h/wk) participated in the study. On two separate occasions, they performed incremental cycling (Velotron Dynafit Pro, Quarq, Spearfish, SD) and rowing (Concept model E, Morrisville, VT) to volitional fatigue to assess maximal oxygen uptake (VO2max) and maximal heart rate (HRmax). The order of the two subsequent sessions was randomized, performed 2 h post-meal, and consisted of a 6 min warm-up followed by 8 min stages of rowing or cycling at 60 - 65, 70 - 75, and 80 - 85 %HRmax, which was determined by the incremental exercise test. During exercise, power output was modified to maintain work rate in the desired range. Gas exchange data were obtained to measure fat and carbohydrate oxidation, and fingertip blood samples were acquired to assess blood lactate concentration (BLa). RESULTS: Fat oxidation increased during exercise ($p < 0.001$) and there was a main effect of exercise mode ($p = 0.03$) indicating higher FOx during rowing, but no modeXintensity interaction ($p = 0.32$). Carbohydrate oxidation increased during exercise ($p < 0.001$) but there was no effect of mode ($p = 0.24$) or modeXintensity interaction ($p = 0.08$). Results showed that BLa was lower ($p = 0.007$) at the end of rowing versus cycling (3.1 ± 1.0 mM vs. 3.9 ± 1.6 mM, $d = 1.1$). CONCLUSIONS: Rowing elicits higher FOx and lower BLa versus cycling, so exercisers desiring to augment fat oxidation while performing body-weight supported exercise should select rowing.

55. PERCEIVED BENEFITS OF PARTICIPATING IN AN UNDERGRADUATE STRENGTH AND CONDITIONING INTERNSHIP

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Background: Internships are considered high-impact practices in higher education. However, to date, such programs to prepare kinesiology students for careers as strength and conditioning (S&C) coaches have rarely been studied for impact. Purpose: The purpose of this study was to qualitatively assess interns' perceived benefits of interning as S&C coaches. Methods: Five interns completed an average of 36 hours of coaching over a 12 week S&C program for a university rugby team. Interns rated themselves on key areas and wrote a self-reflection on how the internship contributed to their professional development. Results: Key themes to emerge were skill development, especially in the areas of monitoring and providing feedback to athletes; learning how to work as a team of coaches; and being more aware and critical of their own knowledge, skills, and abilities; and how much more professional development they will need throughout their career. Conclusions: Internships should focus on fostering self-reflection, allowing ownership, and fostering agency among S&C interns.

56. PILOT ANALYSIS OF SURFACE EMG WEARABLE TECHNOLOGY TO MEASURE TRAINING LOAD IN AN ROTC CADET DURING A SUMMER TRAINING PROGRAM

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INTRODUCTION: The reserve officer training corps (ROTC) is a program that is intended to prepare individuals to enlist in the military by enhancing physical fitness, task-specific skill performance, and mental preparedness. Physical fitness training is intended to enhance the capacities that are stressed during specific military related tasks, which are partly assessed by the Army Physical Fitness Test (APFT). A self-reported session rating of perceived exertion (sRPE) is often used to measure the intensity of training sessions in tactical athletes. Self-reported sRPE takes into account how hard the individual perceives all exercises employed during a session. Surface electromyography (sEMG) wearable technology is a new method to measure training load (TL) via the muscle's response to exercise. PURPOSE: The purpose of this pilot analysis was to determine the applicability of sEMG wearable technology in recording TL relative to sRPE during a 7-week summer conditioning program of an ROTC cadet. METHODS: One college-aged female enrolled in the ROTC program completed the 7-week training program, which involved two sessions per week. The program was designed following NSCA guidelines for varying intensity and volume to improve anaerobic and aerobic capacity. Following each session, the cadet reported overall sRPE on a scale of 0-10. The participant was fitted with leggings to record sEMG responses from the vastus lateralis and medialis, biceps femoris, and gluteus maximus. The sEMG signal for each muscle was measured as a percentage of maximal voluntary contraction to calculate TL (sum of all muscles). Descriptive data was provided for comparison. RESULTS: The mean RPE across the 14 training sessions was 6.96 out of 10. The highest RPE was reported from session 8 with a score of 9.5, and the lowest RPE was 4 from session 3. The mean TL across the sessions was 1876.27 arbitrary units (AU). The highest TL was recorded in session 12 (2429.81 AU) with an sRPE of 8. The lowest TL was recorded from session 10 (1377.88 AU), also with an sRPE of 8. CONCLUSIONS: Session RPE and TL were not always consistent across training sessions. The cadet's lack of experience with sRPE may have contributed to this data. HOWEVER, FATIGUE could play a role in the increased RPE expressed with lower TL in the ROTC cadet. sEMG wearable technology could be a useful tool for tactical facilitators to measure TL across sessions, and further analysis is required.

57. CROSS CALIBRATION OF THE GE PRODIGY AND IDXA FOR THE MEASUREMENT OF BODY COMPOSITION IN YOUNG ADULTS

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Dual-energy X-ray absorptiometry (DXA) is one of the most accurate methods to measure body composition, and it has been widely used in both clinical and research settings. The body composition results on the same client may vary depending on the manufacture, model and software version of the DXA. Therefore, it is important to compare the measurements between different systems in longitudinal research studies and clinical practice. Purpose: To properly cross calibrate between the GE Prodigy and iDXA in health young adults. Methods: Thirty healthy college students, including ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg) participated in the study. The total body composition was measured using the GE Prodigy and iDXA, and analyzed by enCORE version 13 and 17, respectively (GE Healthcare, Madison, WI) by the same licensed DXA technician on the same day. Paired sample t-tests and regression analyses were performed to compare the body composition values between the two systems. Results: No significant differences were found in total body and leg percent fat (%fat), total body and leg Fat Mass (FM), and total body Bone Free Lean Mass (BFLM) ($p > 0.05$). However, there were statistically significant differences in total body and leg Bone Mineral Content (BMC) ($p = 0.000$), arm %fat ($p = 0.012$), arm FM ($p = 0.000$), arm and leg BFLM ($p = 0.000$) between the two systems. Conclusion: Our results suggest that calibration equations are needed mainly for the arm when comparing the total and regional body composition between the GE Prodigy and iDXA in young adults.

58. ASSOCIATION BETWEEN FEMORAL CARTILAGE CHARACTERISTICS AND RUNNING BIOMECHANICS IN COLLEGIATE DISTANCE RUNNERS

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Introduction: Knee osteoarthritis (OA) is the most prevalent form of arthritis and contributes to pain and disability. Running exposes weight bearing joints to high mechanical loads, which may contribute to an anabolic response in articular cartilage. However, certain biomechanical characteristics (e.g. knee adduction moment (KAM)) may disproportionately influence different regions of the articular cartilage. The purpose of this study was to determine the association between running biomechanics and femoral cartilage characteristics in collegiate runners. Methods: Twenty-four collegiate distance runners (83% male; age=20 ± 1.50; mass= 62.7 ± 6.76; height=1.76 ± 0.07 kg; weekly running amount=85.3 ± 16.6 km; running speed=4.18 ± 0.28 m/s) participated. Three ultrasound images of the distal femoral cartilage were obtained from the dominant limb in 140° of knee flexion and analyzed for thickness, cross-sectional area (CSA), and echo-intensity (EI) in the medial (MC) and lateral (LC) compartments. Running biomechanics were recorded during 5 running trials at a self-selected speed in laboratory standard footwear over a force plate. Peak KAM, peak knee flexion moment (KFM), and vertical loading rate (VLR) were extracted to quantify mechanical loading. Partial correlation examined the association between running biomechanics and cartilage characteristics after controlling for sex and speed. Results: A larger KAM was associated with greater MC thickness ($r= 0.424$, $p=0.028$), MC CSA ($r=0.431$, $p=0.025$) and lower MC EI ($r=-0.459$, $p=0.018$). VLR and KFM were not associated with any femoral cartilage outcome, and no associations were found between running kinetics and LC cartilage outcomes (all $p>0.05$). Discussion: The KAM is a surrogate for MC joint loading, and higher MC loading may contribute greater MC thickness, greater MC CSA, and lower MC EI in collegiate distance runners. The MC experiences greater compressive force compared to the LC during gait, which may explain why associations were only found in the MC. Future studies are needed in different populations of runners (older or recreational runners) and individuals with various stages of knee OA given that the KAM is strongly associated with OA progression.

59. SWIM OR RUN? COMPARISON OF FLUME AND TREADMILL MAXIMAL AEROBIC CAPACITIES IN TRAINED SWIMMERS

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Purpose: Treadmill testing and cycle ergometry are the most common modes of exercise testing for assessing maximal aerobic capacity (VO2max). Most sedentary subjects and trained runners have higher VO2max measurements during treadmill testing compared to cycle testing, suggesting mode of exercise affects VO2max. However, trained cyclists attain higher VO2max values on cycle ergometry than treadmill testing due to the specific adaptations of cycle training. Front-crawl swimming is a dynamic exercise involving both upper and lower limbs. The purpose of this study was to determine if trained swimmers have higher VO2max values when swimming compared to running. Methods: Eight trained swimmers (3 M, 5 F; 21.6 ± 2.9 years) performed VO2max testing on a treadmill and in a swim flume. For the flume test, subjects breathed through a 2-way non-rebreathing snorkel that collected their expired breath for analysis. For the treadmill test, subjects used a mouthpiece, nose clip, and 2-way non-rebreathing valve. For both modes of exercise, the subjects' expired air was collected into a mixing chamber and analyzed by a metabolic cart. The subjects exercised at increasing intensities until volitional fatigue on both tests. Blood lactate was assessed before and after each test. Metabolic measurements and heart rates (HR) were measured continuously and reported as 10-s averages. Results: The subjects had higher VO2max values on the treadmill than in the swim flume (56.2 ± 7.8 vs. 50.6 ± 11.5 ml kg-1 min-1, $p = 0.034$). At VO2max, minute ventilation, tidal volume, and respiratory frequency were all higher on the treadmill than in the flume. Respiratory exchange ratio and HR were significantly higher following the treadmill test and post-run lactate tended to be higher on the treadmill test ($p = 0.055$). However, oxygen pulse (VO2/HR), an index of cardiac stroke volume, did not differ between tests, as both VO2 and HR were lower while swimming. Conclusions: Results from the study suggest that running elicits a greater cardiovascular demand than swimming even in trained swimmers. This may be due to greater involvement of the larger leg muscles in running than in swimming. Future studies should examine the other three competitive swimming strokes, as they are less efficient than the front crawl and more reliant on the lower body for propulsion.

60. EFFECT OF A 10-WEEK NOVEL GOLF PROGRAM ON OLDER ADULT FITNESS

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Background: Aging is associated with decreases in physical function. Golf is a unique, multimodal exercise that encompasses aerobic, power, agility, and balance training. The purpose of this study was to investigate the effect of a 10-week golf program on measures of physical function in healthy, older adults. Methods: 15 healthy, older adults were enrolled in a 10-week golf program with fitness testing before and after the intervention. One participant dropped out of the study due to a work-related injury. Paired t tests were used to determine significance. Results are shown as mean ± SD with Cohen's d effect sizes. Results: There were statistically significant changes in timed up & go ($p<0.001$), 30-second chair stand ($p=0.006$), average grip strength ($p=0.017$), maximum hip abductor strength ($p=0.005$), heel raise ($p=0.014$), and 6-minute walk distance (0.043). There was no change in average quadriceps strength ($p=0.805$). Conclusion: Golf is a unique, multimodal activity that has a beneficial impact on fitness in healthy, older adults. Golf should be encouraged as a physical activity program for older adults.

61. A COMPARISON OF DXA, BIS, AND ULTRASOUND BODY COMPOSITION MEASUREMENTS IN COLLEGE STUDENTS

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Body composition is directly related to the overall health of an individual. If the percentage of body fat is high in relation to fat free mass then the risk for cardiovascular disease, type II diabetes and other diseases significantly increases. In this study the DXA, BIS and US were used to estimate body composition. These methods have their respective limitations which leads to some degree of measurement error. Purpose: The purpose of this study was to compare the body composition estimations of the Dual-energy X-ray absorptiometry (DXA), Bioelectrical Impedance Spectroscopy (BIS), and Ultrasound (US) in college students. Methods: Thirty healthy college age individuals, ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg), volunteered for participation. All participants had their body composition assessed using the DXA, BIS, and US. A Pearson correlation was performed to determine the correlations in body composition. A one-way Analysis of Variance (ANOVA) was also performed to determine if there was a difference between the devices for the body composition measurements. Post hoc tests were applied as appropriate. Results: Body fat percentage measures for the DXA, BIS, and US were 30.6 ± 9.2, 28.3 ± 9.1, and 22.8 ± 8.1 respectively. The Pearson correlation coefficients between all three devices were strong with $r = 0.870$ ($p < 0.01$) for the BIS and US, $r = 0.932$ ($p < 0.01$) for the BIS and DXA, and $r = 0.915$ ($p < 0.01$) for the US and DXA. The ANOVA revealed there was a statistically significant difference in body composition results between the devices ($F2, 89 = 6.161$, $p = 0.003$). Tukey's post hoc tests revealed that there was a statistically significant difference between the BIS and the US ($p = 0.05$) and the US and DXA ($p = 0.03$) but not between the BIS and DXA ($p = 0.558$). Conclusion: Although there is a strong positive correlation for body composition between the devices, there is a significant difference in the body composition estimations between the DXA and US and the BIS and US. When comparing changes in body composition, it is best to utilize the same device to minimize the error in the reported differences in body composition.

63. P38-MAPK AND ERK PHOSPHORYLATION RESPONSES TO RESISTANCE EXERCISE ARE NOT IMPAIRED WHEN PERFORMED AFTER A BOUT OF AEROBIC EXERCISE.

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The mitogen-activated protein kinases (MAPK) p38 and ERK mediate skeletal muscle adaptations to aerobic (AE) and resistance exercise (RE). However, contrary to the mTOR pathway, MAPK responses to concurrent training (AE+RE) have not been studied extensively. Furthermore, there are very limited data concerning the effect of concurrent training molecular responses in the limbs of the upper-body. PURPOSE: To determine the RE induced phosphorylation of p38 and ERK when preceded by a bout of AE, as compared to RE alone. METHODS: Eight recreationally active men (age: 26.3 ± 4.9 y.o; ht: 183 ± 5 cm; bodymass: 84.75 ± 7.08 kg) performed unilateral elbow-extensor AE (~45 min at 70% peak workload) followed by unilateral RE (4 X 7 maximal repetitions) for both arms. Thus, one arm performed AE+RE with 15 min recovery between modes of exercise, whereas the other arm conducted RE alone. Muscle biopsies were taken from the triceps brachii of each arm immediately before (PRE) and 15 minutes (POST1) and 3 hours (POST2) after RE. Muscle samples were analyzed for phosphorylation of p38 (p-p38-MAPK) and ERK (p-ERK) via western blotting. Wilcoxon sign-rank tests determined differences between AE+RE and RE arms at each timepoint. Friedman tests determined changes over time within each arm. Significance was determined at $p<0.05$. RESULTS: Pairwise comparisons indicated AE+RE increased p38-MAPK (1.6-fold; $p=0.008$) and p-ERK (6.2-fold; $p=0.008$) at PRE compared to RE alone. p-p38-MAPK and p-ERK in AE+RE arm at POST1 and POST2 were greater than the resting arm (RE PRE; all $p<0.016$). There were no differences between conditions at any post-exercise timepoints ($p>0.05$). In RE only arm, p-p38-MAPK increased (3.7-fold; $p=0.008$) from PRE to POST1. In RE only arm, p-ERK increased (1.5-fold; $p=0.008$) from PRE to POST1. CONCLUSION: Since there were no differences between conditions in p38 and ERK phosphorylation post-exercise, these results suggest that the early RE induced

62. WEARABLE DEVICE PRICE IS CORRELATED WITH THE LIMITS OF AGREEMENT RANGE AS A MEASURE OF HEART RATE VALIDITY DURING TRAIL RUNNING

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Purpose: There has been an increase in the use of commercially available fitness trackers, many with the ability to return heart rate measures. While research has struggled to keep pace with the wearable technology industry, a number of investigations have attempted to determine the validity of these devices which come in a variety of price ranges. To date, it is unknown whether there is an association between device price and validity during exercise. The purpose was to determine whether increasing costs of five commercially available wearables was associated with an increase in heart rate validity measures. Methods: Twenty-one participants (male n = 11, female n = 10, age = 31±2 yrs [mean±SE], ht = 173±2 cm, wt = 76±3 kg) completed a two-mile trail run which included elevation changes of 48 m (McCullough Hills Trail, Henderson, NV), 55m (Three Peaks Trail, Cedar City, UT) or 104m (Bristlecone Trail, Mt Charleston, NV). Heart rate was obtained from five wearable devices (Rhythm+ forearm band, $80; Motiv Ring, $200; Jabra Elite earbuds, $220; Garmin Fenix 5 wristwatch, $400; and Suunto Spartan Sport watch with accompanying heart strap, $450), and the Polar H7 heart strap as the criterion reference. Validity was determined using the Mean Absolute Percent Error (MAPE), Bland-Altman analysis with accompanying bias and Limits of Agreement (LoA), and single measures Intraclass Correlations (ICC). A Pearson Product Moment Correlation Coefficient was used to determine the relationship between the validity measures and device price, with significance accepted at $p<0.05$. Results: Price was significantly correlated with the LoA range ($r = -0.880$, $p = 0.049$), and trended with respect to ICC ($r = 0.856$, $p = 0.064$). Price was not correlated with the validity measures of MAPE ($r = -0.231$, $p = 0.709$) or bias ($r = -0.183$, $p = 0.769$). Conclusions: This study was limited to the use of five commercially available wearable technology devices. Nevertheless, it was determined that as price increased, the limits of agreement fell within a narrower range. These findings provide some evidence that as wearable technology devices become more expensive, they also become more accurate with respect to heart rate measures during outdoor exercise.

64. WHO DOES MORE WORK? A COMPARISON BETWEEN STARTERS AND NON-STARTERS IN DISTANCE, SPRINT DISTANCE, TOP SPEED, ACCELERATIONS, AND PLAYER LOAD IN DIVISION 1 MEN'S SOCCER PLAYERS

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INTRODUCTION: The ability for coaches to track players through GPS has become advantageous for monitoring variables such as player load, distance, sprints, and accelerations in order to manage stress over the course of a season. Although common in professional soccer, the detailed analyses of training load (TL) is less common in collegiate soccer. Collegiate soccer also features different substitution rules and playing schedule to FIFA-sanctioned matches and competitions, which could influence the TL experienced during training and matches. This has not been analyzed in Division I collegiate soccer players. PURPOSE: To compare the weekly TL (training sessions and matches) of starters and non-starters during a week using GPS and heart rate technology. METHODS: A sample of 30 Division 1 male soccer field players (starters=10, non-starters=17) from one team were measured for a week in-season (5 field training sessions, 2 matches). Prior to either a training session or match, players were fitted with a vest and heart rate strap under their uniform to hold the GPS unit and heart rate monitor. These devices were used to measure total distance (km), sprint distance (m), top speed (m/s), number of accelerations, and player load (arbitrary units; AU) within weekly training sessions and soccer matches. Independent samples t-tests were used to compare the starters to the non-starters in mean values for the training sessions and matches ($p<0.05$). RESULTS: There was no significant ($p>0.05$) differences between starters and non-starters in distance, sprint distance, accelerations, top speed and player load for the training sessions. However, there was a significant ($p<0.01$) difference between starters and non-starters in matches when considering the same metrics. Starters had greater distance covered (13.34 ± 2.11 km vs 5.40 ± 1.92 km), sprint distance (1080.57 ± 329.39 m vs 244.49 ± 289.07 m), accelerations (96.45 ± 19.41 vs 41.38 ± 18.78), and a higher player load (588.04 ± 82.47 AU vs 307.54 ± 82.52 AU), in addition to achieving a faster top speed (8.22 ± 0.34 m/s vs 6.91 ± 0.90 m/s). CONCLUSION: Starters experienced greater TL over the course of a week due to the increased amount of playing time during matches. Coaches can use this information to either reduce TL for starters, or increase TL for non-starters, during the duration of a training week in-season.

65. THE INFLUENCE OF INTER-TRIAL INTERVAL ON TRANSCRANIAL MAGNETIC STIMULATION EVOKED MEASUREMENT OF SHORT-INTERVAL INTRACORTICAL INHIBITION

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Purpose: Transcranial magnetic stimulation (TMS) is a non-invasive brain stimulation technique that allows assessment of corticospinal excitability. Short-interval intracortical inhibition (SICI) is the most commonly studied and well-described intra-cortical pathway. It is evoked by paired-pulse TMS which determines the effect of a first (conditioning stimulus; CS) on the size of responses evoked by a second (test stimulus; TS) at various inter-stimulus intervals (ITI). The purpose of this study was to examine the influence of different ITIs on the measurement of SICI at rest in healthy young adults. Based on a previous study involving the influence of ITI on MEPS following single pulse TMS, it was hypothesized that the amount of SICI observed would be different for the 4, 6, and 8 ITIs compared to the 10 second ITI.
Methods: Fifteen healthy adults participated in a single experimental session lasting ~ 1.5 hours. Surface EMG signals were recorded from the first dorsal interosseous muscle of the index finger of the right hand. TMS was performed using a Magstim 2002 connected to a figure-of-eight coil, which was placed over the ""motor hot spot"" for evoking MEPs in the FDI.
Results: The primary outcome measure was the amount of SICI expressed as the percentage inhibition (ratio of the MEP amplitude elicited by TS alone relative to the TS amplitude when given after the CS). SICI was compared between the 4, 6, 8, and 10 second ITIs with a one-way ANOVA. The one-way ANOVA indicated that there were no significant differences in SICI between the 4 ITIs ($P > 0.05$).
Conclusions: The main finding was that the amount of SICI observed was similar between the 4, 6, 8, and 10 second ITIs. These findings indicate that previous studies that involved ITIs that ranged between 4-10 seconds likely all provided valid quantification of SICI in both healthy adults and in patients with motor disorders. Based on these results, we recommend that researchers use an ITI of 4 seconds for measurement of SICI as this is much more time efficient and makes the experiment much more convenient for both the subject and the experimenters.

66. THE RELATIONSHIP BETWEEN MOUNTAIN BIKE SEAT TUBE ANGLE, KNEE-PEDAL ALIGNMENT, AND KNEE RANGE OF MOTION

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PURPOSE: Newer bicycles have increasingly steep seat tube angles. Seat tube angle (STA) is consistent within each bike model, but changes with seat height and post positioning. Traditionally, a bike fit will vertically align the knee with the pedal at the midpoint of the downstroke. This positioning has an effect on a rider's knee range-of- motion (ROM) potentially affecting fatigue rates. Additionally, the ROM may affect the knee-pedal spindle alignment position thereby affecting power capacity. Therefore, the purpose of this study was to determine if effective seat tube angle affects knee-pedal alignment and knee ROM. METHODS: Participants included 17 male and female (176.9 ±3.9 cm, 66.6 ±25.4 kg), amateur and elite, cross-country mountain bike racers. Reflective markers were placed by the same researcher at locations on the participants dominant side: greater trochanter of femur, lateral condyle of femur, and lateral malleolus of fibula. Photographs were taken of the bike alone and with the participant in their typical riding position, with leg at full extension, full flexion, and halfway through the downstroke. Photographs were analyzed to determine knee-to-spindle horizontal distance (KTS), peak knee flexion angle (KFA), and STA using digital measurement software (Dartfish USA, Alpharetta, GA). Linear regression was used to statistically analyze the data (alpha=0.05). RESULTS: For every 1 degree increase in STA, knee position moved forward 1.42 cm closer to the handlebars ($p=0.050$, $R2 = 0.23$). After accounting for STA, KFA explained an additional 44% of the variance in KTS ($p<0.001$) where every 1 degree increase in KFA resulted in knee position moving 0.58 cm further away from the handlebars. When combined, STA and KFA explain 67% of the variance in KTS. CONCLUSION: It is generally accepted that KTS should be 0 to have optimal power transfer to the pedals and limit sagittal forces on the knee joint. Changing STA in order to decrease KTS may be effective to increase performance. Further research should examine how individualized STA could affect rider positioning and performance during endurance efforts.

67. CHANGES IN SERUM FERRITIN ARE RELATED TO TOTAL CALORIC INTAKE, BUT NOT DIETARY IRON IN COLLEGIATE FEMALE ENDURANCE RUNNERS.

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Iron is essential for endurance athletes, as it relates to effective oxygen transportation throughout the body. Iron supplementation is often suggested for endurance athletes to improve aerobic performance. Ferritin plays a key role as an iron storing protein that maintains an equilibrium of serum iron. PURPOSE: To determine changes and relationships between serum ferritin (SF), dietary iron (DI), hemoglobin (Hb), and hematocrit (Hct) at the beginning and at the end of a competitive track and field season. We also sought to determine if any of these parameters were related to sports performance. METHODS: Sixteen female track and field middle distance (X±SD; MD; n=9; age: 20.2±1.5 years; ht: 167.86±5.04cm; body-mass: 56.15±5.05 kg; VO 2MAX : 53.62±6.04 ml/kg/min) and long-distance (LD; n =7; age: 20.5±1.5 years; ht: 162.48±6.11cm; body mass 56.15±5.99kg; VO 2max : 61.94±3.29 ml/kg/min) runners participated in this descriptive study (15-weeks). SF, Hct, Hb, DI, and total caloric intake (kcals) were determined at the beginning of the indoor season (PRE) and the end of the outdoor season (POST). Percent change (PΔ) in race time (season-best vs. championship performance) was also calculated and in indicator of the change in performance during the season. Paired-sample T-tests were used to determine differences in SF, Hct, Hb, DI and kcals from PRE to POST. Pearson correlations examined relationships between these variables and running performance. RESULTS: Hct, Hb, and kcals increased from PRE to POST ($p<0.05$). DI did not change from PRE to POST (n=9; 13.4±5.8mg vs 28.2±40.3 mg; $p=0.284$). SF decreased from PRE to POST (111.3±69 ng/mL vs 84.2 ±49 ng/mL; $p=0.037$), but was not correlated to changes in DI (n=8; $r=-0.140$; $p=0.741$). However, SF was positively associated with an increase in kcals (n=8; $r=0.771$; $p=0.025$,). None of these variables were associated with PΔ in running performance ($p>0.05$). CONCLUSION: In an athletic population, it may be more pertinent to increase total kcals and macronutrient intake to improve performance, than to supplement with iron. Despite iron's critical role in oxygen delivery, in cases of inadequate macronutrient intake, it is unlikely that iron supplementation will lead to improvements in performance.

68. THE RELATIONSHIP BETWEEN MULTIPLE MEASURES OF VASCULAR ENDOTHELIAL FUNCTION AND VO2MAX

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Purpose: Both vascular endothelial function and aerobic fitness strongly relate to cardiovascular health, and can be helpful predictors of overall cardiovascular health. The purpose of this study was to examine the interrelationship among three measures of endothelial function and determine how each relates to aerobic fitness. Methods: Twenty-three healthy, young adults performed a series of endothelial function measurements with Doppler ultrasound. Passive leg movement (PLM) and rapid onset vasodilation (ROV) were performed on the same day. Flow-mediated dilation (FMD) of the superficial femoral artery was completed on the following visit. Blood flow and arterial dilation were measured at the common femoral artery using Doppler Ultrasound. Aerobic fitness (i.e. VO2max) was measured during graded cycle ergometry with indirect calorimetry during a separate visit. Results: VO2max (L/min) related to vascular function measured during PLM, fixed ROV, and FMD peak ($r = 0.466$-0.524, $r =0.733$, and $r = 0.492$- 0.430 respectively, $p<0.05$ all), but when adjusted for body mass (ml/kg/min) only related to PLM ($r = 0.466$ PLM AUC and $r = -0.524$ PLM peak). PLM, ROV, and FMD all had significant correlations with quad mass, ROV holding the strongest correlation ($r = 0.744$, $p<0.001$). BMI also related to each of these measures, but had a stronger correlation with PLM measures ($r= 0.559$ PLM Peak and $r= 0.510$ PLM AUC, $p<0.02$) than with FMD or ROV ($r= 0.451$, and $r= 0.571$ respectively, $p<0.05$). Conclusion: In conclusion, endothelial function assessed by ROV and PLM are related, but not FMD and PLM. Notably, PLM and ROV are strongly related to VO2max (L/min), but the relationship is weakened when VO2max is considered in terms of ml/kg/min, suggesting that body mass may modulate the observed relationship between PLM, ROV and VO2max.

69. RELATIONSHIPS OF BONE MINERAL DENSITY, MUSCULAR PERFORMANCE, AND BODY COMPOSITION IN COLLEGE-AGE STUDENTS

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The skeletal system is adapted to all types of loading, for example, muscle contraction generates mechanical loading on the bone. One of the gold standards to assess skeletal health is to utilize the dual energy X-ray Absorptiometry (DXA) to measure bone mineral density (BMD), however, the DXA is not portable and is costly. Purpose: To investigate the relationships between BMD, muscular performance, and body composition. Methods: Thirty healthy college-age individuals, ten males (23.7 ± 1.9 years; 171.9 ± 6.7 cm; 81.8 ± 11.4 kg) and twenty females (23.1 ± 1.9 years; 161.8 ± 6.1 cm; 64.9 ± 15.3 kg), volunteered for participation. Participants were positioned on the iDXA (GE Healthcare, Madison, WI) by a licensed technician to obtain total body, lumbar spine, dual femur and dual forearm scans. Muscular performance was measured by grip strength, single-leg vertical jump, and knee extension and flexion. Pearson correlations were used to examine the relationships between BMD, muscular performance, and body composition. Results: Radius BMDs were significantly correlated with grip strength at their corresponding side ($r = 0.684$ on the right and $r = 0.744$ on the left). Total hip BMDs and femoral neck BMDs had strong correlations with hamstring peak torque (PT) and jump peak power (PP) but not quadricep PT ($p < 0.05$). However, the correlations were stronger at the opposite side to their respective leg (r values ranged from 0.534 to 0.722). We also found strong correlations between all sites BMD and body composition variables: total mass, total body bone free lean mass (BFLM), legs BFLM, arms BFLM ($p < 0.05$). Conclusion: Our results suggest that muscular performance and lean mass are significant predictors of bone mineral density at most sites in young adults.

70. THE EFFECTS OF FREQUENCY FRAMING ON FITNESS CENTER COMMITMENT CONTRACTS

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Research from the field of behavioral economics indicates that different frames of similar or equal situations can have robust impacts on decision-making. Rather than only focusing on maximizing utility, decision-makers are influenced by other, nonrational factors, such as the way choices are presented.
Purpose: The purpose of this study was to analyze if the framing effect applied to the context of fitness center commitment contracts.
Methods: 145 adults (mean age [SD]: 36 [11] years; 88 men, 56 women) in the United States completed an online survey in which they were randomized to one of two frames. In the Twice/Week group, participants were asked to consider a commitment contract in which attending a fitness center twice per week for one year would result in a 50% membership reimbursement. Participants in the 104/Year group were asked to consider a commitment contract in which attending the fitness center 104 times in one year would result in a 50% membership reimbursement. Both commitment contracts were identical in terms of total commitment and total number of required fitness center visits (i.e., 104 times per year, or twice per week for 52 weeks [2*52 = 104]) but framed to emphasize either short-term intervals (weekly) or long-term (yearly). Participants responded to questions about the likelihood of signing up for the promotion, the perceived effectiveness of the promotion for changing exercise behavior, and the perceived effectiveness of the promotion for getting new members to join the fitness center.
Results: Independent t-tests indicated no difference in reported likelihood of signing up for the promotion ($p = .434$), no difference in the perceived effectiveness for changing exercise behavior ($p = .144$), and no difference in the perceived effectiveness for getting new members to join the fitness center ($p = .324$).
Conclusion: In the context of hypothetical fitness center memberships and commitment contracts, different frames of visit frequency did not impact the likelihood of signing up for the promotion, perceived effectiveness for changing exercise behavior, or perceived effectiveness for recruiting new members. The usually robust framing effect may not translate to this situation. These data were about hypothetical commitment contracts; therefore, real-world data are needed to replicate these findings.

71. EVALUATING THE IMPACT OF MODERATE AND VIGOROUS EXERCISE ON SUBJECTIVE FEELINGS OF FATIGUE

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Purpose: This study examined the impact of different intensities of exercise on subjective feelings of fatigue immediately after exercise and after 60 minutes of intense cognitive work in men and woman.
Methods: These results come from a secondary analysis of a larger randomized crossover study examining the different levels of exercise intensity on cognitive performance. We recruited 228 men and woman to participate in the study. Each participant completed three conditions in random order: moderate (35% VO2 max), vigorous (70% VO2 max), and sedentary (no exercise). Each condition was separated by one week. After each 40-minute exercise condition, we administered a visual analog scale to evaluate subjective feelings of fatigue. This assessment of fatigue was delivered before treatment, immediately after treatment and one hour after treatment during which time the participant performed numerous cognitive tasks.
Results: For the sedentary condition, feelings of fatigue increased after the 40-minute intervention ($p<0.001$) and decreased after 60 minutes of cognitive work but remaining elevated compared to baseline ($p<0.01$). For the moderate condition, feelings of fatigue did not change immediately after exercise ($p=0.063$) but then increased after 60 minutes of cognitive work ($p<0.001$). For vigorous condition, feelings of fatigue increased after exercise ($p<0.001$) and remained elevated after performing the cognitive tasks ($p=0.163$). Following the 40-minute intervention, fatigue was highest for the sedentary condition, followed by the vigorous condition and did not change in the moderate condition. Following 60 minutes of cognitive work, fatigue was highest in the vigorous condition ($p<0.001$) and did not differ between the sedentary and moderate conditions ($p=0.063$).
Conclusion: The results of this study show that moderate exercise has no significant impact on feelings of fatigue but exercise at a higher intensity and being sedentary increase fatigue. Doing cognitive work increases fatigue if exercise precedes the tasks but being sedentary beforehand decreases feelings of fatigue during cognitive tasks. This suggests cognitive work is usually draining, but if done after being sedentary such as watching TV, cognitive work will be invigorating and make the brain more alert.

72. THE EFFECTS OF THE 16/8 DIET ON CARDIO-METABOLIC RISK OUTCOMES IN COMPETITIVE MALE RUNNERS

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Background: Time restrictive feeding (TRF) is a form of intermittent fasting that is increasingly popular in endurance runners due to its purported health benefits such as increased insulin sensitivity, improved lipid profile, and reduced fat mass. It is thought that these health benefits arise as a result to a shift in the body's substrate for fuel from favoring glucose to adipose tissue-derived free fatty acids. However, to date there are no studies that have investigated the effect of TRF in this unique population.
Objective: The objective of the present study is to investigate the effects of a form of TRF colloquially referred to as the "16/8" diet (16 hours fasted and 8 hours ad lib feeding) on insulin sensitivity, the lipid profile, as well as body composition, respiratory exchange ratio and resting energy expenditure in competitive male runners.
Methods: The present study is a randomized cross-over intervention that consists of two 4-week arms-the "normal diet" arm and the "16/8" arm along with a 2-week washout. Sixteen subjects will complete the study and will participate in 4 test days, one at the beginning and end of each arm, where they will undergo a DEXA scan to determine body composition, a resting energy expenditure and respiratory exchange ratio determination using indirect calorimetry, and a fasting blood draw for cardiovascular disease related biomarkers.
Expected Outcomes: We hypothesize that adhering to the 16/8 diet will yield an improvement lipid profile as determined by alterations in circulating HDL, LDL, VLDL, and TGs; as well as a decrease in body fat percentage and respiratory exchange ratio with an increase in resting energy expenditure.

73. PHYSIOLOGICAL RESPONSES TO RECREATIONAL SNOWBOARDING IN ADULTS

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PURPOSE: Snowboarding is a recreational activity with large popularity and is also a sport in the Winter Olympics. Despite its popularity and inclusion in the Olympic program, relatively little remains known about the physiological characteristics of a snowboard session, particularly in field settings. The purpose of this study to classify physiological responses to recreational snowboarding relative to ACSM daily activity guidelines. METHODS: Twenty-one men and women who were experienced snowboarders, were recruited from a university community and while snowboarding wore a heart-rate monitor and GPS device. Data were collected at 1-second intervals and analyzed for time spent in moderate and vigorous intensities based on percentage of heart rate maximum (HRmax) (light < 60% HRmax; moderate 60-75% HRmax; vigorous 76% HRmax). Based on this information, the amount of absolute (in minutes) time in each HRzone were calculated RESULTS: Participants snowboarded an average duration of ~6 hours, covering ~38 kilometers. Average heart rate over the entire session was 63.3±9.5% of HRmax (122±19 BPM); during actual snowboarding, average heart rates were ~72% of HRmax (140±10 BPM). Based on heart rate data, participants spent 25.4±11.2 minutes in moderate intensity and 13.4±8.2 minutes in vigorous intensity. Maximal heart rate achieved was equal to 193±6 BPM. CONCLUSION: The present data suggest that snowboarding can meet ACSM guidelines for moderate-vigorous intensity exercise of at least 30 minutes a day.

74. BRONCHODILATION INCREASES ESTIMATED VENTILATORY CAPACITY IN CHILDREN WITH MILD ASTHMA

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Purpose: Children with asthma experience reduced maximal expiratory flows, which can decrease ventilatory capacity and increase ventilatory limitations during exercise; however, the effects of mid-flow bronchodilation on these variables are underappreciated. The purpose of this study was to examine the effect of bronchodilation on ventilatory capacity and ventilatory limitations during a maximal exercise test.
Methods: Nine children with mild asthma (7 boys, 10±1 yr, BMI percentile: 66±30, forced expiratory volume in 1s, FEV1: 106±24 %predicted, Range 78-144) completed spirometry before and after 360µg of albuterol. On a separate visit, they completed an incremental exercise test to exhaustion. Estimated ventilatory capacity was calculated using the volume time curve from estimated maximal tidal volume (FVC/2) and estimated maximal total respiratory cycle time (2xFET25-75%) both before and after bronchodilator. Ventilatory limitation was defined as <10% of breathing reserve (Estimated ventilatory capacity - maximum minute ventilation).
Results: Estimated ventilatory capacity increased by 16% after bronchodilator (60±23 vs. 69±27 L/min; p=0.013). Measured maximal tidal volume was lower than estimated (1.12±0.32 vs. 1.33±0.25, p=0.002) but measured maximal total respiratory cycle time (TTot) was not different from estimated (1.41±0.36 vs. 1.47±0.46, p=0.792). In a subset of seven children who received 180µg albuterol before the incremental test, five would have been ventilatory limited (i.e., <10%breathing reserve) at maximal exercise using "before bronchodilator" estimated ventilatory capacity (breathing reserve range: -61 to +9%). However, only one child was ventilatory limited at maximal exercise using "after bronchodilator" estimated ventilatory capacity.
Conclusions: Bronchodilator administration prior to maximal exercise testing may be necessary to increase estimated ventilatory capacity and reduce ventilatory limitations even in children with mild asthma.

75. A PRACTICAL INVESTIGATION OF BODY COMPOSITION CHANGES IN WILDLAND FIRE SUPPRESSION AID CANDIDATES WHEN PROVIDED A CARBOHYDRATE SUPPLEMENT DURING ACADEMY TRAINING

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INTRODUCTION: Wildland firefighting relies heavily on academy training to prepare fire suppression aid (FSA) candidates for various physical job tasks. Maintaining adequate hydration levels during training and when deployed allow FSA's to remain safe and be successful in their strenuous occupational duties. Wildland firefighter performance can be reliant upon sufficient hydration levels and the presence of muscle mass in the body. Firefighting agencies typically introduce methods (hydration supplements, readiness monitoring, education) to sustain hydration and dry lean body mass (DLBM) of candidates during academy training. Further preservation of lean tissue and hydration through carbohydrate (CHO) drink supplementation could be advantageous to wildland FSA candidate performance. PURPOSE: To track the influence of CHO supplementation on body composition characteristics (intracellular water [IW], extracellular water [EW], fat mass [FM], DLBM) of wildland FSA candidates during academy. METHODS: Retrospective analysis was conducted on two wildland firefighter academy classes, including 15 males from class 1 and 9 males from class 2. Both classes received typical hydration supplements and education from training staff; class 2 received additional CHO supplementation. IW, EW, FM, and DLBM body composition components for both classes were typically measured between 0600-0700, using a research-grade bioelectrical impedance and body water analyzer. The difference between the first and last day of academy in IW, EW, FM, and DLBM were derived for each class, and independent samples t-tests ($p<0.05$) calculated any differences. Effect sizes (d) were also calculated. RESULTS: For both classes, IW, EW, and DLBM were higher on the last day versus the first day, while FM was lower. There were no significant differences between classes in the change scores, with small-to-medium effects. Class 2 did finish with higher DLBM (d = 0.23). CONCLUSIONS: During wildland firefighter academy training, education and appropriate interventions, including CHO supplementation, can generally conserve body composition in candidates. The methods implemented by the staff resulted in adequate hydration and body composition levels in both classes. However, candidates from class 2 had slightly higher DLBM and provided anecdotal evidence of minimal-to-no gastrointestinal distress after CHO consumption, suggesting potential value for this supplement.

76. EVALUATING RECRUITMENT FOR YMCA-BASED PROGRAM TO INCREASE PHYSICAL ACTIVITY, REDUCE CHILDHOOD OBESITY, AND INCREASE PARENT NUTRITION KNOWLEDGE

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Purpose. Childhood obesity (CO) has reached epidemic levels in the USA. Physical activity (PA) and improved diet may help to reduce CO and attenuate onset of chronic disease later in life. The Mid-Valley YMCA's "Let's Eat, Let's Play" program is meant to address this epidemic with a goal of 20 children and their parents in the program. This study examines the effectiveness of recruitment into the program. Methods. Subjects were recruited using flyers posted within the YMCA and word of mouth from YMCA fitness staff. Weekly physical activity was conducted as well healthy eating workshops. Attendance was documented and physical activity habits of the children before and after the program were evaluated. The parent's general nutrition knowledge before and after the program was also evaluated. Results. Four adults and 8 children enrolled in the program. The children were ages 6 to 12 years. Three adults and six children completed the program, with two adults and two children attending 100% of the sessions. Only slight improvement was observed in physical activity habits at the end of the program. Parent's general nutrition knowledge improved slightly as well. Conclusions. Recruitment of Latino youth and parents should be more culturally specific to attract a critical mass of participants in programs targeting children and their parents. Research has shown child-specific programs that indicate reducing obesity as an aim have less success recruiting, than programs indicating reducing physical inactivity or increasing PA as a goal. Programs targeting children and physical activity should be categorized according to age or grade level (ages 5-10 and 11-14). Additionally, educational material or workshops for healthy eating should be more culturally specific, to enhance chances of success.

77. EVALUATING THE VALIDITY OF HEART RATE MEASURED BY THE SUUNTO SPARTAN SPORT WATCH DURING TRAIL RUNNING

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Purpose: In the last decade or so, a plethora of fitness tracking devices have come to market. With this, use of these devices has increased exponentially. Among these devices' many functions is the ability to monitor heart rate (HR). The purpose of this investigation was to determine if HR measured by the Suunto Spartan Sport watch was statistically comparable to that of our criterion, the Polar H7 HR monitor.
Methods: Twenty-one participants (male n = 11, female n = 10, age = 31±2 yrs [mean±SE], ht = 173±2 cm, wt = 76±3 kg) completed a two-mile trail run which included elevation changes of 48 m (McCullough Hills Trail, Henderson, NV), 55m (Three Peaks Trail, Cedar City, UT) or 104m (Bristlecone Trail, Mt Charleston, NV). Heart rate was obtained from the Suunto Spartan Sport watch with accompanying heart strap and the Polar H7 chest-worn heart rate monitor as the criterion reference. Validity was determined using the Mean Absolute Percent Error (MAPE), Bland-Altman analysis with accompanying bias and Limits of Agreement (LoA), and single measures Intraclass Correlations (ICC). A Pearson Product Moment Correlation Coefficient was used to determine the relationship between the validity measures with significance accepted at $p<0.05$. Results: During uphill running, the MAPE was 1.46%, and the lower and upper LoA were -11.53 and 12.34, respectively. The single measures ICC was 0.95 with a 95% CI of 0.953 to 0.956 ($F(14834, 14834) = 43.15$, $p < 0.000$). During downhill running, the MAPE was 2.18% with the lower and upper LoA at -15.76 and 14.15, respectively. The single measures ICC was .94 with a 95% CI of 0.946 to 0.951 ($F(9075, 9075) = 38.45$, $p < 0.000$). Conclusions: These results demonstrate a there was a very low percentage of error for the Suunto Spartan Sport watch in recording HR for both uphill and downhill running. This suggests that The Suunto Spartan Sport might be a valid and reliable option for consumers wishing to monitor HR during outdoor trail running activities.

79. EFFECTS OF MODERATE AND VIGOROUS EXERCISE ON SUBJECTIVE FEELINGS OF VITALITY

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Purpose: This study examined the effect that differing exercise intensities have on subjective ratings of vitality immediately following the condition and after 60 minutes of intense cognitive work.
Methods: These findings come as a secondary analysis of a larger randomized crossover study that examined the effects of differing exercise intensities on cognitive performance. For this study we recruited 228 men and women in roughly equal numbers to participate. Each participant reported to the study lab four times one week apart. The first day the participants ran a VO2 max test to determine pacing and baseline values. The next three visits involved the participant completing a subjective vitality questionnaire before exercise, after 40 minutes of exercise or watching a video and after 60 minutes of cognitive tasks. The exercise condition varied randomly between vigorous (70% VO2 Max), moderate (35% VO2 Max) and sedentary activity (watching a video).
Results: The vitality rating before exercise was not significantly different between the three conditions with a mean rating of 19.9 ± 8.6 cm. Within the sedentary condition, subjective ratings of vitality went down after exercise from 19.9 cm to 12.5 cm and increased after the cognitive task to 15.0 cm remaining below pre-exercise values. Within the moderate exercise condition, vitality did not significantly change after exercise (20.2 cm to 21.0 cm) but was lower following the cognitive tasks (15.9 cm). In contrast, vitality was slightly elevated in the vigorous condition after exercise (19.8 cm to 21.3 cm) but went down after the cognitive tasks (17.1 cm). There was no difference in ratings of vitality between exercise conditions at any time. The sedentary condition was lower than both exercise conditions after the 40-min intervention ($p<0.001$) and was lower than the vigorous exercise condition after the cognitive tasks ($p<0.001$).
Conclusion: Sedentary tasks reduce subjective feelings of energy and vitality and this subjective evaluation remains suppressed after a period of cognitive exertion. Feelings of vitality and energy remain similar before and after exercise (vigorous or moderate) but then reduce with cognitive work. Vigorous exercise might have a slight benefit on subjective feeling of vitality after exercise and following extended cognitive exertion.

78. CORRELATES OF ENJOYMENT OF A ROAD RACE: AN EXPLORATORY STUDY

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Exercise is beneficial for improving emotional and physical health. Exercise enjoyment is related to exercise adherence. It is crucial to know the factors related to the enjoyment of exercise so that individuals will continue to maintain a healthy, active lifestyle.
Objectives: The purposes of this exploratory study were to determine (a) if age, frequency of exercise, and total exercise behavior are related to the enjoyment of an acute bout of exercise, and (b) if duration of an acute bout of exercise is related to exercise enjoyment.
Methods Participants (N = 21; Mean age [SD]: 38 [16] years; 12 men) engaged in a 5k or 10 fun runs. After completing the run, the participants were recruited to complete a short survey that measured age, characteristics of exercise behavior, and enjoyment. The four-item enjoyment scale demonstrated acceptable internal consistency (Cronbach's α= .80). Due to the low sample size and statistical power, emphasis is placed on the strength of the correlations and exploratory nature of this study, rather than statistical inferences.
Results: The age of the individual (r = .392), the frequency of exercise participation (r = .375), and total exercise behavior (r = .281) demonstrated positive correlations with exercise enjoyment. Duration of acute exercise showed a negative correlation with enjoyment of exercise (r = -.429).
Conclusions: We found that age and exercise behavior were positively related to exercise enjoyment, while time spent running in an acute bout of exercise was negatively related to enjoyment - possibly indicative of effects of lower fitness or less experience. A larger sample size along with more surveys obtained from various 5 or 10k runs is needed to obtain a more in-depth view of current study outcomes.

80. VALIDATING THE HEART RATE FEATURE OF THE MOTIV RING ON OUTSIDE GRADED TERRAIN

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Wearable technology provides instant feedback to the wearer regarding measures of physical activity, including heart rate (HR). Previous research has shown the reliability and validity of HR measured by wearables in outdoor, applied settings of short duration (<5-min) and on level surfaces. However, it is presently unknown whether wearables accurately measure HR over longer time intervals at variable grades. Purpose: This study aimed to determine the validity of HR recorded during trail running by the Motiv ring in comparison to the Polar H7. Methods: Twenty-one apparently healthy participants (males = 11, females = 10, 31 ± 2 yrs, 173 ± 2 cm, 76 ± 3 kg) ran 2 self-paced, 1-mile runs at one of three outdoor trails. Participants ran one mile at an incline, passively rested until their heart rates returned to baseline, and then ran one mile at a decline. Uphill and downhill minute-by-minute HR data were compared separately using mean absolute percent error (MAPE), a Bland-Altman analysis with limits of agreement (LoA), and an intraclass correlation (ICC). Prior to testing, the benchmark for validity was established as a MAPE < 10% and an ICC > 0.7 ($p < 0.05$), with the lower limit of the ICC 95% confidence interval (CI) > 0.7. Results: The lower and upper LoA for the uphill and downhill runs were -24.47 to 70.87 and -36.79 to 75.09 beats per minute, respectively. The MAPE values from the Motiv ring produced a forecast of 16.39% for uphill and 15.39% for downhill conditions. The Motiv ring demonstrated uphill ICC = 0.393 (95% CI = -0.055, 0.638, p-value < 0.001) and downhill ICC = 0.145 (95% CI = -0.005, 0.288, p-value = 0.003). Conclusion: The data indicate a poor level of agreement between the Motiv ring and Polar H7 during uphill and downhill trail running. The present results limit enthusiasm in utilizing the Motiv ring to measure HR for outdoor settings at an uphill and downhill grade.

81. INTERACTION BETWEEN HISTAMINE RECEPTORS AND THE MUSCLE METABOREFLEX IN NORMOTENSIVE HEALTHY MALES

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The muscle metaboreflex (MMR) induced by intramuscular accumulation of exercise-produced metabolites elicits a rise in sympathetic nerve activity. It is known that an increase in arterial blood pressure induced by the reflex is mainly due to an increase in cardiac output (CO) with little change in peripheral vasoconstriction. Histamine receptors activated by the release of histamine from mass cell contribute to peripheral vasodilation during exercise. However, it is unknown that the histamine receptors substantially impacts on the strength of the MMR. To demonstrate this research question, the rise in arterial blood pressure initiated by the MMR was compared before and after the histamine receptor blockade during dynamic exercise. 10 healthy males participated in this study. The MMR was activated during 40% workload exercise via partial occlusion of the right femoral artery. The cycle was started and after 3-5 minutes all data reached steady state. Thereafter, right leg perfusion was reduced by partially inflating BP cuff. This experimental procedures were repeated with and without the ingestion of ranitidine (brand name: Zantac, 300 mg) 2 hours before, and fexofenadine (brand name: Allegra, 180 mg) one pill 1 hour before the onset of exercise. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure (MAP), CO, total peripheral resistance, were obtained at rest and during cycling exercise. Our results indicated that the increase in MAP induced by the MMR was mainly due to an increase in CO before the blockade. However, the larger pressor response occurred after the blockade because of a smaller increase in CO and substantial increase in peripheral vasoconstriction. Thus, this current study suggests that vasodilation mediated by the histamine receptors may play an important role in modifying the MMR-induced pressor response during exercise.

82. THE FUNCTIONAL MOVEMENT SCREEN IS NOT ASSOCIATED WITH SELF-REPORTED DISABILITY IN INDIVIDUALS WITH ACL RECONSTRUCTION

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Purpose: The functional movement screen (FMS) is used to assess movement patterns and mobility. The International Knee Documentation Committee and Knee Injury (IKDC) and Knee Osteoarthritis Outcome score (KOOS) are validated survey instruments that assess patient-reported knee-related disability. The purpose of this study was to determine the associations between FMS and IKDC scores, and between FMS and KOOS subscale scores in individuals with anterior cruciate ligament reconstruction (ACLR).
Methods: 30 individuals with primary unilateral ACLR (53% female; 71.00±46.43 months post-ACLR; 22.57±1.78 years old; 11 patellar tendon graft, 12 hamstring tendon graft, 7 allograft) completed the IKDC and KOOS and were scored on a scale of 0-100. Following the IKDC and KOOS, participants completed all 7 tasks of the FMS (overhead deep squat, hurdle step, inline lunge, active straight leg raise, trunk stability push up, rotary stability, and shoulder mobility). Each task was scored on a scale of 0-3. A score of 0 indicated pain during the task, and a 3 indicated that the task was performed without compensation. Both limbs of the upper and lower extremities were scored for their respective tasks. The lowest score between limbs was used, and scores were summed for analysis. Partial correlation examined the association between the FMS and the IKDC and KOOS subscales while controlling for time since ACLR and sex.
Results: The average IKDC score was 84.3±10.6, and average scores on KOOS subscales were: pain=90.5±9.1, symptoms=84.2±14.8, function in daily living=95.6±5.9, function in sport and recreation=78.2±21.3, and knee-related quality of life=72.0±2.3. The average FMS score of the sample was 15.0±1.8. No significant associations were found between the FMS score and IKDC (r=0.15, p=0.49) or the KOOS subscales (r=0.06-0.30, p>0.05 for all).
Conclusion: The IKDC and KOOS indicated that participants reported some knee-related physical disability. Conversely, the average FMS score was above the clinical threshold for dysfunctional movement patterns. Therefore, the FMS **may** not identify knee-related disability in individuals with ACLR. The FMS incorporates other joints in the upper extremity, which may mask knee-related disability, and may explain the lack of relationship between the FMS and IKDC and KOOS.

83. DIFFERENCES IN REGIONAL SKIN TEMPERATURES AMONG MALE AND FEMALE SURFERS DURING A SIMULATED SURF SESSION IN A 2-MM WETSUIT

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Purpose: Recent data derived from field studies in the ocean suggest that regional differences in skin temperature may exist between males and females wearing 2-mm wetsuits during surfing. However, it is unclear if these differences resulted from lack of control for environmental factors that impact thermoregulation. Therefore, the purpose of this study was to test the hypothesis that differences in skin and core temperatures exist between females and males performing a simulated surf session in a controlled environment while wearing a 2-mm wetsuit. Methods: Male (n=20) and female (n=13) surfers engaged in a 60-minute simulated surf protocol using a custom 2-mm Hurley wetsuit in an Endless Pool Elite Flume with water temperature set to 15.56°C. Subjects were instrumented with a Polar RCX5 heart rate monitor, eight-iButton skin temperature sensors (calf, thigh, forearm, upper arm, chest, upper back, lower abdomen and lower back), and a CorTemp ingestible sensor for measurement of core temperature. Subjects then engaged in a 60-minute surf simulation consisting of resting, duck-diving and stationary activities. Three different paddling speeds. (1.2, 1.4 and 1.6 m/s) were utilized throughout the protocol. All data were collected at 1-minute intervals. Skin temperature data was analyzed using RMANOVA. Results: There were no significant differences in core temperature between males (37.31 +/- 0.35°C) and females (37.32 +/- 0.48 °C) (p=0.977). Upper arm and thigh skin temperatures were significantly lower in females (27.45 +/- 1.04 °C and 23.53 +/- 0.78 °C, respectively) compared to males (28.61 +/- 1.32 °C and 24.73 +/- 0.68 °C, respectively; p=0.012, p=0.00005). Conversely, skin temperatures in the abdomen were significantly lower in males (26.57 +/- 1.44 °C) compared to females (27.75 +/- 1.50 °C; p=0.035) Conclusion: These data suggest that regional differences in skin temperature likely exist between males and females during surfing. Therefore, wetsuit manufactures should be cognizant of these sex differences in skin temperature when designing wetsuits in the future.

84. IMPACT OF DIFFERENT TYPES OF NEOPRENE ON SKIN TEMPERATURE DURING RECREATIONAL SURFING

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Purpose: Wetsuits are a critical piece of equipment to the sport of surfing because they combat heat loss by insulating the surfer in hypothermic environments, which can impair muscle functionality and performance. While some research does exist on wetsuit thermoregulation, there is currently a paucity in the literature describing how various types of neoprene materials affect skin temperatures during surfing. Therefore, the purpose of this study was to compare the impact of slick neoprene and jersey wrapped neoprene on skin temperature during surfing. We hypothesized that wearing slick neoprene would lead to significantly higher skin temperatures than jersey wrapped neoprene. Methods: Fifty-eight subjects wore a custom Hurley wetsuit, with the left half of the torso and back comprised of slick neoprene material and the right half comprised of a jersey wrapped neoprene material. Subjects were instrumented with four iButton wireless thermistors located on the right and left side of the chest and upper back (n = 27) or the abdomen and lower back (n=31). Skin temperatures were measured at 1-minute intervals and subjects were asked to participate in normal surfing activities for at least 30 minutes in duration at beaches in northern San Diego County. Results: Average skin temperatures were significantly greater in the slick neoprene when compared to the jersey wrapped neoprene for the chest (slick: 33.09 ± 0.36°C, jersey: 31.55 ±0.30°C), upper back (slick: 35.09 ± 0.33°C, jersey: 33.56 ±0.28°C), and lower back (slick: 30.0 ± 0.43°C, jersey: 29.31 ± 0.46°C) measurement sites. There were no significant differences in average skin temperature in the abdomen (slick: 28.88 ± 0.34°C, jersey: 28.70 ± 0.31°C). Conclusions: Results from this study suggest that slick neoprene provides greater insulation than jersey-lined neoprene in the chest, upper back and lower back anatomical locations during surfing. These findings may be a result of greater heat absorption from the sun of slick neoprene compared to jersey wrapped neoprene.

85. THE EFFECT OF CONCENTRIC PRIME MOVERS VS. SYNERGIST MUSCLE CONTRACTION ON COACTIVATION RATIOS

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Purpose: The purpose of this study was to examine the coactivation ratio of agonist to antagonist muscle groups with varying pre-exhaustion protocols, and to see if postactivation potentiation is influenced by pre-exhaustion. Methods: Eight college age males and females were recruited for the study. Each participant visited the Human Performance Laboratory four times over the duration of the study. Subjects were monitored via EMG and randomly performed 1 set of 50 repetitions maximal voluntary knee extension, knee flexion, and knee extension/flexion at 60°•-1 using an isokinetic machine on the dominant leg. They performed 1 set of 10 repetitions of modified Peterson step-up testing at pre-exercise, immediately post-exercise, and seven (7) min following exercise. Results: The 50 repetitions of isokinetic knee extension, flexion, extension/flexion at 60•s-1 resulted in a significant drop in peak torque in all groups ($P<0.01$). Pre-exhausting the agonist muscle group prior to Pearson step-up improved agonist skeletal muscle motor unit recruitment ($P<0.05$). Pre-exhausting the antagonist muscle group with flexion and combination prior to Pearson step-up did not have any effect on agonist skeletal muscle motor unit recruitment. Pre-exhausting the agonist muscle group down-regulated antagonist muscle activity. Coactivation improved only by fatiguing the agonist muscle group. Postactivation potentiation was only affected by fatiguing the agonist muscle group ($P<0.05$). Conclusions: We conclude that pre-exhausting the agonist muscle group might be beneficial for improving muscle activity in functional rehabilitation exercises and during the period of recovery. Given the small number of subjects in this study, additional research using larger subject groups and different fatiguing and post-activation protocols is warranted to support the use of pre-exhaustion techniques to improve activity/recruitment of atrophied muscle in physical therapy settings.

86. EXHAUSTED? TRY NAVIGATING IN THE DARK

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Purpose: The process of stepping up and over an unexpected obstacle while walking requires proper visual perception and coordination in lower-limb kinematics. In able-bodied individuals, these systems are easily employed in rested states. However, these systems may become compromised when individuals are fatigued, posing an increased likelihood for an individual to sustain an injury. As perception and action are tightly linked, a delay in obstacle recognition as a result of fatigue may be detrimental to their ability to execute a safe obstacle crossing strategy. Hence, the purpose of this study is to determine the effect of physical fatigue on perceptual and biomechanical obstacle crossing strategies during locomotion. Findings from this study may have implications for the reduction of injury for physically demanding professions.
Methods: Twenty healthy participants between the ages of 18-35 have been recruited for this study. Participants were asked to perform five trials of walking (rested) through a darkened lab, where light would suddenly illuminate a 30 cm high obstacle randomly placed along their path. This motion light was set to activate when they were 1 m away from the obstacle. Participants then performed a series of anaerobic and aerobic exercises and repeated the obstacle crossing trials five times (fatigued). Eye-gaze data was recorded at 100 Hz and saccade initiation and angular velocity were used to quantify how quickly obstacles were visually perceived. Lower-limb obstacle crossing kinematic data were collected at 60 Hz using an 8-camera motion capture system at a frame rate of 60 Hz. Heart rate data and RPE was recorded to assist in gauging the participant's exhaustion levels.
Results: Preliminary data indicates some change in visual perception following exercise, but little to no change lower-limb kinematic strategies. Following exercise, participants demonstrated an increased time to initiate saccades, as well as a decreased combined (head and eye) angular velocity. Despite changes in eye behavior, no difference is seen in lower-limb kinematics and gait spatiotemporal measures (toe clearance, hip hike, step length and width, and velocity) between the rested and fatigued conditions.
Conclusions: Preliminary results indicate physical fatigue causes a perceptual delay in obstacle recognition. While this delay indicates a lessened time to plan crossing strategy, only small changes in crossing mechanics were elicited post-exercise. More evidence is needed to corroborate findings, but preliminary results provide interesting insight into the perceptual-motor capabilities that healthy individuals have in highly fatigued states.

87. STEP LENGTH ASYMMETRY OF BELOW KNEE AMPUTEES ARE ASSOCIATED WITH FALL RISK AND FALLS

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Introduction: Below-knee amputees (BKA) experience a higher rate of falls when compared to healthy age-matched controls. Underlying gait pattern anomalies, such as increased spatiotemporal limb asymmetry during gait, has been reported to be associated with increased fall risk and falls. Purpose: To investigate the relationship between spatiotemporal limb asymmetry, fall risk, and falls in BKA patients. Methods: Twenty-six unilateral BKA patients (mean age = 47.3 years; SD = 9.0) walked at a self-selected gait speed, along a 4.3 m instrumented walkway (GAITRite). Gait asymmetry for step length, swing time, and stance time were calculated by creating symmetry ratios for the prosthetic and unaffected lower limb. All symmetry ratios that were below 1.00 were inverted, therefore any ratio greater than 1.00 indicated asymmetry. The "Timed Up and Go" (TUG) test, reported falls (within the previous 12-months), and the Activities-specific Balance Confidence scale (ABC) questionnaire were also collected. Pearson correlation and regression analysis were performed to determine the relationship between limb asymmetry, number of falls and fall risk.
Results: When walking at self-selected speed, the number of falls were significantly correlated with step length, swing time, and stance time asymmetry ($r = 0.91, 0.65, 0.69$, respectively). Regression analysis revealed the change in the number of falls was significantly predicted by functional mobility, balance confidence, and limb asymmetry measures ($r^2= 0.86$). Step length asymmetry was the only measure to be a significant unique contributor to the number of falls: for every increase of 52.6% in step length asymmetry, the number of falls would increase by 1. Conclusion: As limb asymmetry is linked to falls for BKA patients, further work should be conducted to investigate potential interventions to reduce limb asymmetry, especially for step length, as well as to promote functional mobility and balance confidence in order to mitigate falls.

88. EFFECTS OF COMBINED RHODIOLA AND CORDYCEPS ON VO2 MAX, BLOOD GLUCOSE, AND LACTATE

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Rhodiola and Cordyceps are two common herbal supplements that have been shown to increase VO2 max and exercise performance, but limited research has examined the combined effects. PURPOSE: To determine the combined effects of Rhodiola and Cordyceps (R+C) supplementation, compared to Rhodiola alone (R) and placebo (PL), on VO2 max, blood glucose and lactate concentrations. METHODS: 13 physically active college students (7M, 6F; Mean ± SD; 21.08 ± 1.55 yrs, 22.60 ± 2.29 kg/m2) completed three conditions in a counterbalanced, crossover, double-blinded fashion; 1) PL (250 mg calcium), 2) R (250 mg Rhodiola), 3) R+C (250 mg Rhodiola + 225 mg Cordyceps). In response to each condition, VO2 max (assessed by Bruce Protocol), blood glucose and lactate (via fingerstick) were examined using an ANOVA. RESULTS: There was no significant condition effect for VO2 max between PL, R, and R+C ($P=0.80$; Mean ± SD; 50.42 ± 8.75, 51.08 ± 7.44, 50.76 ± 7.64 mL/kg/min). There was no significant condition x time interaction for blood glucose ($P=0.99$). However, compared to PL, blood glucose was significantly higher in R+C ($P=.047$; LSM ± SEM; 104.97 ± 2.91, 113.08 ± 2.91 mg/dL). There was no significant condition or condition x time interaction in blood lactate concentrations between conditions ($Ps>0.05$). CONCLUSIONS: Our preliminary data suggest that R+C had no effect on VO2 max or blood lactate concentrations, but increased blood glucose concentrations. Future studies are needed to examine ventilatory threshold and other markers of exercise performance in response to these supplements.

89. RELIABILITY OF A SUBMAXIMAL CYCLE ERGOMETER VERIFICATION PHASE TO CONFIRM VO2MAX

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Purpose: To test the reliability of a submaximal cycle ergometer VO_{2max} test with a 90% power output verification phase (VP) test in active male and female participants. Methods: 20 active (BMI = 22.7±2.9 kg/m^2; age = 25.5±4) men (n = 10) and women (n = 10) completed 3 ramp VO_{2max} graded exercise tests (GXT) on a cycle ergometer followed by 10 minutes of active recovery, then performed a constant-load verification phase test at 90% of maximum power output achieved on the ramp VO_{2max} tests to verify attainment of a 'true' VO_{2max}. Results: Maximum attained VO_2 did not differ between the two verification phase tests (verification phase test 2: 3.01±0.69 L/min,verification phase test 3: 3.04±0.69 L/min; p=0.55). However, VO_{2max} achieved on the verification phase higher than the ramp VO_{2max} test (verification phase test 2: 3.01±0.69 L/min,verification phase test 3: 3.04±0.69 L/min; GXT 2 = 3.03±0.71 L/min, GXT 3 = 3.04±0.69 L/min). ICCs and CVs for the group showed excellent consistency for VP VO_{2max} (ICC = 0.991; CV = 2.68 ±2.52%). Bland-Altman Plots showed no bias between VO_{2max}. Conclusions: The verification phase proved to be reliable with low variability and showed no bias based on VO_{2max} value. A 90% submaximal verification phase is a reliable test to confirm a 'true' VO_{2max}.

90. VIRTUAL REALITY GAMING AS A WAY TO INCREASE EXERCISE-INDUCED BRAIN AND MUSCLES OXYGENATION FOR YOUNG AND ELDERLY INDIVIDUALS.

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Aging is the most important risk factor for cognitive decline, partly due to the attenuation of brain oxygenation. Exercise enhances brain and muscle oxygenation. The emergence of Virtual Reality (VR) technology could prove to be meaningful and relevant to stimulate the brain. There is a lack of studies on the effect of VR and exercise on cerebral and muscle oxygenation across ages.
Purpose: to assess the effect of VR on exercise-induced transient changes in cerebral oxygenation in the elderly. We hypothesized that there would be a greater augmentation of cerebral oxygenation ($CerO_2$) in the prefrontal cortex (PFC) while cycling with VR compared to the No-VR condition for the elderly.
Methods: Both young male and female participants (n=10, 21±9 years) and old male and female participants (n=4, 50±25 years) first performed a graded VO_{2max} test on a cycle ergometer (828E, Monark) and returned to the lab to perform the VR paradigm. The VR test was performed on a stationary bicycle made to synchronize with a cycling game (VR bike, ViRzoom). Participants wore a virtual reality headset (Playstation 4, Sony) and cycled at a moderate intensity (50% of Peak power). Near-infrared spectroscopy (NIRS, Artinis Oxymon MkIII) was used to measure O_2Hb, deoxyhemoglobin (HHb), and total hemoglobin (tHb) from the left and right frontal brain cortices (LFC, RFC) and the right vastus lateralis (RVL) muscle.
Results: Brain O_2Hb mean values increased with exercise, while muscle O2Hb decreases in both age groups. There is a trend to increase further oxygenation in the brain and decrease deoxygenation in the muscle in both groups in the VR condition. Very surprisingly, VR induced a decrease in brain oxygenation across ages.
Conclusion: The combination of cycling with VR did not enhance cerebral oxygenation in the PFC compared to cycling alone in both age groups. Perhaps, other parts of the brain may be affected by VR.

91. DIFFERENCES IN GOLF SWING REACTION FORCES PLAYED FROM SLOPED ADDRESS POSITIONS

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Introduction: During competition, golf players are often faced with shots that may be played from inclined (toes above heels), declined, uphill (lead leg above trailing leg) or downhill address positions. While the player's initial configuration may change, the mechanical requirements of the shot stays the same. Players must regulate reaction forces to successfully complete the swing. Previous research shows the center of pressure shifts toward the lower foot when on uphill or downhill slopes (Blenkinsop et al., 2018). Additionally, target leg horizontal force was found to be larger when the target leg is lower than the rear leg (Peterson & McNitt-Gray, 2019). Purpose: The aim of this study was to determine how reaction forces are generated by golf players in different sloped address positions. Methods: Eight skilled golf players (3 male, 5 female, avg. handicap: 5.125 ± 4.123) volunteered to participate in this study in accordance with the local institutional review board. Players performed 10 golf shots with a 6-iron in the flat, uphill, downhill, inclined and declined conditions. Golf shots were initiated with each foot supported by an artificial turf covered force plate with custom ramps orienting them into the modified address positions (5° increments). Players wore their own spiked golf shoes. Reaction forces (RFs) were calculated in the mediolateral (ML), anteroposterior (AP), and vertical (V) directions by identifying peak values during the downswing. Differences amongst the group between conditions were determined using a repeated measures ANOVA (α=0.05). Results: In the frontal plane, the lower leg provided more ML RF as compared to other conditions. For example, uphill rear leg ML RF was significantly greater (0.244 ± 0.056 BW, $p < 0.034$) than all other address positions. In sagittal plane slopes, more AP RF was pushed into the slope. In the declined condition, the magnitude of AP RF was greater in the target leg (-0.312 ± 0.073 BW, $p < 0.012$) than all other address positions. No significant changes in peak V RF were found ($p = 1.000$). Conclusions: Sloped address positions change how skilled golf players generate RFs in the AP and ML directions. Players may take into consideration their individual RF differences on sloped address positions to achieve the desired golf swing performance.

92. THE RELATIONSHIP OF SMOKE EXPOSURE TO VO2MAX IN WILDLAND FIREFIGHTERS: A PILOT STUDY

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Purpose: Inhalation of wildfire smoke can cause reduced lung function, chest pain, fatigue, and depressed respiratory immune defenses. Those at highest risk for these adverse effects would be wildland firefighters who actively suppress forest fires. Aerobic fitness is a key component of wildland firefighting performance. Additionally, it is known that higher levels of cardiovascular fitness correlate with lower levels of cardiovascular morbidity and mortality. The impact of wildland smoke exposure on cardiovascular fitness is unknown.
Methods: Wildland firefighters from the Arizona high country were recruited for this study. Firefighters were asked to come to the lab at Grand Canyon University both before fire season and again after fire season. Currently presented data is only pilot data from the pre-season assessment. Firefighters were asked to fill out a survey assessing the number of seasons they have actively engaged in firefighting and then underwent a VO2peak assessment.
Results: Twenty-eight subjects completed the study. Subjects were 31.0±5.7 yrs., with a BMI of 25.7±3.0 kg/m2, VO2peak of 55.4±6.6 mL/kg/min and have worked on average 10.6±5.8 seasons of firefighting. Hierarchical regression was conducted with age in model one and number of seasons in model two, VO2peak was the outcome variable. Model one was not a significant predictor of VO2peak. Model two significantly explained 23% of the variance in VO2peak (P=0.044).
Conclusion: This pilot study suggests that the duration of a wildlife firefighter career may be a factor in explaining VO2peak. Further studies of higher quality are needed and data assessing the impact of a single season of smoke exposure is warranted. Data is being actively collected at this time to address these needs.

93. THE ROLE OF COLLEGE WEIGHT GAIN ON WEIGHT SATISFACTION AND EATING BEHAVIORS

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Purpose: The transition from high school to college is a transitional point in life where risk for weight gain is higher than at other periods. At the same time, the early part of college may be important for body image development. Prior research has shown that body satisfaction is linked to eating disorders, depression, and self-esteem. The role of college weight gain (CWG) on body image is unknown.
Methods: Healthy young adults ages 18-30 were recruited from the Grand Canyon University campus. Each subject came to the lab for a single visit and completed the WALI to assess CWG. The WALI has been shown reliable in reporting amount of weight gained or lost (R=.87 both P values <0.001). Subjects were also given the TFEQ to assess eating behaviors.
Results: Seventy-one male and 61 female subjects aged 21.1±2.7 yr. with a mean BMI of 25.9±4.8 kg/m2 completed this study. Average CWG was 13.3±16.3 lbs. In the entire sample of 142 subjects, CWG was associated with decreased weight satisfaction (R=.207, P=0.021) and appearance satisfaction (R=.241, P=0.007). Uncontrolled eating was a predictor of CWG (R=.214, P=0.013). In men (n=71), CWG was associated with decreased weight satisfaction (R=.376, P=0.004) and appearance satisfaction (R=.296, P=0.025). No relationship was found in TFEQ scores and CWG in men. In women, CWG was associated with decreased appearance satisfaction (R=.303, P<0.021) and emotional eating (R=.280, P=0.026). Hierarchical regression with BMI in model one and CWG in model two showed BMI explained 12% of the variance in appearance satisfaction (P<0.001) and CWG significantly added to the model as an independent predictor (R=.384, P<0.001).
Conclusion: Uncontrolled eating in the entire sample, and emotional eating in women, were predictors of CWG. CWG is an independent predictor of body satisfaction in college aged adults. Mitigating CWG through nutritional counseling may be integral in developing positive body satisfaction.

95. CHARACTERIZATION OF ADULT HEART RATE RESPONSES DURING RECREATIONAL SKATEBOARDING AT COMMUNITY SKATEPARKS

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Purpose: Youth participating in recreational skating at community skate parks attain exercise intensities and durations that are comparable with the ACSM's exercise recommendations for cardiovascular fitness for their age group. However, it is currently unclear if adults who skateboard in the same environment also achieve the recommended intensities and durations for cardiovascular fitness. Therefore, the purpose of this study was to test the hypothesis that skateboarding would elicit heart rates and durations consistent with the ACSM's recommendations for cardiovascular fitness in adults. Methods: Fifty-five subjects between ages 18-55 were recruited from six community skateparks for this study. Subjects completed a questionnaire and were instrumented with a Polar V800 heart rate receiver on the left wrist and an H7 Bluetooth heart rate transmitter around the chest below the pectoralis major (Polar Electro, Inc., LakeSuccess, NY, USA). Participants were instructed to engage in a typical skateboarding session with the duration and intensity of activity to be determined by the participant. Results: The average age of the participants was 27.4 ± 8.5 years, and participants reported skateboarding at a community skate park an average of 3.1 ± 1.8 days/week. Participants had an average heart rate of 138.2 ± 21.9 beats per minute (71.7% of age predicted maximum), skated for 65.5 ± 36.2 minutes, and traveled 4.56 ± 4.5 kilometers. Subjects spent 70% of their total duration at moderate-intensity or above and 30% within the low, and below low-intensity range. Conclusions: Results from this study suggest that adults participating in recreational skateboarding in community skateparks achieve the ACSM's exercise recommendations for cardiovascular fitness. These findings may have implications for community skatepark design and professional training programs for adult skateboarding athletes.

94. EFFECT OF ACUTE MUSCLE HEATING ON MICROVASCULAR ENDOTHELIAL FUNCTION

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Purpose: This study investigated the relationship between acute diathermy heating treatment and microvascular endothelial function. Methods: The quadriceps femoris of one leg was heated for 100 minutes with localized, shortwave diathermy (~39°C), while the other leg remained unheated. Resting blood flow (Doppler Ultrasound) and microvascular endothelial function (passive leg movement) were assessed before, immediately after and 30 minutes after the localized heating on the heated leg, as well as the unheated leg. Results: Resting blood flow measurements of the heated leg immediately after diathermy treatment showed a significant increase in comparison to the baseline blood flow measurements taken before the heat treatment (P<0.05), as well as the contralateral leg immediately after heating (P<0.05). Microvascular function, assessed by the peak hyperemic response to PLM, also tended to increase with the heat treatment. Conclusion: Acute diathermy heat treatment demonstrated an increase of baseline blood flow, as well as a tendency for increased microvascular responses in the treated leg. Diathermy heat treatments may be a non-invasive, low-risk modality to increase vascular function.

96. MILK-FAT INTAKE ACCOUNTS FOR DIFFERENCES IN ABDOMINAL OBESITY AND BMI: AN NHANES STUDY OF 5,254 U.S. ADULTS

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Purpose: The present study was conducted to determine the extent to which abdominal obesity and BMI (Body Mass Index) differ across categories of milk-fat intake in adults. Methods: A total of 5,254 U.S. adults were randomly selected as part of the National Health and Nutrition Examination Survey (NHANES). Consequently, results are generalizable to all U.S. adults. Those reporting that they did not drink cow's milk formed one category and were labeled, non-milk drinkers. Those reporting that they drank cow's milk were divided into two categories: Low-fat drinkers (LFD) and High fat drinkers (HFD), with skim and 1% milk representing the LFD, and 2% and whole milk representing the HFD. Abdominal obesity was indexed using waist circumference. Age, race, family size, total physical activity (MET-minutes), energy intake, and smoking were used as covariates. Analyses were conducted separately for men (n=2,569) and women (n=2,685) and included individual sample-weights, enabling generalization of the results to all U.S. adults. Despite the large sample size, each analysis had 29 degrees of freedom in the denominator because of nesting. Results: Average age (±SE) was 46.4±0.4 years. Approximately 13.3±0.7% of the sample reported that they did not drink cow's milk. A total of 59.7±1.9% were HFD and 27.0±2.0% were LFD. Milk-fat intake was not related to BMI or waist circumference in men. However, in U.S. women, after adjusting for the covariates, non-milk drinkers weighed significantly less than HFD and LFD, based on mean BMI levels (F=3.7, P=0.0377). Specifically, non-milk drinkers had a mean BMI of 27.6±0.5, whereas HFD averaged 29.5±0.4 and LFD averaged 29.1±0.5. Women non-milk drinkers also had significantly smaller waists compared to HFD and LFD (F=4.0, P=0.0302). Specifically, the mean waist size of non-milk drinkers was 91.8±1.3 cm, which was significantly smaller than HFD (96.2±0.8 cm) and LFD (95.2±1.3 cm). Women non-milk drinkers consumed approximately 193±35 kcal less per day than HFD and LFD (F=16.7, P<0.0001). Conclusion: In a large sample of U.S. adults, not drinking cow's milk was related significantly in women to having less body weight (BMI) and a smaller waist size than women drinking high-fat or low-fat milk. However, milk consumption did not account for BMI or waist size differences in U.S. men.

97. COMPARATIVE EFFECTS OF INTERVAL WARM-UP EXERCISE AND BRONCHODILATOR ON EXERCISE-INDUCED BRONCHOCONSTRICTION IN CHILDREN WITH MILD ASTHMA

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Purpose: Bronchodilators and interval warm-up exercise are both recommended for preventing exercise-induced bronchoconstriction (EIB). Whether interval warm-up exercise can prevent EIB to the same extent as bronchodilators is unknown but clinically very important. The purpose of this study was to compare the effects of bronchodilator and interval warm-up exercise on EIB in children with mild asthma.
Methods: Eight children (6 boys, 10±1 yr) completed exercise challenge tests (target ventilation 40-60% of predicted maximal voluntary ventilation) following three conditions on separate days: control; 180μg of albuterol; and interval warm-up exercise (eight 30s cycling intervals at 80-90% of HRmax with 45s recovery between intervals). Spirometry and impulse oscillometry (IOS) were completed before; 10min after condition; and after the exercise challenge test at minutes 2, 5, 10, 15, 20, 25, and 30.
Results: Baseline spirometry and IOS were not different between the three conditions. FEV1 was higher for bronchodilator (2.4±0.4L) compared with interval warm-up (2.2±0.3L) and control (2.2±0.4L; P=0.005). Respiratory resistance at 5 Hz (R5) was lower for bronchodilator (4.78±1.03 cmH2O/L/s) compared with interval warm-up (5.86±0.96 cmH2O/L/s) and control (5.93±1.06 cmH2O/L/s; P<0.001). Only one child was diagnosed with EIB (15% reduction in FEV1) after the exercise challenge test (control), one child was diagnosed with a borderline response (10-14.9% reduction in FEV1), and five children experienced bronchodilation (Range for FEV1 %change: 5-18%).
Conclusions: EIB was not common in this limited sample. Pre-treatment with bronchodilator was associated with more favorable changes in lung function when compared with interval warm-up exercise.

99. A SIMULATED CLIMBING TEST IS CORRELATED WITH TOTAL WORK FROM THE WINGATE ANAEROBIC TEST

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INTRODUCTION: The Wingate Anaerobic Test (WAnT) is a popular test for measuring lower-body anaerobic capacity and related variables. However, it may be beneficial for athletes in activities where the whole body is utilized to perform an anaerobic test that includes both the upper and lower body. Simulated climbing machines may provide comparable anaerobic capacity test results to that of the WAnT.
PURPOSE: To determine if a distance climbed 30-s maximal-effort test on a simulated climbing machine correlates with WAnT variables, specifically total work (anaerobic capacity).
METHODS: 32 participants were recruited from the local university population and reported to the lab five times. Day 1 included reading and signing the IRB approved informed consent, recording of anthropometric data, and practicing the protocol on both the cycle ergometer (Monark 598E) and simulated climbing machine (Versaclimber SM Sport). On days 2-5, participants performed the anaerobic test protocol on each machine twice using a random order. The WAnT protocol used a 7.5% body mass resistance with a 3-5-minute warm-up followed by 30-sec of maximal effort cycling. The climbing protocol included a 3-5-minute warm-up with no resistance followed by a 30-sec maximal effort climb with the lowest resistance possible on the machine. Each protocol was performed twice on two separate days. Intraclass correlation coefficient (ICC3,1) were calculated between two trials of the WAnT total work (J), between the two trials of the climber for distance climbed. Bivariate correlations were calculated for total work on the WAnT and distance on the climber.
RESULTS: Fifteen males (24.8±6.5yrs; 176.2±5.4cm; 77.0±13.5kg) and fifteen females (23.1±4.1yrs; 159.4±6.4cm; 69.2±13.8kg) completed the study. A high degree of test-retest reliability was found for WAnT total work (ICC= .99 [.98-.99], p<0.001) and climbing distance (ICC=.94 [.93-.99], p<0.001). WAnT total work and climbing distance were significantly correlated, r = .81, p < .001.
CONCLUSIONS: Simulated climbing machines may be a reliable method for performing anaerobic capacity testing. Athletes involved in actives involving both the upper and lower body may have a greater benefit using a simulated climbing machine over the traditional cycle ergometer.

98. COGNITIVE DIETARY RESTRAINT PREDICTS ENERGY, MACRONUTRIENT, AND FOOD GROUP INTAKE IN FEMALE ADOLESCENT ENDURANCE RUNNERS

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Low energy availability has been associated with poor menstrual and bone health outcomes, but few investigations exist examining the association of dietary restraint and diet intake, menstrual function, and bone density. PURPOSE: To investigate associations between cognitive dietary restraint (CDR), energy and nutrient intake, menstrual function, and bone density in female adolescent endurance runners. METHODS: 41 adolescent runners (15.6 ± 1.1 y) completed daily 24-hour recalls and exercise logs for 1 week to determine mean daily nutrient intake and exercise energy expenditure (EEE). Runners then attended appointments where they underwent a DXA scan for bone mineral density (BMD) and body composition, the Three Factor Eating Questionnaire (TFEQ) for CDR, and a health behavior survey for menstrual function and other health outcomes. Elevated CDR was defined as a score ≥11 on the TFEQ CDR subscale. RESULTS: 13 of 41 participants met criteria for elevated CDR. Runners with elevated CDR compared to non-elevated CDR had significantly higher weight (58 ± 7 vs. 53 ± 8 kg, p <.05), resting metabolic rate (per Harris-Benedict equation; 1439 ± 60 vs. 1387 ± 81 kcal, p =.04), total energy expenditure (RMR + EEE; 2218 ± 215 vs. 2067 ± 211 kcal, p <.05), fiber intake (25 ± 6 vs. 20 ± 5 g, p =.02), and fruit intake (3 ± 2 vs. 2 ± 1 servings/d, p <.01) and had significantly lower grain intake (8 ± 2 vs. 10 ± 2 servings/d, p =.01) and lumbar BMD Z-score (-0.7 ± 0.5 vs. -0.3 ± 0.8, p =.03; ANCOVA for BMI, -0.8 ± 0.9 vs. -0.2 ± 0.1, p =.01). Restraint score negatively predicted intake of energy, carbohydrate, fat, and grain, while positively predicting fiber, fruit, vegetable, and sweets intakes (Table 1).

Table 1. Univariate linear regression representing relationships between CDR score, nutrient, and food group intake.

	B	P-Value	R^2
Energy			
Energy Intake (kcal/kg)	-0.39	.01	0.13
Macronutrients & Fiber			
Carbohydrate (g/kg)	-0.33	.04	0.09
Fat (g/kg)	-0.37	.02	0.12
Fiber (g)	0.38	.02	0.12
Food Groups			
Grain	-0.38	.01	0.13
Sweets	0.40	<.01	0.14
Fruit	0.48	<.01	0.21
Vegetable	0.35	.02	0.10

CONCLUSIONS: Elevated restraint may serve as a predictor of dietary patterns that may predispose endurance runners to developing chronic energy deficit, which results in health detriments such as low BMD. Specific nutrients of concern include energy, carbohydrate, and grain intakes.

100. LOCOMOTOR RECOVERY IMPROVES FOLLOWING NEW FORM OF LOCOMOTOR TRAINING IN SPINALLY CONTUSED RAT

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Following a spinal cord injury (SCI), animals have the capacity to recover stepping using Body Weight Supported Treadmill Training (BWSTT). However, this recovery is only demonstrated when stepping on the treadmill, and translation to the over ground environment remains unresolved. The Circular BWS-Ambulatory Rodent Trainer (cBART) is a tool used to train and assess over ground stepping of animals in their natural quadrupedal gait. The cBART made using cost effective and easily accessible material. Am arm made of PVC pipe rotates around a caster bracket base. One end of the rotating arm is modified to allow for the attachment of a harness, which is used to animal. The other end of the arm has a sliding counter weight to provide adjustable body weight support. A small video camera is mounted to the lever arm to record locomotion data for analysis. The device allows the animals to continuously step in a circular path. This study compared the effects of BWSTT only versus combined training using cBART on the effects of locomotor recovery in spinally contused rats. Two groups were trained for 8 weeks using the BWSTT, with one group receiving additional over ground training using cBART. Following the training period, locomotor recovery testing was performed. Analysis include identifying forward movement of the ankle as a measure of initiation of hindlimb stepping, and hip-ankle-toe (HAT) angle has a measure of kinematic activity of the hindlimb joints. Preliminary data suggests that both initiation of stepping and HAT angle significantly improved when BWSTT was combined with cBART overground training (n = 6). These results demonstrate the importance of providing overground training in addition to BWSTT in order to produce an optimal training paradigm. These findings have implications for refining rehabilitation strategies following spinal cord injury and will address whether BWSTT alone is optimal training for locomotor recovery.

SATURDAY POSTER PRESENTATIONS

1. EFFECTS OF BLOOD FLOW RESTRICTION AND NEUROMUSCULAR ELECTRICAL STIMULATION ON STRENGTH OF THE PLANTAR FLEXORS

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Exposure to a microgravity environment removes the frequent loading of postural, or antigravity muscles, such as those found in the calf. Due to this reduced stimulation, muscle atrophy and strength significantly decrease. Currently used exercise countermeasures do not effectively mitigate the negative changes in the calf muscles and therefore alternative methods should to be investigated. Blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES) are nontraditional methods that have been shown in previous literature to elicit muscle growth in thigh and wrist musculature. However, the effects of these methods on the calves are unknown.
PURPOSE: The purpose of this study was to explore the effectiveness of BFR coupled with NMES for increasing calf strength.
METHODS: Six student participants (age 20 ±1.7 yr, weight 74 ± 14.6 kg) were recruited from California State University, Long Beach with each leg being randomized to one of three training conditions: 1) BFR only, 2) NMES only, or 3) BFR with NMES, for six weeks of training. Calf strength was measured using an isokinetic dynamometer to assess peak torque during maximal plantarflexion contractions through a range of velocities (0-210 deg/s).
RESULTS: A significant main effect for time was found for average isometric torque (P= 0.01), peak isometric torque (P= 0.02), and peak torque at 30 deg/s (P= 0.04) as a result of training with no differences found between conditions. No significant differences were found for the other velocities.
CONCLUSIONS: This study helps add to the literature regarding the feasibility of these methods as alternative exercise countermeasures for promoting favorable adaptations in the calf musculature.

2. THE UNIVERSITY STAFF PHYSICAL ACTIVITY INVENTORY (USPAI)

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Biola University

INTRODUCTION: The work-related environment has been implicated as a factor involved in the declines of physical activity (PA) in the United States and abroad. Although, the collective literature would suggest that reductions of risk for multiple chronic health conditions has been associated with physically active lifestyles meeting or exceeding 150 minutes/week. Staff in a University setting may experience unique work-related challenges that may inhibit his-or-her ability to achieve recommended daily levels of PA. Few studies exist; however, that have evaluated PA among University staff members.
PURPOSE: To explore self-reported levels of PA among staff members at Biola University.
METHODS: Eligible survey respondents (N = 320) were men (n = 108, 40.3 ± 13.1 years of age, 168.0 ± 8.5 cm in height, 74.8 ± 14.3 kg in weight, and an average body mass index (BMI) of 26.4 ± 4.7 kg/m2) and women (n = 212, 39.7 ± 13.3 years of age, 164.2 ± 8.1 cm in height, 69.8 kg in weight, and an average body mass index (BMI) of 26.03 ± 6.5 kg/m2) who reported being staff members from Biola University. Participants completed the International Physical Activity Questionnaire (IPAQ), using the Survey Monkey© platform. Workers were grouped by type of job (administration, staff and facilities). Total daily sitting time and metabolic equivalent (MET) minute activity-specific (leisure, household, occupational, and transport) and total weekly PA were calculated.
RESULTS: A Multivariate Analysis of Variance MANOVA revealed significant ($p < 0.05$) main effects for job type, total minutes of PA per week, and grand total PA per week. Post-hoc analyses revealed facilities had significantly greater minutes of work PA and total weekly PA than staff and administration. There was no significant ($p > 0.05$) difference between job types in quantity of leisure, transport, and household PA. An independent T-test was employed to evaluate gender differences for total minutes of work PA and overall minutes of weekly PA. Significant ($p < 0.05$) differences were observed for gender and total work PA, but not for overall PA. Men were significantly more active at work than women.
CONCLUSION: Mean weekly minutes of overall PA exceeded minimal weekly recommendations among all job titles and sexes.

3. COMPARISON OF SHOE VS NO SHOE ON DEADLIFT BIOMECHANICS

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Deadlifts are an integral part of strength programs, but current research has not examined the performance outcomes when performed with and without shoes. Purpose: To examine the differences in lower extremity sagittal plane joint kinetics and peak vertical ground reaction force (vGRF) of a conventional deadlift with and without shoes. Methods: Ten subjects who deadlift regularly, were free from injury, and had never had a lower extremity surgery were recruited. Subjects first performed a one repetition max (1RM) test according to the NSCA protocol. At least 72 hours later subjects returned for a 3-Dimensional analysis of their deadlift at 70% of their 1RM. Subjects performed 1 set of 5 continuous reps of a conventional deadlift in both shoe and barefoot conditions in a randomized order. A 5-minute rest was given between each condition. Visual3D was used to process raw marker and force data, calculate sagittal joint moments, and obtain dependent variables. A one-way repeated measures MANOVA was performed to statistically test differences between shoe and no shoe conditions in the dependent variables. Results: No significant differences were found in internal hip extension moments ($p = 0.305$), knee extension moments ($p=0.271$), ankle plantar flexion moments ($p=0.303$), and peak vGRF ($p=0.435$) between shod and barefoot conditions. Conclusion: Anecdotal claims suggest performing a deadlift barefoot enhances stability and increases connection to the ground which would lead to improvement in deadlift performance. The lack of difference seen in sagittal plane kinetics and peak vGRF suggest that deadlift performance is unaffected by footwear choice. Future research should investigate if similar results would be attained when subjects' deadlift performance is tested at various percentages of the 1RM.

4. IS GAIT INHERITED?

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Purpose: Family history is being recognized as a risk factor for various health issues such as cardiovascular disease and diabetes. If family history is known early on, preventative steps can be taken to reduce risk and the possible onset of said disease. Gait has been shown to influence the degradation of joints, especially at the knee. More specifically, the frontal plane knee joint moment can be a predicting tool with determining the risk of arthritis in the knee. To date, no project has been done to identify if family history can play a significant role in walking gait. Our purpose is to identify if there is a measurable similarity within familial walking gait.
Methods: A family was identified to model this study because of a parent at risk of developing joint disease. Retro-reflective markers were placed bilaterally on the participant's upper and lower extremities and trunk. This included the pelvis, trunk, both legs, feet, and shoulders, to measure individual segment motion during treadmill walking trials using a 16-camera motion capture system (100 Hz, Vicon Nexus). The treadmill used to measure walking gait will collect ground reaction force data (1000 Hz, Bertec Inc.). Participants in the study walked at a pace of 1.4 meters per second. Visual 3D (C-Motion, Inc., Germantown, MD) was used to calculate peak knee and hip moments in the frontal plane during walking.
Results: The father had a knee abduction loading moment that was 0.903 Nm/kg. This is a value that is elevated compared to healthy populations in other studies. Of the five sons that were tested in the study, three had similar elevated values of the knee abduction moment (0.801, 0.718, and 0.806 Nm/kg). The other two had values that were in line with healthy populations (0.577 and 0.495 Nm/kg). For the hip abduction moments, the sons had values that were similar to each other and 35% less than the fathers (1.23 Nm/kg).
Conclusion: Similar to the father, three out of the five sons had elevated knee adduction moments. We also found that hip abduction was not related between the generations. We found that the 3 father-like individuals were not in order of age. This could be due to a genetic link or it might be a lifestyle change that was made that prevented this from occurring. Further testing and the addition of a lifestyle survey could help us better understand the connection in the future.

5. MUNG BEAN PROTEIN SUPPLEMENT IMPROVES MUSCULAR STRENGTH IN HEALTHY, UNDERACTIVE VEGETARIAN ADULTS

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Although vegetarian diets are considered generally protective against chronic disease, nutrient deficiencies, including protein, are possible due to low bioavailability from plant-based sources. Consequences of inadequate dietary protein include reduced lean body mass (LBM) and muscle weakness. This study examined relationships between protein intake, strength, and LBM in 37 underactive vegetarians and recorded the impact of protein supplementation (18 g/d mung bean protein) on these indices utilizing an 8-week, randomized, controlled, feeding trial. Both hand grip and knee flexor and extensor strength were measured at baseline and week 8. At baseline LBM was significantly related to grams of protein consumed daily. LBM was also correlated to grip strength ($r=0.569$, $p<0.001$) and lower body strength ($r=0.763$ to 0.784; $p<0.001$). Twenty-five vegetarians completed the feeding trial, including 11 in the protein supplementation group (PRO) and 14 in an unsupplemented control group (CON). At the end of the trial, LBM and strength did not differ significantly between groups. However, average percent change for grip, flexor, and extensor strength did differ between PRO and CON participants (+2.9±7.2% and -2.6±7.3% respectively, $p=0.05$). Thus, there were strong associations between dietary protein, LBM, and strength in vegetarians and an indication that supplementary vegetarian protein increased strength in the absence of exercise and independent of LBM.

6. ELECTROMYOGRAPHIC COMPARISON OF THE FRONT SQUAT AND OVERHEAD SQUAT

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Purpose
Squat variations have been extensively studied, though, the vast majority of attention has focused on leg and trunk musculature. To date, a limited amount knowledge exists surrounding musculature of the scapula and its relationship to the erector spinae during the front squat (FS) and overhead squat (OHS). Therefore, the purpose of this study was to compare the muscle activation of the scapula, leg, and trunk between the FS and OHS.
Methods
Seven recreationally trained men (mean ± standard deviation; age: 28 ± 3.6 years, body mass: 92 ± 26.1 kg, height: 175 ± 5.3 cm, 3-RM front squat test: 125 ± 49.8 kg, 3-RM overhead squat test: 91 ± 15.5 kg) participated in this within-subject crossover design. Electromyographic (EMG) activity was measured during the FS and OHS for the vastus lateralis (VL), biceps femoris (BF), thoracic region of erector spinae (ES), middle trapezius (MT), rectus abdominis (RA), external oblique (EO), serratus anterior (SA), and anterior deltoid (AD). Differences in mean EMG activities as a percentage of maximal voluntary isometric contraction (% MVIC) during the FS and OHS were analyzed using a 2 X 3 (squat variation X intensity) repeated measures analysis of variance (ANOVA), effects were further analyzed by paired t-tests. Two isometric exercises (plank and Biering-Sorenson back extension) were also included for trunk musculature comparisons.
Results
Results showed that SA and AD activity was significantly greater ($p<0.05$) during both concentric and eccentric phases of the FS. RA and MT activity was significantly greater ($p<0.05$) during both concentric and eccentric phases of the OHS. EO activity was significantly greater ($p<0.05$) during the eccentric phase of the OHS. ES activity was significantly greater ($p<0.05$) during the FS and OHS compared to the back extension.
Conclusion
Results of the study show that on top of strengthening lower body and abdominal musculature, the FS and OHS can help strengthen muscles supporting the shoulder complex and scapula. Findings also demonstrated that anterior trunk musculature (RA & EO) activity was greater in the OHS and was comparable to the plank exercise.

7. A FIELD OBSERVATION OF ENERGY EXPENDITURE IN A PARA-ATHLETE AT REST AND DURING EXERCISE: A CASE STUDY

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Purpose: The purpose of this study was to collect energy expenditure and substrate usage data from trained para-athletes performing in their specific modes of exercise during a simulated practice and at rest. Over time, similar case profiles can be compiled to assist in the generation of energy expenditure prediction equations for para-athletes.
Methods: Two para-athletes recruited from Challenged Athletes Foundation (2 females, age 30.5 + 1.5 years) participated in the study (one left leg Syme's amputee triathlete and one T7 incomplete paraplegic wheelchair basketball athlete). Both athletes' resting energy expenditure was measured using the Cosmed K4b2 Portable Metabolic System and values were compared with predicted values. Additionally, the triathlete's exercise energy expenditure was measured during a moderate intensity (40-59% of HRmax), vigorous intensity (60-89% of HRmax), and a track workout. Substrate use during each of these exercise intensities was profiled.
Results: The study found that in the triathlete with a Syme's amputation, energy expenditure and substrate use during exercise were similar to that of an able-bodied athlete, increasing in both caloric expenditure rate and carbohydrate contribution as intensity increased (rest: 1.5 kcal/min, 30% CHO vs. vigorous intensity: 9.33 kcal/min, 65% CHO). The study also found that the revised Harris-Benedict equation and the Mifflin-St Jeor formula underestimated resting metabolic rate in both the triathlete (measured: 2,198 kcal/day, predicted: 1348 + 39 kcal/day) and the wheelchair basketball player (measured: 1,713.6 kcal/day, predicted: 1,241 kcal/day + 36 kcal/day).
Conclusion: In this case study, the athlete with a Syme's amputation had similar substrate utilization patterns compared to able-bodied athletes during a moderate and vigorous exercise intensity. However, resting energy expenditure for the two athletes profiled was higher than that predicted from formulas developed with able-bodied athletes.

8. MONITORING RESPONSES TO A SUMMER STRENGTH AND CONDITIONING PROGRAM FOR DIVISION I COLLEGIATE BASKETBALL PLAYERS

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INTRODUCTION: Basketball is a sport that requires a high aerobic fitness, strength and anaerobic power. Collegiate strength and conditioning programs tend to focus on development of these components during the off-season. Per NCAA rules, collegiate basketball teams have a maximum of 8 hours allowed per week to work on their athletes during the summer, of which at least 4 hours must be dedicated to strength and conditioning. PURPOSE: To follow a 9-week summer training program that to evaluate physiological and performance changes of the team as a whole and individually in Division I collegiate basketball athletes. METHODS: 8 collegiate basketball athletes completed a 9-week training program that included 4 hours of resistance training a week, and an additional 90 min of speed and agility training through weeks 4-9. The program was split into 3 abbreviated 3-week mesocycles, each with a different focus: hypertrophy, strength, and power. Speed and agility training consisted of sprint mechanics work, sprints upwards of 40 m, and various change of direction drills. Athletes were assessed pre and post in the following: body mass, lean body mass (LBM) and body fat via the BodPod; maximum repetitions of an 84-kg bench press; ¾ court sprint; lane agility drill (LAD); and vertical countermovement (CMJ) and two-step approach jump test (VJ). Independent samples t-tests calculated any changes between pre and posttest measurements ($p < 0.05$). Change scores were also logged for each athlete to measure individual responses to training. RESULTS: Some players were not available for all pre and posttests because of scheduling conflicts and other obligations. No significant differences were found in the pre to posttest comparison of the testing battery. However, individual responses were noted as some athletes responded better in certain tests. 4/7 athletes increased their LBM; 5/8 improved their bench press; 6/7 and 4/5 were faster in the ¾ sprint and LAD, respectively; 2/5 increased their CMJ; and 3/5 increased their VJ. CONCLUSIONS: While there were no significant performance changes considering overall results, the data suggested individual responses to the training varied greatly, and some players responded better to different parts of the program. It may be important to consider more concentrated and individualized training prescription over the summer, which may be difficult depending on the team goals set by the sport coach.

9. THE EFFECTS OF WHOLE-BODY VIBRATION AND FATIGUE ON VERTICAL JUMP PERFORMANCE

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Whole Body Vibration (WBV) is the exposure of vibration to the body, which may result in an increase of the rate of motor unit activation to prepare muscles to do physical activity. Fatigue of knee extensor muscles hinders vertical jump (VJ) performance by a limited muscle efficiency to jump. Purpose: The purpose of this study is to investigate the effects of WBV and fatigue on vertical jump (VJ) performance. Methods: Sixteen active males and females (age, 23.19 ± 2.56; weight, 79.05 ± 16.97; height, 174.36 ± 12.11) volunteered for five-day study. On day 1 familiarization, after completing an IRB approved informed consent and health screening questionnaire participants were prepped on testing protocols. Following a dynamic warm up, testing sessions 2-5 will include one of four conditions: No WBV and No Fatigue (C1), WBV and Fatigue (C2), WBV and No Fatigue (C3), and No WBV and Fatigue (C4). WBV was performed using a frequency of 50Hz and a low amplitude while performing quarter squats for a total of 4min with a 30s rest or work ratio. Lower-body fatigue induced using Bosco fatigue test, performing 60s of jump squats. VJ was performed using an AMTI force plate and peak force, velocity, and power were calculated and a Vertec was used to measure vertical jump height (VJH). VJ data was collected pre and post conditions each day. Percent change scores were calculated between pre and post conditions and used for analysis. SPSS was used to perform a Repeated Measures ANOVA where an alpha level of < 0.05 was used to determine significance. Results: There was significant differences between C1 and C2 ($p= 0.005$), C1 and C4 ($p= 0.002$), C2 and C3 ($p<0 .001$), C3 and C4 ($p< 0.001$) in VJH. There were significant differences between C1 and C4 ($p= 0.011$) and between C3 and C4 ($p= 0.017$) in peak force. There were significant differences between C1 and C2 ($p= 0.01$), C1 and C4 ($p= 0.02$), C2 and C3 ($p< 0.001$), and C3 and C4 ($p= 0.001$) in peak velocity. There were SIGNIFICANT DIFFERENCES BETWEEN WAS BETWEEN C1 AND C2 ($P= 0.03$), C1 and C4 ($p= 0.03$), C2 and C3 ($p= 0.004$), and C3 and C4 ($p= 0.008$) in peak power. There were no significant differences between other variables. Conclusion: WBV did not show to change the detrimental effects of lower-body fatigue, however this study did show lower-body fatigue decreases vertical jump performance.

11. RELATIONSHIP OF SCRUM RATE OF FORCE DEVELOPMENT AND SQUAT VARIABLES IN AMATEUR CLUB RUGBY ATHLETES

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Rate of force development (RFD) may be important because it represents how much force and strength an athlete can produce in a short amount of time. The purpose of this study was to assess correlations between scrum RFD and other measures of force, anthropometrics, and experience in club amateur rugby athletes. Height, body mass, body fat percentage and training experience were collected. We set subjects into scrum position in an instrumented scrum machine. Participants warmed up with 50% and 75% perceived maximal effort trials, then completed 5 scrums at maximum effort. After 5 minutes rest, they completed the isometric squat test, performing 50%, 75%, with two maximum effort trials. RugEX, WeightsEX, sex, height, total mass, and BF% had small to moderate correlations with scrum RFD (r=-0.04 -0.49). Lean mass, squat peak force, average force, and RFD had large to very high correlations to scrum RFD (r=0.52-0.95). Squat and scrum variables were strongly related, indicating that results from the squat may affect outcomes in scrum. Anthropometrics had small correlations with scrum RFD, while squat and scrum variables had large to high correlations to RFD in the scrum. Squat outcomes are related to scrum RFD and are probably important to scrum outcomes in a game.

10. THE EFFECT OF ACUTE CARBOHYDRATE RESTRICTION ON SQUAT PERFORMANCE AND SERUM ENERGY SUBSTRATE LEVELS

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Purpose: The purpose of this study was to investigate the acute effects of carbohydrate restriction (CR) on squat performance and serum energy substrate levels in recreationally trained individuals. Methods: Seven healthy recreationally trained males (22.6 + 3.47 yrs., 80.74 + 8.40 kg, 178.05 + 5.0 cm) completed resistance exercise (RE) under two conditions: A control (CON) and a carbohydrate restricted (CR) condition, which included a carbohydrate depletion exercise trial (CDEX). The order of CON and CR was randomized. In the CR, subjects first performed the CDEX, which consisted of 60 minutes of cycling at >75% of participants heart rate (HR) max followed by four 1- minute bouts at >95% HR max. CDEX was then followed by 48 hours of reduced carbohydrate (CHO) intake (<5% daily caloric intake). RE in both CON and CR consisted of squats, loaded via inertial resistance using a novel flywheel squat device. Fasting blood glucose and triglyceride (TG) levels were measured pre-exercise in both conditions as well as throughout the CDEX. Results: Total caloric intake was significantly ($p = 0.00$) lower during CR (mean + SD: 1661.24 + 691.6 kcal) compared to the CON (2433.85 + 527.4 kcal). No differences were found in total grams of protein (PRO) or fat intake between conditions. Percent total daily caloric intake from CHO ($p = 0.00$) was significantly lower in the CR condition (7.40 + 3.32% CHO), while total daily caloric intake from PRO and fat were significantly higher in the CR (32.90 + 8.54% PRO, 58.17 + 11.96% fat) compared to CON (37.81 + 9.26% CHO, 20.03 + 5.53% PRO, 37.47 + 11.80% fat). Fasting blood glucose levels ($p = 0.017$) were significantly lower in the CR (84.57 + 4.79 mg/dL) compared to the CON (93.28 + 6.90 mg/dL) yet there was no difference in blood TG levels ($p = 0.177$; 64.43 + 15.13 mg/dL vs. 59.29 + 14.16 mg/dL). Total average power output ($p = 0.05$) and total peak power output ($p = 0.047$) were significantly lower in the CR. Conclusion: While CDEX combined with CR may acutely reduce fasting blood glucose, this may be at the sacrifice of RE performance, especially during the initial phase of CR adaptation.

12. EFFECT OF A NOVEL GOLF PROGRAM ON GAIT PERFORMANCE IN OLDER ADULTS

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Purpose: Age-related decreases in gait speed are associated with quality of life, mortality, and falling risk in older adults. Golf is a multimodal, dynamic exercise that encompasses a wide range of movement patterns including walking, balance, squatting, and lunging movements. Therefore, the purpose of this study was to investigate changes in gait speed and stride length (SL) following a 10-week golf intervention for healthy, older adults without previous golf experience. Methods: Fifteen healthy, older adults completed a 10-week golf training program with fitness testing before and after the program. The golf program consisted of warm up exercises, driving range practice, and golf play 2x per week for 90 minutes. Participants were instructed to perform fast gait (FG) and self-selected gait (SS) tasks on a Protokinetics walking mat, pre- and post- intervention. The fast gait task required participants to walk across the walking mat as quickly and as safely as possible. The self-selected gait required participants to walk across the mat with their preferred walking speed. Five trials were performed by each participant for each task, and the three middle trials from each task were included in data analysis. A repeated-measures t-test was used to examine the pre-post changes and Cohen's effect sizes were calculated. Results: Participants completed 283/300 sessions (94%). There were no adverse events or drop-outs related to the intervention. Fourteen of fifteen participants completed pre- and post- testing. There was a statistically significant increase in FG average speed from 1.95±0.17m/s to 2.09±0.21m/s ($p = 0.026$; $d = 0.67$) and SL from 1.56±0.20m to 1.63±0.15m ($p = 0.031$; $d = 0.65$) with moderate effect sizes. There were no significant changes in SS speed or SL. Conclusions: Golf is a multimodal, dynamic activity that includes large walking distances over uneven terrain and meets ACSM's guidelines for weekly aerobic activity for older adults. The significant changes in FG average speed and SL suggest that a golf program can safely improve gait performance, even in healthy, relatively active older adults. Golf should be considered when planning physical activity programs for older adults.

13. THE PREDICTIVE CAPACITY OF FATIGUE-RELATED THRESHOLDS ON HIGH-INTENSITY FUNCTIONAL TRAINING PERFORMANCE IS DEPENDENT ON THE PHYSIOLOGICAL DEMANDS OF THE WORKOUT

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Introduction: High-Intensity Functional Training (HIFT) has evolved from solely a training modality into a sport where athletes compete in workouts that are scored by time-to-completion, number of repetitions, or total weight lifted. Previous findings suggest physiological indicators of HIFT performance may be specific to the demands of the workout. Yet, across most sports, the ability to compete at a high-intensity and delay the onset of fatigue is an important component for performance. Therefore, this study examined the relationship between fatigue-related thresholds — specifically ventilatory threshold (VT), respiratory compensation point (RCP), and maximal aerobic capacity (VO2max) — and performance across specific HIFT workouts. Purpose: The purpose of this study was to determine which fatigue-related threshold is the best indicator of performance on three standardized HIFT workouts. Methods: 11 functionally-trained, recreational male athletes (Age: 28 ± 5 years) completed three workouts for time-to-completion. Workout 1 consisted of 3 rounds of thrusters (95 lb) and pull-ups with a 21-15-9 rep scheme. Workout 2 consisted of 30 clean and jerks (135 lb). Workout 3 consisted of 5 rounds of a 400m run and 15 overhead barbell squats (95 lb). For attainment of VT, RCP, and VO2max, participants performed a customized graded exercise test (GXT) proceeded by a square-wave supramaximal verification phase at 105% peak speed of the initial test. A Pearson's r test was conducted to determine the relationship between each threshold and workout performance. For each workout dependent variable, a stepwise multiple linear regression was created using significant correlative data. Results: For Workout 1 (217.8 ± 46.8 s), VO2 at VT (33.9 ± 7.0 ml·kg-1·min-1) explained 54.2% of the variance, F (1,9) = 10.65 (β = -0.736, p = 0.010). For Workout 3 (814.2 ± 57.5 s), VO2max (49.5 ± 6.7 ml·kg-1·min-1) explained 45.2% of the VARIANCE, F (1,9) = 7.43 (B = -0.672, P = 0.023). Workout 2 (156.3 ± 46.6 s) displayed no statistically significant variables. Conclusions: Results indicated that high aerobic fitness and the ability to sustain high-intensity exercise was an important factor in Workouts 1 and 3, respectively. Workout duration and exercise type may impact which fatigue-related threshold is the best indicator of HIFT performance.

15. EVALUATING THE VALIDITY OF HEART RATE MEASURED BY THE RHYTHM DURING TRAIL RUNNING

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The emergence of wearable technology requires practical validation in order for users to be confident in their use. Previous studies have examined the validity of wearable devices in outdoor applied settings during short exercise time periods (< 5 minutes) and on level surfaces. Few studies have examined longer time periods or the effect of environmental grade (uphill and downhill). Purpose: The purpose of this study was to investigate the validity of heart rate (HR) measurement by the Rhythm armband against the Polar H7 chest strap over a prolonged period of exercise at a variable environmental grade. Methods: A total of 21 healthy adults (males = 11, females = 10, 31 ± 2 yrs, 173 ± 2 cm, 76 ± 3 kg) were recruited to run one of three trails: Mt. Charleston in Clark County, Nevada; Three Peaks Trail in Cedar City, Utah; or McCullough Hills in Henderson, Nevada. Participants were fitted with both a Polar H7 HR monitor and the Rhythm HR monitor. At a self-preferred pace, participants ran one mile uphill, rested passively in a seated position to allow HR to return to baseline levels (~15 minutes), and then ran one mile downhill back to the starting point. Results: The lower and upper limit of agreement (LoA) range was -243.60 to 252.55 and -20.76 to 24.63 beats per minute (bpm) for uphill and downhill running, respectively. The mean absolute percent error (MAPE) was 7.51% and 3.76% for uphill and downhill running, respectively. The Rhythm armband demonstrated uphill ICC = 0.065 (95% CI = 0.044, 0.087, p-value < 0.001) and downhill ICC = 0.885 (95% CI = 0.875, 0.893, p-value = <.001). Conclusion: While the Rhythm met our MAPE criterion for validity (< 10%) during uphill running, there was low agreement with the Polar H7. In contrast, the Rhythm met our MAPE criterion for validity during downhill running, and there was good agreement with the Polar H7. The Rhythm may not offer valid measurements of heart rate at all grades while trail running.

14. EFFECTS OF REPEATED-SPRINT TRAINING WITH VOLUNTARY HYPOVENTILATION AT LOW PULMONARY VOLUMES ON SPRINT PADDLING ABILITY AND BREATH-HOLD CAPACITY IN SURFERS

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Purpose: To compare the effects of a repeated-sprint training program performed using voluntary hypoventilation at low lung volume (RST-VHL) with a repeated-sprint training program performed using normal breathing (RST-NB) on competitive surfers' repeated-sprint ability (RSA) and breath-hold capacity. Methods: Competitive surfing is characterized by a number of physiological challenges, such as repeated bouts of vigorous intensity paddling and prolonged breath-holds. The proposed study aims to test the effects of a six-session RST-VHL paddling program performed on a modified swimming ergometer on surfers' RSA and breath-hold capacity. The performance of maximal effort sprint-paddling with the VHL technique may create an acute hypoxic and hypercapnic response, which may serve to enhance both anaerobic endurance and carbon dioxide buffering capacity. To pilot test the acute physiological effects of this training method, four subjects performed two training sessions in random order. Each session consisted of 15 x 20-second bouts of sprint-paddling separated by 40-second periods of passive recovery. During one session participants performed the sprints using the VHL breathing technique, while the other session was performed using a normal breathing technique. In order to determine if the RST-VHL protocol was successful in inducing an acute state of hypoxia, peripheral oxygen saturation (SpO2) was measured using forehead pulse oximetry and compared across RST-VHL and RST-NB conditions. Results: During the sprint intervals, the NB technique elicited an average SpO2 98.7 ± 0.38%, while the VHL technique elicited an average SpO2 of 87.5 ± 2.60%. Conclusions: Our results indicate that the RST-VHL protocol induces the acute hypoxic response necessary to facilitate the desired training outcomes. We hope that this experimental conditioning technique will enhance both RSA and breath-hold capacity in our population of competitive surfers.

16. HYPERMOBILITY CHARACTERIZATION IN PARTICIPANTS WITH DOWN SYNDROME ATTENDING AN INSTRUCTOR LED CONTROLLED ADAPTIVE EXERCISE SETTING

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Introduction/Background: Joint hypermobility (JHM) and hypotonia are features shown in people with Down Syndrome (DS). Adaptive Exercise Programs adapt not only to the physical but also to behavioral and intellectual challenges. This study characterized JHM and related measures in a sample of adults with DS attending an adaptive exercise program.
Methods: Thirteen adults with DS (11 males and 2 females, 28.5 ± 3.2 y height: 138.6 ± 45.8 cm, body mass = 78.22 ± 15.03 kg) participated. Participants attended adaptive exercise programming twice a week for 9 months. Tests included active range of motion (AROM) measured three times (median score reported), JHM was determined through the 9-point Beighton scale, upper body (hand-grip dynamometer) and lower body (30-second sit-to-stand) strength.
Results: Means ± SD for AROM included: shoulder extension = 21.3 ± 8.9 °, shoulder flexion = 179.0 ± 9.7 °, shoulder abduction = 174.9 ± 8 °, shoulder medial rotation = 59.2 ± 13.2 °, shoulder lateral rotation = 86.1 ± 11.6 °, hip extension = 14.3 ± 5.8 °, hip flexion = 94.0 ± 13.6 °, hip abduction = 27.8 ± 8.4 °, hip adduction = 17.1 ± 4.5 °, hip medial rotation = 31.5 ± 6.3 °, hip lateral rotation = 31.9 ± 5.6 °, ankle dorsiflexion = 16.6 ± 8.2 °, ankle plantarflexion = 44.9 ± 8.2 °, subtalar inversion = 25.9 ± 6.0 °, and subtalar eversion = 19.2 ± 9.6 °. Participants presented with: no JHM 38.4% (n=5) and with JHM 60.14% (n=8). Strength was 26.4 ± 6 kg and the sit-to-stand included 20 ± 6 movements. There were not significant correlations between JHM and muscle strength (r=-0.338, p=.259) or physical function (r=-0.085 , p=.220).
Discussion/Conclusion: Adults with DS that participated in an instructor-led adaptive exercise setting showed lower AROM compared to norms in adults without DS, potentially because of persistent hypotonia. Despite the sizable incidence of JHM, JHM was more prominent in hands (50% of 8). Participants showed comparable upper-body strength but higher lower body strength than shown in DS. The program focused on strengthening large muscle groups with less emphasis on wrist or hand muscles which can potentially explain why only 1/3 of participants presented with the overall JHM and good lower body strength. Future studies should evaluate changes in JHM, AROM and muscle strength in response to adaptive exercise training in DS.

17. DOES TREADMILL GRADE EFFECT THE ACCURACY OF ENERGY EXPENDITURE AND HEART REATE MEASURES FROM POPULAR WRIST-WORN DEVICES

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The popularity of wrist-worn tracking devices has increased, with devices used to track steps, heart rates, energy expenditure and sleep. The accuracy of these devices is still being investigated. PURPOSE: The purpose of this study is to evaluate the accuracy of energy expenditure and heart rate measures for two of the most popular devices (Garmin Vivoactive 3, FitBit Ionic) during treadmill activity at different grades. METHODS: We recruited 26 male and female college aged adults to participate in this study. During one laboratory session, after programming the wrist-worn devices with anthropometrics for each participant, they were each fitted with the two wrist-worn activity devices, one on each wrist. Participants were then fitted with a Polar heart rate monitor (chest worn strap and receiver) as well as a neoprene face mask for collecting expired gases to determine a criterion measure of energy expenditure using indirect calorimetry. Participants then completed three steady state walking intervals at three different grades in random order (0%, 3% and 6% treadmill grades). They were asked to walk at a self-selected "somewhat hard" pace for approximately 10 minutes during each interval. During each interval steady-state energy expenditure and average heart rate from each device was recorded. Values derived from each device were compared to criterion measures to determine the difference or error. Difference scores were then compared across treadmill grades to determine if treadmill grade effected the accuracy of these devices. RESULTS: There was no difference in the HR values of the devices compared to the criterion HR measure. The Garmin device overestimated EE compared to criterion by 30-35% at 0% and 3% grades ($p=0.03$, $p=0.05$ respectively). CONCLUSIONS: Both devices provided accurate HR measures at all grades. Both devices generally overestimated EE and users should expect error when measuring EE while treadmill walking, especially at lower grades.

18. RELATIONSHIPS BETWEEN INTERNAL AND EXTERNAL TRAINING LOAD MEASURED BY GPS TECHNOLOGY IN DIVISION I COLLEGIATE FEMALE SOCCER PLAYERS

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INTRODUCTION: Global positioning system (GPS) provides an objective measure of workload based on locomotion changes. Recent advances in GPS technology allow practitioners to quantify the demands of training, monitor, and adjust training load (TL) to develop specific training programs. GPS devices have been used in conjunction with rating of perceived exertion (RPE) in an effort to quantify the influence of the various loads imposed on the athlete. However, there has been limited use of GPS technology in collegiate female soccer players. PURPOSE: To determine the relationships between internal (RPE) and external TL metrics measured by GPS wearable technology. METHODS: 20 NCAA Division I female soccer players, excluding goalkeepers, participated in the study during the competition season. The player's external TL was quantified over 7 training sessions by means of GPS devices operating at a sampling frequency of 10 Hz. Each player wore a specialized harness which held the GPS posteriorly positioned between the scapulae. GPS-based measures of total distance (TD), explosive efforts (EE; traveling less than 2.2 m/s for at least 0.5 s, accelerate to at least 4.75 m/s and sustain speeds above this threshold for at least 1.5 s), number of sprints (NS; sprint defined as traveling above 4.75 m/s for at least 1 s, ends when speed drops below 3 m/s), and overall GPS load (GPSLoad) were recorded to quantify external TL. After each training session, participants reported their RPE using the Borg CR-10 scale. Correlation analysis ($p < 0.05$) was used to calculate relationships between RPE and the external TL variables from each session. RESULTS: There were significant relationship between RPE and external TL for training session 1 (TD $p = .028$; EE $p = .014$; NS $p = .020$; GPSLoad $p = .023$) and training session 6 (TD $p < .001$; EE $p = .002$; NS $p = .001$; GPSLoad $p < .001$). There were no significant correlations between RPE and the external training variables for training sessions 2-5 and 7. CONCLUSIONS: RPE provided some indication of external TL measured by GPS technology. This is beneficial for coaches to understand the demands placed on the athlete and modulate TL. However, player familiarity with RPE could have influenced this data, given the GPS data appeared to provide valid metrics. Coaches should also recognize this when combining the use of internal and external TL metrics.

19. FUNCTIONAL TRAINING IMPROVES THE EFFECTIVENESS OF STRETCHING PROGRAMS FOR COLLEGE CLEANING STAFF

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Purpose: Stretching interventions are common for the mitigation of work-related musculoskeletal disorders (WMSD) but often do not address specific job demands. The purpose of this study was to determine whether combining a structured stretching program with education and functional application training would yield additive effects on flexibility, ergonomic practices, and subjective pain levels. Methods: A total of 22 Occidental College cleaning staff (ages 35-63) participated in a 10-week full-body progressive stretching intervention, facilitated during the first 15 minutes of the workday three times per week. During the third session of each week, experimental participants (n=13) only spent 10 minutes stretching and 5 minutes practicing functional movement patterns. Joint-specific flexibility, work-specific tasks, and perceived pain were assessed pre and post-intervention with validated flexibility protocols, task ergonomic form analysis, and pain surveys. Data was analyzed with 2-way repeated measures ANOVA and Pearson correlation at a significance value of 0.05. Results: The intervention improved overall flexibility (+21.9±3.3%; $F(1,19) = 59.58$, $p < .001$, large effect) and work task ergonomic form (+26.3±10.5%; $F(1,19) = 7.83$, $p < .05$, large effect). Both variables were negatively correlated with pain levels ($r = -.460$, $p < .01$ and $r = -.323$, $p < .05$, respectively). Experimental subjects experienced greater joint-specific improvements in shoulder (control = +16.8± 9.0%; experimental = +64.2±11.5%; $F(1,19) = 5.38$, $p < .05$, medium effect) and hip (control = +31.4±9.9%; experimental = +91.2±19.9%; $F(1,19) = 6.72$, $p < .05$, large effect) flexibility as well as in task-specific ergonomic form for vertical (control = +3.8±4.1%; experimental = +177.8±49.7%; $F(1,19) = 10.04$, $p < .01$, large effect) and horizontal wiping (control = -13.2±6.0%; experimental = +149.7±41.8%; $F(1,19) = 6.32$, $p < .05$, large effect) tasks. Shoulder ($r = -.469$, $p < .05$) and hip ($r = -.440$, $p < .05$) flexibility were negatively correlated with pain levels. Conclusions: Results suggest that supplementing a stretching program with functional application has the potential to significantly improve flexibility and decrease pain. Future studies are needed to confirm intervention impacts on WMSD and worker productivity.

20. DESIGN MATTERS: PHYSICAL ACTIVITY AND SOCIAL BEHAVIORS OF URBAN CHILDREN ON SCHOOLYARDS WITH DIFFERING LEVELS OF GREEN SPACE

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The purpose of this study was to determine how the presence or absence of green space and specific schoolyard design features impact individual physical activity (PA) and social behaviors during recess in urban Title 1 schools. Methods: Recess behaviors were recorded for 947 students (kindergarten-6th grade) with the SOCARP observation tool at four schoolyards with differing levels of green space and hardscape play options. Data was analyzed with linear mixed models and Pearson correlation at a significance value of 0.05. Results: An interaction effect between location and zone type (green space vs hardscape) was discovered for the amount of time spent in vigorous PA ($F1,749 = 5.308$, $p < .05$). Students were more vigorous in green space, when available, compared to hardscape and when not available, students were more vigorous at locations with painted asphalt and the greatest variety of play options. The play structure zone areas designed for climbing were the most conducive to extended periods of vigorous PA across locations ($F10,617 = 2.660$, $p < .01$). More time was spent in small groups in green space than hardscape ($F1,749 = 4.114$, $p < .05$) which was positively correlated with time spent in locomotion ($r = .209$, $p < .001$) and the frequency of prosocial interactions ($r = .209$, $p < .001$). Students spent more time in large groups on hardscape at locations with a greater number of features designed for sport and traditional playground games (e.g. tetherball, handball, 4-square) ($F1,749 = 5.824$, $p < .05$). Conclusions: Schoolyards that provide diverse play options, present motor skill challenges, and connect students to nature maximize individual student participation in moderate-to-vigorous physical activity and positive interactions with peers.

21. ENERGY EXPENDITURE AND PEAK POWER OUTPUT IN RELATION TO BODY COMPOSITION IN COLLEGE-AGE FEMALES

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Purpose: Several research studies have reported that a combination of diet and exercise produces more health benefits than either diet or exercise alone. Measurements most often assessed were changes in body weight, body composition and cardiorespiratory fitness (VO2max). With the rise in participation rates in HIIT training for weight loss and maintenance, anaerobic or supramaximal testing can be used to explain differences in FFM, rather than relying on aerobic testing alone. The purpose of this preliminary study is to determine if basal metabolic rate (BMR) and anaerobic measures of peak power (PP) and time at PP have a relation to fat free mass (FFM) of college-age females. Methods: The subjects for this study included 18 female students (ages 19-22) enrolled in an exercise physiology course. The testing sessions were spaced over a three-week period and specific instructions were provided to the subjects two days prior to each test. Body composition was assessed using air displacement plethysmography; BMR was determined through indirect open-circuit calorimetry; and the Wingate Anaerobic Test was used to measure PP and time at PP. A multiple regression analysis was run to predict FFM from BMR, PP, and time at PP, α=0.05. Results: The average FFM was 70.52 ± 5.8 (%), BMR was 1759.56 ± 350.7 (kcal/day), PP was 608.84 ± 148.8 (W), and time at PP was 2004.44 ± 237.2 (ms). BMR, PP, and time at PP statistically significantly predicted FFM (F(3,12)=12.649, p=0.001, R2=0.70). Conclusions: Although time at PP individually proved to be statistically significant as an indicator of FFM, BMR and PP did not. Therefore, the findings of this study suggest that the combination of BMR, PP, and time at PP may be able to predict FFM. These results demonstrate that a greater amount of FFM is beneficial in anaerobic activities such as HIIT and in aiding metabolism. Further research can be done using different variables of the Wingate or other anaerobic tests, to see whether they produce similar findings.

22. EFFECT OF ETHNICITY ON CHANGES IN VO2MAX AND CARDIAC OUTPUT IN RESPONSE TO HIGH INTENSITY INTERVAL TRAINING

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Prior data show that ethnicity does not mediate responsiveness to exercise training (Skinner et al. 2001; Slentz et al. 2004), although populations used in these studies were primary Caucasian (C) and African-American. It is unknown if Hispanics (H), who face elevated health risks and are reported to be less active than C (CDC 2017), exhibit a similar response to exercise training versus other populations. AIM: To determine if ethnicity alters physiological responses to HIIT in sedentary C versus H women. METHODS: Eleven C and seven H women ages 18 - 35 yr who were healthy, non-obese, and inactive (< 150 min/wk of physical activity in the last 12 mo) participated in the present study. They completed nine sessions of progressive HIIT on a cycle ergometer at 85 %PPO. To determine maximal oxygen uptake (VO_2max), participants initiated progressive cycling with simultaneous acquisition of gas exchange data consisting of 2 min at 15 or 20 W followed by 15 - 20 W/min increases in power output until fatigue. During the bout, an impedance cardiograph device was used to evaluate measures of hemodynamic function including stroke volume (SV) and cardiac output (CO). Habitual physical activity was assessed during the study using accelerometry. RESULTS: Training elicited a heart rate equal to 84 %HRmax, and 99.4 % of sessions were completed. Results showed a significant main effect of training for VO_2max in C and H (30.7 ± 3.7 to 33.6 ± 3.9 mL/kg/min and 30.1 ± 2.6 to 32.4 ± 1.8 mL/kg/min, F = 11.6, p = 0.004), but there was no group by training interaction (p = 0.69). Significant increases were also exhibited in PPO (p < 0.001), SV (p = 0.02), and CO (p = 0.018), but there was no group by training interaction for any variable (p = 0.13 – 0.66). CONCLUSION: Our data show no effect of ethnicity on the cardiorespiratory and hemodynamic response to HIIT, although longer studies in similar populations are needed to verify this result.

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23. NUMBER OF PRIMARY CARE TELEMEDICINE VISITS INFLUENCES PERCENT WEIGHT LOSS IN OBESE PATIENTS

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Purpose
The American Heart Association and American College of Cardiology recommends 14 or more sessions to achieve a clinically significant percentage of weight loss within 6 months. The objective of this study was to assess the relationship between the number of telemedicine visits within a primary care setting completed and overall percent weight loss achieved.
Methods
Forty-eight obese participants (Age: 59.27±16.68, BMI=34.4± 5.5, 21 males, and 27 females), were recruited from a primary care setting via inHealth Medical Service, Inc. All participants received feedback regarding their nutrition, physical activity, and behavior change by a certified health coach. SPSS v25 was used to conduct a Pearson Correlation to assess the relationship between number of visits and percent weight loss. The Kruskall Wallis Test was used to determine number of visits and average percent weight loss. Significance was set to p<0.05.
Results
Participants completed 32.6 ± 12.5 videoconferencing visits and lost an average of 6.30±7.4% body fat between 6 to 12 months. There was a negative correlation between number of visits and percent body weight loss, which was statistically significant (r = -.299, p = .039).
Conclusion
Results indicated that the number of telemedicine visits within a primary care setting influences percent body weight loss.

24. THE EFFECTS OF A 12-WEEK TRAINING PROGRAM ON ISOMETRIC AND DYNAMIC PERFORMANCE TESTS IN YOUNG MALE ATHLETES

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PURPOSE: Literature shows that training children and adolescents can enhance strength and power irrespective of their stage of development; however, the development of the kinetic variables that underpin strength and power performance are typically unreported in youth training studies. METHODS: Twenty-four pre- and 14 post-peak height velocity (PHV) males were divided into maturity-specific experimental (EXP) and control groups (CON), with the EXP groups completing a twice-weekly, 12-week training program. Force-time characteristics during the isometric mid-thigh pull (IMTP), countermovement jump (CMJ), and squat jump (SJ) tests were quantified at both baseline and following the completion of the 12-week program. Alpha level was set at p < 0.05. RESULTS: Analysis of IMTP data revealed that only the post-PHV EXP group significantly increased absolute isometric peak force (PFabs) and peak rate of force development within the IMTP following training. Both EXP groups displayed significant increases in isometric PF at time epochs 0-90 ms, 0-150 ms, 0-200 ms, and 0-250 ms. Data from the dynamic tests indicated that the pre-PHV EXP cohort improved concentric qualities as reflected by increased SJ height and CMJ concentric power. There were no significant changes for any variables across all tests within either CON group (p > 0.05). CONCLUSIONS: Maturity related differences in response to short-term training affects the kinetic variables associated with strength and power performance in young male athletes. Adolescent males induce greater gains in strength and power following a combination of resistance and plyometric training than children.

25. ENERGY EXPENDITURE, HEART RATE AND WEARABLE DEVICES: SPORT SPECIFIC MODES VERSUS GENERAL MODES

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Wearable wrist worn tracking devices have become more popular, with the capacity to track steps, heart rate (HR) and energy expenditure (EE). Two of the most popular wearable devices were selected for evaluation, the Fitbit Ionic and the Polar Vantage. Research has been done on the accuracy of the EE measures from these devices but little research has indicated if there is any advantage to using a Sport Specific Mode (SSM) for estimating EE versus the General Mode setting (GM). PURPOSE: This study determined the accuracy of HR and EE measures from wearable devices using pre-programmed SSM versus GM. METHODS: 12 apparently healthy, recreationally active adults were recruited via word of mouth. Participants included both men and women. Each participant attended two randomly ordered laboratory sessions. At each session they were fitted with the wrist-worn devices as well as a face mask for collecting expired gases to determine EE through indirect calorimetry and a Polar heart-rate monitor (chest worn strap) as the criterion EE and HR measures. During each session, participants performed intervals of steady state exercise on a treadmill or stationary bicycle with the final 5 minutes of HR and EE recorded from each device. Participants exercised at a self selected "somewhat hard" intensity for both modes of activity. Devices were set on GM for one interval and SSM for the other to determine EE (Kcal/min-1) and HR. Criterion measures of EE were compared to EE estimates from the pre-programmed SSM and from the GM for each device. Criterion measures of HR were also compared to HR measures from each device. RESULTS: There were no differences in EE measures for either device compared to the criterion regardless of mode. However, compared to the criterion HR measure, the Vantage consistently measured low for HR on the treadmill only. For GM on the treadmill HR was underestimated by 11.8% (p=.009), HR with SSM was underestimated on the treadmill by 7.5% (p=.019). CONCLUSIONS/DISCUSSION: Regardless of the type of wearable device HR and EE measures were similar for SSM compared to GM. Within this population the data suggested a more accurate HR was derived from the Fitbit Ionic, with no significant differences in measures of EE.

27. BIOMECHANICS AND ENERGETICS OF CURVED VS. TRADITIONAL TREADMILLS IN FEMALE ADULTS

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INTRODUCTION Curved treadmills (CT) are marketed to increase metabolic costs while minimizing load on users. If the CT can minimize joint stress, it may increase the length of exercise sessions and increase overall energy expenditure (EE). PURPOSE This study aims to examine the biomechanical and energetic differences between the non-motorized curved treadmill and the motorized flat (i.e., traditional) treadmill (TM). We hypothesize that, when compared to TM, CT will result in significantly higher EE, percentage of VO2 max and trunk flexion under all testing conditions. METHODS Data collection included two sessions. In session one, participants filled out an informed consent, health questionnaire, and anthropometric data was collected. After, the participants underwent a 20-minute resting energy expenditure test to gather baseline metabolic data and the session concluded with a Bruce VO2 max test. In session two, participants were connected to a metabolic cart to measure metabolic costs and outfitted with reflective markers to capture 3D kinematic data.). RESULTS There was not a significant increase in the amount of trunk flexion under any of the conditions between treadmills. There was a significant increase in the amount of EE from the TM to the CT across all six speeds. At 15% above their self-selected jogging (SSJ) speed, EE was 10.00 ± 1.32 kcal/min and 8.74 ± 1.34 kcal/min for the CT and TM, respectively (p=.002). At 15% slower than SSJ speed, participants' EE was 8.44 ± 1.16 kcal/min and 7.36 ± 1.05 kcal/min (p=.005) for the CT and TM, respectively. At SSJ speeds, participants EE was 8.94 ± 1.17 kcal/min and 7.47 ± 1.13 kcal/min for the CT and TM, respectively (p<0.001). At 15% above participants' self-selected walking (SSW) speed, EE was 5.35 ± 1.18 kcal/min and 3.38 ± 0.68 kcal/min on the CT and TM, respectively (p<0.001). At 15% slower than SSW, participants EE was 4.34 ± 0.92 kcal/min and 2.93 ± .47 kcal/min on the CT and TM, respectively (p<0.001). At SSW speeds, participants EE was 4.66 ± 1.00 kcal/min and 3.18 ± 0.62 kcal/min on the CT and TM, respectively (p<0.001). CONCLUSIONS Our findings suggest that female athletes may benefit from using CTs over TMs because of the increased EE utilization but further research needs to be conducted to assess the viability of CTs as a safe option with respect to musculoskeletal structures.

26. CORRELATIONS BETWEEN ACADEMIC CONFIDENCE AND COGNITIVE FUNCTION

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Purpose: Several studies have looked at the effects that confidence and cognitive function have on academic performance. The data is somewhat inconclusive due to the many different variables and instruments utilized. We did not find much research on the effects of confidence on cognitive function testing. Therefore, the purpose of this study was to see if there was a correlation between several academic confidence tests and several cognitive function tests. Methods: Forty recreationally active college students were recruited for this study (fem = 20, male = 20, mean age = 21.63 ± 2.05; mean BMI = 23.71 ± 3.06 kg/m2). All subjects completed several Likert type scaled surveys on academic confidence, learning, and reasoning style; the Individual Learning Profile (ILP), Academic Behavioral Confidence Scale (ABC), and Memory and Reasoning Competency Inventory (MARCI). Subjects also completed several cognitive function tests; Stroop Color Word Interference test, a memory test for accuracy and speed, and a spatial reasoning test. Results: Multiple correlations were run to identify relationships between all the measured variables. There was a significant but small correlation between time management on the ILP and the Stroop and memory speed tests (r = 0.37, P = 0.0192; r = 0.42, P = 0.0033, respectively), and a negative correlation between MARCI and the Stroop and spatial reasoning tests (r = -0.25, P = 0.0306; r = 0.23, P = 0.0242, respectively). There were also significant correlations between the ABC and aspects of the ILP (reading r = 0.58, P = 0.0268; time management r = 0.50, P = 0.0055; total ILP r = 0.699, P = 0.0138). Conclusion: These results show a moderate correlation between measures of academic confidence and learning styles. However, there seems to be little evidence of a relationship between measures of academic confidence and performance of several types of cognitive function tests.

28. THE EFFECTS OF WHOLE-BODY VIBRATION AND FATIGUE ON ISOMETRIC MID-THIGH PULL

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Musculature exposed to continuous stress overtime will begin to decrease performance as a result of fatigue. However, past research has shown that Whole Body Vibration (WBV) can have a positive effect on performance by increasing motor unit recruitment. Purpose: The purpose of this study is to analyze the effects of WBV and Fatigue on Isometric Mid-Thigh Pull (IMTP). Methods: Sixteen active males and females (age: 23.19 ± 2.56yr, weight: 79.05 ± 16.97kg, height: 174.36 ± 12.11cm) volunteered to participate in a 5-day study. Day 1 consisted of familiarization where participants completed an IRB approved informed consent, Health History Questionnaire, and a PARQ. Following anthropometrics measurements, participants were familiarized with all the testing protocols and interventions. Day 2-5 testing sessions consisted of a dynamic warm-up consisting of 2 sets of a light jog, high knees, and butt-kicks for a fixed distance, 2 sets of 10 body weight squats, and 2 sets of 10 arm circles forward and backwards were completed at the beginning of every session; followed by pre-testing of IMTP's. Post-tests for IMTP were taken following the completion of one of 4 conditions, each performed on separate days. Conditions consisted of C1 (No WBV-No Fatigue), C2 (WBV-Fatigue), C3 (WBV-No Fatigue), and C4 (No WBV-Fatigue) in a randomized order. Peak Force for the IMTP was measured using an AMTI Portable Force Plate. WBV was administered while performing quarter squats at a frequency of 50Hz and low amplitude on for a total of 4min with a work to rest ratio of 30s/30s. The Bosco fatigue protocol was administered to induced lower-body fatigue by having participants perform 60s of jump squats. Percent change scores were calculated between pre- and post-tests for each condition and analyzed for statistical differences between conditions. SPSS was used to run a Repeated Measures ANOVA to compare condition differences of percent change scores. An alpha level was set at p <0.05 to determine significance. Results: There were no significant differences found between conditions for peak force (p=0.84). Conclusion: Although no significant differences were found for peak force between pre- and post-tests for IMTP, further studies need to investigate alternative ways to evaluate the effects WBV on lower-body muscular performance.

29. KNEE JOINT CONTACT COMPRESSIVE FORCE OF TRANSITIBIAL AMPUTEE AND CONTROL PARTICIPANTS IN GAIT, CYCLING, ELLIPTICAL TRAINING

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Purpose
Transtibial amputees have an increased risk of contralateral (intact) knee osteoarthritis (OA) [1,2] that may be influenced by abnormal joint contact compressive forces (JCCFs). The hypothesis was that maximum knee JCCFs of the intact or dominant leg would depend on participant type (transtibial [TT] amputee, control) and exercise (gait [G], cycling [C], elliptical [E]).
Methods
Protocols were approved by Cal Poly's IRB. Experiments were conducted with 6 TT amputee (2 F, 4 M, aged 18-37) and 6 control (2 F, 4 M, aged 20-23) participants. Kinematic data were collected for 32 markers using a 12-camera motion analysis system (Motion Analysis, CA). Kinetic data were collected using 4 force plates (AMTI, MA) for G, and a stationary bike (Life Fitness, IL) and an elliptical machine (Spirit Fitness, AR) with pedals containing 6-axis load cells (AMTI) for C and E. G trials were conducted at self-selected walking speeds, and C and E trials were conducted at 70 RPM with moderate resistance. Data were filtered (4th order Butterworth, 6 Hz cutoff frequency) and interpolated for one full cycle. An OpenSim (OpenSim, CA, USA) musculoskeletal model [3] was used with OpenSim's Joint Reaction tool to calculate maximum JCCFs that were normalized (body weight) and averaged across all control and amputee participants. Two-factor repeated measures ANOVA and post-hoc Tukey tests ($p<0.05$) were conducted (Minitab, PA) to analyze effects of participant type and exercise.
Results
JCCFs were highest in G followed by E and C, consecutively, for control and TT amputee participants (Fig. 1). No differences were found between control and TT amputee participants.
Conclusions
Results reinforce that C and E may be preferred exercises for limiting OA risk in TT amputees due to lower JCCFs. Limitations of this study include small sample size and lack of EMG-driven analyses.

30. EFFECTS OF TRAIL RUNNING ON ANKLE KINEMATICS

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Trail Running is a popular outlet for runners looking for a change of scenery from the sidewalk. However, the varying terrain presents unknowns on the body Biomechanically. While studies have investigated inclined surfaces and cross sloped surfaces independently, it is to the author's best knowledge that they have not yet been explored simultaneously. Purpose: This pilot study explores the kinematics of running on a simultaneously inclined and cross-sloped running surface. Understanding the biomechanical effects of running on this surface will better equip clinicians with knowledge of possible mechanisms of injury runners might encounter on this surface during an ultra-marathons or while trail running. Methods: Participants were tested for ligament stability in the ankle and knee prior to participation. After, they ran 5 different incline and cross slope conditions on a modified treadmill. The Conditions included: 2 cross sloped trials at 5 and 10 degrees, an inclined trial at 9 degrees as well as combined analysis trial with a 5 degree cross slope and 9 degree incline and another with a 10 degree cross slope and 9 degree incline. Peak frontal plane angles at the ankle and the knee were compared between the conditions. Results: The maximum ankle joint angles in the frontal plane were not found to be different for any of the conditions under consideration. This is not surprising considering the small sample size. However, peak ankle eversion angle of the upslope foot during the 9 degree cross slope condition which had 3 degrees more eversion compared to the level cross slope condition. For the same conditions the ankle inversion angle on the upslope was almost 4 degrees greater, which was twice the amount of inversion. For all the other variables the amount of angular motion appeared to be similar between all conditions. Discussion: Despite the few subjects tested, the biggest impact trail running has on running gait is the ankle of the upslope leg during the cross slope conditions. This may result in stress on the lower extremity, especially on frontal plane alignment. However, the increase in eversion was not as significant as the trial with the incline and cross slope, possibly due to a change in overall speed. This would lead us to believe that the body may potentially adapt more to inclines than cross slopes when running on trails.

31. EFFECTS OF RESPIRATORY IMPEDANCE ON PERFORMANCE AND RECOVERY

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Respiratory impedance has been studied as a possible countermeasure against fatigue during repeated bouts of high-intensity exercise. By creating resistance during inspiration, an impedance threshold device (ITD) decreases intrathoracic pressure and pulls more blood back to the heart, resulting in increased cardiac output and stroke volume. This increased blood flow may enhance exercise recovery by clearing metabolites and increasing tissue perfusion. PURPOSE: To examine the effects of breathing with an ITD during recovery between repeated bouts of high-intensity exercise. METHODS: Eleven participants accustomed to performing high-intensity exercise (8 men, 3 women, 19-29 years-of-age) performed a total of 9, 20 s high-intensity exercise bouts interspersed with 3 min of active recovery on a Lode Excalibur bicycle ergometer. Resistance was set at 45 g/kg body mass. Participants were instructed to perform each exercise bout at an intensity that would elicit a rating of approximately 7 (very strong) on the Borg Category-Ratio scale of perceived exertion. The same exercise protocol was performed on separate days, with and without the ITD during recovery. Results: As expected, the exercise protocol significantly increased blood lactate and ratings of perceived exertion. Participants rated their perceived recovery lower as the number of exercise bouts increased. There were significant differences in peak and mean power output, as well as total work, between exercise bouts, with the highest values recorded during the 9th bout. Thus, participants paced themselves during early bouts and gave a near maximal effort during the last bout. However, results were not significantly different between the control and ITD conditions. Conclusions: Use of an ITD during recovery periods between repeated, high intensity exercise bouts that required pacing did not positively impact subsequent performance. Results may be different if individuals perform repeated, high-intensity exercise that requires a maximal or near maximal effort during each exercise bout rather than a pacing strategy.

32. THE RELATIONSHIP BETWEEN SCRUM AND SQUAT PEAK FORCE OF WOMEN'S RUGBY ATHLETES.

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In a rugby scrum strength gives the ability to generate high forces against opponents. Lean body mass may allow for higher forces when scrummaging. This study's purpose was to evaluate the relationship of scrum peak force relative to both total body mass (SFTM) and lean body mass (SFLM) to isometric squat and demographic and anthropometric characteristics. Eighteen male and female collegiate rugby athletes completed isometric strength tests using an instrumented scrum machine and an isometric squat rack. For both tests, participants were placed in a position to achieve a knee angle of 120°. For each test, they warmed up by pushing at 50% and 75% of perceived maximal effort for six seconds, then completed three to five 100% trials. Correlations between the SFTM and SFLM and other variables were calculated using Google Sheets. Squat peak force and average force showed large to near perfect correlations to SFTM ($r = 0.55$) and SFLM ($r = 0.91$), anthropometrics showed small correlations to SFTM, except in SFLM, and age, rugby experience, and resistance training experience displayed small to moderate correlation to SFTM and SFLM ($r = 0.16$) and ($r = 0.32$) respectively. Scrum and isometric squat results have a high specificity for normalized force production. The results suggest that squat training may give athletes an advantage to perform better in the scrum.

33. MAXIMAL VOLUNTARY ISOMETRIC MID-SHANK PULL DOES NOT RESULT IN A POST-ACTIVATION POTENTIATION MECHANISM FOR A DEADLIFT EXERCISE IN RECREATIONALLY TRAINED MALES

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Introduction: Post-activation potentiation (PAP) is a phenomenon in which the contractile history of a muscle, typically heavy loads, results in a short-term improvement in performance of subsequent muscle contractions. PAP has been shown to increase performances in explosive exercises, such as jumping and sprinting following some form of potentiating exercise such as a heavy loaded back squat, or an isometric exercise such as a mid-thigh pull. While research has demonstrated that a potentiating exercise can improve the performance of a different, yet related movement, less is known about using an isometric exercise as a potentiating mechanism for the same movement. Purpose: To examine the effectiveness of a maximal isometric mid-shank pull as a PAP for a subsequent deadlift exercise. Methods: Fourteen recreationally trained males (height = 173.46 ± 7.09 cm, mass = 78.86 ± 11.62 kg, age = 23.4 ± 2.71yrs.) participated in this study. Participants were included if they consistently trained deadlifts and had not sustained any serious musculoskeletal injury within the previous 6 months. Participants attended 3 lifting sessions with 72 hours of rest between each session. The first day was used to establish the participant's deadlift 1-repetition maximum (1RM). The second and third day were randomized and consisted of 3 sets of 3 repetitions (3x3) at 80% of the participant's 1RM of either a standard deadlift, or a maximal isometric mid-shank pull followed by 8 minutes of rest and then the 3x3 deadlift protocol. Average peak vertical ground reaction forces for the three repetitions across each set were extracted for analysis for each of the conditions. 2 (condition) x 3 (set) repeated measures ANOVA's were conducted for the peak forces as well as rate of force development. An alpha level of 0.05 was set a priori. Results: The ANOVA's revealed no significant differences between the two conditions in either peak force (p = 0.26) or rate of force development (p = 0.34). Conclusions: Data from this work indicates that an isometric mid-shank pull as a potentiating mechanism does not significantly influence ground reaction force production or rate of force development of a subsequent deadlift performance in recreationally trained college-age men.

34. THE ASSOCIATION BETWEEN THE FUNCTIONAL MOVEMENT SCREEN AND LANDING BIOMECHANICS IN INDIVIDUALS WITH ACL RECONSTRUCTION

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Purpose: The functional movement screen (FMS) was designed to assess movement dysfunction and may classify individuals at risk for injury. It is unclear if FMS scores are associated with prospective risk factors for primary and secondary ACL injury such as dynamic knee valgus during a drop vertical jump (DVJ). The purpose of this study was to compare landing biomechanics during a DVJ between the involved and uninvolved limb in individuals with ACLR, and to evaluate the association between the FMS score and landing biomechanics.
Methods: 28 participants with primary unilateral ACLR (sex=54% female, age=22.6 ± 3.8 years, months post-ACLR=70 ± 46 months, graft type=9 patellar tendon, 11 hamstrings tendon, 9 allograft) performed the FMS (deep squat, hurdle-step, in-line lunge, active straight-leg raise, rotary stability, shoulder mobility, and trunk-stability push-up) and then completed 3 DVJs while 3-dimensional biomechanics were recorded. Each FMS task was scored from 0-3, and scores were summed for analysis. DVJ variables included the peak knee abduction angle, knee flexion angle at ground contact, peak knee flexion angle, and peak vertical ground reaction force (vGRF) normalized to body weight (BW) in the involved and uninvolved limb. Interlimb comparisons of landing biomechanics were conducted via paired samples T-tests. Partial correlation examined the association between FMS score and landing kinematics after controlling for sex.
Results: The involved limb had a lower peak vGRF compared to the uninvolved limb (1.98 (0.49) vs. 2.29 (0.43) BW, p=0.001), but no other differences in landing biomechanics were found between limbs (all p>0.05). Lower FMS score was associated with greater peak knee abduction angle in the involved limb (r=-0.361, p=0.035). There were no other associations between the FMS score and landing biomechanics (all p>0.05).
Conclusion: Individuals with ACLR had lower GRF in their involved compared to uninvolved limb. A lower FMS score was associated greater knee abduction during a drop landing. However, there was a substantial proportion of unexplained variance in the peak knee abduction angle (87%), and no other relationships were identified between FMS score and landing biomechanics. Therefore, the FMS scores may not adequately represent aberrant knee motion during a DVJ.

35. BILATERAL BONE STRENGTH DIFFERENCES IN DII FEMALE VOLLEYBALL PLAYERS (PILOT STUDY)

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Exercise (loading) increases bone strength and reduces the likelihood of fractures later in life. However, questions remain as to the specific loading parameters that optimize bone strength. Current models investigating the effect of loading on bone strength include tennis players and professional baseball pitchers, which provides an internal control (Haapasalo et al., 2000). These studies have reported significant bilateral differences in bone characteristics favoring the dominant arm in male tennis players (Haapasalo et al., 2000) and professional baseball pitchers (Warden et al 2014). Results showed positive lifelong effects of exercise (loading) on bone. Volleyball players primarily have a dominant side; therefore, they may be an excellent model to investigate the effects of exercise on bone. The purpose of this study was to determine bilateral differences in bone strength, including bone architecture, size and density in the radius. To determine these differences, 16 DII female volleyball players (mean age=19 years) underwent peripheral quantitative computed tomography (pQCT) scans on both the dominant and non-dominant arm. Trabecular and cortical sites were analysed yielding the following variables: trabecular bone mineral density (tBMD.tb), total bone mineral content (Total BMC), and total cross sectional area (To.Ar) at the distal 4% radial site and CORTICAL bone mineral density (cBMD.ct), cortical cross sectional area (Ct.Ar), and structural strength index (SSI) at the proximal 66% radial site. One-tailed paired T-tests were performed to compare the variables. The only significant bilateral difference found was in the cBMD.ct (~1%), where the dominant arm had a lower cortical density at the proximal 66% site than the non-dominant arm. This finding was comparable to that of Haapasalo et al. In conclusion, bone adaptations found in male tennis players and baseball pitchers cannot be generalized to DII female volleyball players because of the lack of bilateral differences observed**.** A major limitation of the results in this study may be the comparison of data between male and female samples of different sports. The results also suggest that volleyball may not be a distinctly bilateral sport.

36. YOU BETTER BE ACTIVE EVEN IF YOU PLAY VIRTUAL REALITY GAMES

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Paradigms that could potentially increase brain oxygenation have received a lot of attention. Among the most important, physical activity (PA) has been shown to improve and/or maintain brain activity. The averment of virtual reality (VR) games is recent but has already profound implications on our society. Several studies have been conducted to explore the role of VR games-based learning approach on brain activity. A wide variety of cognitive skills have been associated with VR games such as spatial recognition, visual selection, memory and executive strategies. However, the effect of PA on brain activity induced by VR games is unknown. Various neuroscientific methods of collection from EEG to fMRI have been used to assess the effect of VR games on brain activity. Near infrared System (fNIRS) is a noninvasive and sensitive method to measure brain oxyhemoglobin (O2Hb) and deoxyhemoglobin (HHb). We hypothesized that higher level of PA correlates with enhanced brain O2Hb induced by playing VR games. Eight participants (4 females, 4 males, aged 25±3.5 years) were recruited. They were asked to wear an accelerometer (GT9X, ActiGraph, Pensacola, FL) for 7 consecutive days. Steps, calories, and minutes spent doing light, moderate exercise were retrieved (Actilife 6.0). Participants were asked to abstain from taking caffeine and alcohol and doing strenuous activity 12h prior to testing. For the VR experiment participants were equipped with a helmet (PlayStation VR Headset, San Mateo, CA) and played a bike racing game (VirZOOM, Cambridge, MA) for 10 min using the PS4 controller and their head to control movement in the game. Their frontal cortex O2Hb was measured during the game using an OxyMon (OxyMon MkIII Laser-based NIRS system, Artinis, NH). Wavelengths of 760-846 nm were used to detect changes in O2Hb and HHb. Our preliminary results are showing no changes in brain O2Hb, HHb, or total hemoglobin while playing VR game. We found a trend for a correlation between the most active subjects and an increased brain O2Hb (P=0.067). We did not find a correlation between the average number of steps (P=0.142) or the calorie (P=0.672) and brain O2Hb. In conclusion, it seems that being physically active for at least a moderate intensity may affect VR games-related brain oxygenation.

37. RELATIONSHIPS BETWEEN MEASURES OF STRENGTH, POWER, AND SPEED IN NCAA DII SOCCER PLAYERS

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BACKGROUND: Athlete monitoring programs provide insight into the physiological underpinnings of sport performance through the measurement of fitness characteristics such as strength, power, and speed. Relationships between these characteristics may vary depending on the level of preparedness and competition status of the athlete, as well as the sport-specific training parameters. Soccer athletes in particular rely on repeated short sprint ability and explosive lower body movements such as jumping headers and kicks in competition. A greater understanding of relationships between their strength, power, and speed qualities is warranted.
PURPOSE: The purpose of this analysis was to determine relationships between strength, power, and speed qualities in collegiate soccer players. METHODS: Forty-seven NCAA DII male (n = 25) and female (n = 22) soccer athletes performed vertical jumps and isometric mid-thigh pulls on force platforms, and performed 30m standing-start sprints using magnetic field timing gates. Countermovement jump height (CMJH), peak propulsive force (PPF), peak propulsive power (PPP), isometric peak force (IPF), and 10m, 20m, and 30m sprint times (S10, S20, and S30) were collected and analyzed.
RESULTS: Pearson product-moment correlation revealed moderate to strong inverse relationships between S10, S20, and S30 and CMJH (r = -0.61, -0.75, and -0.84, $p < 0.5$), and weak to moderate inverse relationships between S10, S20, and S30 and IPF (r = -0.4, -0.58, and -0.61, $p < 0.5$). Isometric peak force correlated moderately to strongly with CMJH, PPF, and PPP (r = 0.61, 0.77, and 0.78, $p < 0.5$).
CONCLUSION: These results indicate that both IPF and CMJH are associated with sprinting ability in collegiate soccer athletes, however CMJH is more strongly associated. Furthermore, these relationships are stronger as the length of sprint increases. This might be due to poor acceleration technique or to the horizontal force component of acceleration.

39. COMPARISONS BETWEEN MALE AND FEMALE DEPUTY SHERIFF RECRUITS IN THE WORK SAMPLE TEST BATTERY

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INTRODUCTION: The job demands of law enforcement may require officers to perform strenuous tasks with little advanced warning. In addition to having to complete generic tasks (pushing, pulling and carrying), on-duty law enforcement officers (LEOs) may have to execute job-specific tasks (defensive tactics, vaulting obstacles, pursuing suspects). These job-specific tasks are the same for all LEOs, regardless of sex. Recruits will complete job-specific tests, such as the Work Sample Test Battery (WSTB) in California, intended to prepare them for these demands. The WSTB was designed to duplicate what a LEO may encounter on duty. PURPOSE: To determine differences between male and female deputy sheriff recruits in the WSTB. METHODS: A retrospective analysis was performed on 308 deputy sheriff recruits from five academy classes (males = 259, females = 49). The WSTB is comprised of five tests completed for time: a 99-yard obstacle course (99OC), 165-pound body drag (BD), 6-foot chain link fence climb (CLF), 6-foot solid wall climb (SW), and a 500-yard run (500R). These tests must be completed to a state-mandated minimum standard in order for recruits to graduate, and were typically performed in the last weeks of academy. Independent samples t-tests ($p < 0.05$) and effect sizes (d) were calculated to document any differences between the sexes. Effect size ranges were set as follows: trivial effect = < 0.2; small effect = 0.2 - 0.6; moderate effect = 0.6 - 1.2; large effect = 1.2 - 2.0; very large effect = 2.0 - 4.0; and an extremely large effect = 4.0+. RESULTS: Females were significantly ($p < 0.001$) slower on all items of the WSTB when compared to males. Specifically, females were slower on the 99OC (males = 18.78 ± 1.39 s; females = 20.76 ± 1.71 s), BD (males = 4.86 ± 2.49 s; females = 6.71 ± 1.78 s), CLF (males = 7.69 ± 1.29 s; females = 9.48 ± 1.55 s), SW (males = 7.39 ± 1.17 s; females = 9.92 ± 6.28 s) and 500R (males = 88.25 ± 9.20 s; females = 100.41 ± 6.28 s). The effects ranged from small-to-large (d = 0.56 - 1.54). CONCLUSIONS: Females scored lower on all WSTB items. Slower performance in job-specific tests could translate to slower performance in the tasks required in line of duty for many female LEOs while working alongside their counterparts. This may pose a liability to not only to themselves, but to their colleagues. Training staff should consider developing the physical qualities important for WSTB performance in females to enhance future job performance.

38. ACADEMY GRADUATION AND THE PHYSICAL FITNESS OF POLICE RECRUITS

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INTRODUCTION: Success of recruit graduation from police academies is vital in order to reduce administrative costs from those who separate from academies due to either self-termination or injury. Since law enforcement academies can be physically demanding on recruits, the physical fitness of recruits may influence whether they graduate academy. PURPOSE: To determine whether physical fitness levels of recruits prior to starting academy affect graduation success. METHODS: Retrospective fitness data for 311 (M = 260, F = 51) recruits (age: 27.50 ± 6.08 yrs., ht: 1.73 ± 0.09 m, wt: 79.75 ± 13.75 kg) from four training academies were analyzed. The fitness tests included: grip strength (left and right hands, and sum of both hands); vertical jump (VJ); 75-yard pursuit run; 2-kg medicine ball throw; push-ups, sit-ups, and arm ergometer revolutions performed in 60 seconds; multistage fitness test (MSFT) shuttles; and estimated VO_{2Max} from the MSFT. Recruits were categorized into graduated (n = 269) and separated (did not graduate; n = 42) groups. Independent samples t-tests were performed to evaluate any differences in mean scores between groups. Independent sample t-tests were also performed on the same variables to evaluate any between-group differences based on sex. Significance was set at $p \leq 0.05$. RESULTS: Separated recruits were significantly older, and performed poorer in every fitness test ($p \leq 0.02$) except for right-hand and combined grip strength. Females who separated scored significantly lower in the arm ergometer and estimated VO_{2Max} ($p \leq 0.02$). Males who separated were older and scored significantly ($p \leq 0.03$) lower in all fitness tests except right-hand and combined grip strength and the VJ. CONCLUSIONS: Future recruits, both male and female, preparing to participate in academy training should focus on improving multiple aspects of fitness, including their muscular endurance, lower-body power, and cardiorespiratory endurance, in order to better their chances of graduating from academy. Coaches and physical training instructors responsible for conditioning recruits should also emphasize improving these physical fitness levels as well.

40. INFLUENCE OF HAMSTRINGS FATIGUE ON COUNTER-MOVEMENT JUMP GROUND REACTION FORCE METRICS

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Jumping is a key component to most sport related activities. Practitioners have been trying to quantify injury risk and athlete readiness by monitoring vertical jump performance. However no research has attempted to determine how jump performance is affected by altering the function of specific lower-body muscles. PURPOSE: This study compared ground reaction force derived metrics between non-fatigued and hamstring-fatigued conditions. METHODS: Following a warm-up 11 recreational or competitive basketball and volleyball players performed three two-step approach counter-movement jump with arm swing trials in two conditions. The first condition was performed in the absence of fatigue and the second condition was performed following up to 5 sets of 10 repetitions of the Norwegian Leg Curl exercise. Vertical ground reaction forces from each jump trial was collected on two force plates (1000 Hz). The two ground reaction force signals were summed and the eccentric rate of force development, average concentric force, and jump height were calculated using inverse dynamics. Jump height was calculated using center of mass take off velocity. Multilevel models with subject as a random effect and condition and trial as fixed effects were used to analyze each variable (alpha = .05). RESULTS: For eccentric rate of force development and mean concentric ground reaction force, there was no significant interaction between jump condition and trial or significant main effect for trial, but there was a significant main effect for condition. Eccentric rate of force development was ~11% lower (p=0.04) in the fatigue condition (7190± 3429 N/s) than the no-fatigue condition (8130±3843 N/s). Mean concentric ground reaction force was ~2.4% lower (p=0.04) in the fatigue condition (1899±540.4 N) than the no-fatigue condition (1947±553.7 N). For jump height (0.39±0.07 m), there was no significant interaction between jump condition and trial nor was there a significant main effect of condition or trial. CONCLUSION: Practitioners are interested in using jump performance metrics to track athlete readiness and injury risk. Our results suggest such practitioners should shift focus from analyzing jump height to ground reaction force components.

41. EXAMINING THE EFFECTIVENESS OF ELECTROMYOGRAPHY BIOFEEDBACK AT IMPROVING THE UPPER TRAPEZIUS TO SERRATUS ANTERIOR MUSCLE ACTIVATION RATIO

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Introduction: The upper trapezius (UT) to serratus anterior (SA) muscle activation ratio is essential for optimal shoulder function. An alteration of this ratio, specifically a decrease in UT and increase in SA activation, is a main area of focus in shoulder rehabilitation. Electromyography (EMG) biofeedback has been shown to be effective during rehabilitation but there is limited research on the retention of improvements. Purpose: To determine if EMG biofeedback can be used to improve scapular control by decreasing the UT to SA activation ratio. A secondary purpose was to determine if these predicted improvements in the ratio can be retained beyond the treatment period of four weeks. Methods: 20 college aged (21.75±1.77 yrs) subjects (10 males, 10 females) participated in this study. Subjects were randomized to the exercise only (EO) group or EMG biofeedback group. Both groups performed 30 repetitions of three exercises twice a week for four weeks under supervision. The EMG biofeedback group performed them with the addition of EMG biofeedback. They were given the instructions to decrease the UT and increase the SA activation by adjusting the corresponding EMG trace on the monitor. The percent maximal voluntary contraction for each muscle during each exercise was measured on visit one, visit nine (after the four weeks) and visit 10 (after a two-week retention period) and presented as a percent change value. Results: There was no statistically significant effect of group on the ratio comparing visit one to visit nine (p=0.084), nor when comparing visit nine to visit ten (p=0.065). The EMG biofeedback group had a significant decrease in UT activation (-10%) compared to the EO group (+27%) (p=0.007) at the end of the four weeks with no effect seen after the retention period (p=0.358). There was a significant increase in SA activation in the EMG biofeedback group (+196%) compared to the EO group (+29%) (p=0.000) comparing visit one to nine. There was a significant increase in SA activation comparing visit nine to visit ten in the EMG biofeedback group (+14%) compared to the EO group (-12%) (p=0.001). Conclusion: EMG biofeedback did not decrease the upper trapezius to serratus anterior activation ratio, but the individual muscle activation changes indicate that EMG biofeedback can be effective at altering muscle activation rates in individual muscles and that those changes can be retained beyond the timeframe of the intervention.

43. PREVALENCE AND FREQUENCY OF SUPPLEMENT USE AND SPORTS FOODS: A COMPARISON BETWEEN COLLEGIATE AND HIGH SCHOOL ENDURANCE RUNNERS

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PURPOSE: This study aimed to compare the frequency and type of dietary supplement products and sports foods used among high school and collegiate male and female endurance runners.
METHODS: One hundred seventy-two (n= 36 high school; n= 136 collegiate) endurance runners reported on the dietary supplements and sports food regularly consumed upon completion of a web-based nutrition screening survey, which also evaluated dietary intake and exercise training. Runners completed measurements of height and weight. Chi-square and independent t-tests evaluated differences between high school and college student athletes. RESULTS: A total of 74.6% (n= 129) of runners acknowledged use of one or more dietary supplements on 4 or more days per week over the past month. Supplements most frequently used included iron (46.5%, n= 80), multivitamins (43.0%, n= 74), and vitamin D (29.7%, n= 51). More collegiate compared to high school runners reported use of three or more dietary supplements (47.8% vs. 28.6%, X2 = 4.178, p<0.05). Collegiate runners also noted higher use of vitamin/mineral supplements (77.9%, X2 = 8.155, p<0.05) and vitamin D (33.8% vs. 14.7%, X2 = , p<0.05). The most frequently consumed sports foods included sports bars (64.7%, n= 134) and energy drinks (41.6%, n= 72), however, no significant differences were identified, based on age group, for sports food products, including sports bar, protein drink, energy drink, energy gels, chews, or powders. CONCLUSIONS: Collegiate runners exhibited higher use of vitamin/mineral supplements overall and vitamin D, specifically, however, no differences were identified for sports foods. The higher supplement use among collegiate runners may be due, in part, to greater access to or increased awareness of supplements, a higher level of training, or a greater pressure to perform. Higher use of vitamin D in collegiate runners may be attributed to its role in bone health as well as an increased awareness of bone-related injuries.

42. DIETARY SUPPLEMENTATION WITH GRAPE SEED EXTRACT IMPROVES TIME-TRIAL EXERCISE PERFORMANCE IN COLLEGE-AGED MALES

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Reactive oxygen species in working muscles are produced and contribute to muscle fatigue. Studies have shown that antioxidant-rich foods can benefit endurance athletes due to an improvement in exercise performance. Grape seed extract (GSE), an antioxidant supplement rich in polyphenols, possesses the ability to increase nitric oxide through upregulation of endothelial nitric oxide synthase, improving endothelial function and oxygen delivery. Accordingly, the aim of this study is to determine the effect of a single dose of GSE on hemodynamics and exercise performance in college-aged males. Ten endurance trained male athletes were recruited in a double-blind, randomized, crossover study. Subjects ingested either a 600 mg dose of GSE or placebo capsule via a cross-over design. Subjects completed a 10-minute submaximal cycle ergometer exercise at the workload corresponding to 60% VO2peak. Heart rate (HR), stroke volume (SV), cardiac output (CO), total peripheral resistance (TPR), oxygen consumption, and mean arterial pressure (MAP) were obtained at rest and throughout the experiment. Following 10 min rest periods, subjects performed a 4 km maximal time trial. Time-to-completion was recorded during the time-trial test to determine exercise performance. Our resulted indicated that there were no significant differences in HR, SV, CO, TPR, and MAP between placebo and GSE supplementation. However, dietary supplementation with GSE improved exercise efficiency (i.e., lower oxygen level) at the submaximal trial (32.8 vs. 33.8 ml/kg/min) and time-trial exercise performance (7.68 vs. 7.77 min) compared to the placebo. Findings suggest that GSE can act as an ergogenic aid of enhancing oxygen delivery, allowing to perform exercise for a longer period time before the onset of muscle fatigue.

44. DIFFERENCES IN KINEMATICS BETWEEN TWO GOLF SWING STYLES

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Background: Amateur and professional golfers have inconsistent performance and are often injured. The Optimal Performance Swing (TOPS) was developed to improve key aspects of performance, and reduce specific kinematics associated with low back pain. Characteristics of TOPS include: a more upright stance, a pre-backswing rotation of the torso facing away from target, and an arms-only backswing that maintains right side (for right handed golfers) lateral flexion and reduces overall body motion. Methods: 15 healthy male and female golfers (ages 18 to 73; golf handicaps +2 to -20) participated in a study that compared the thoracic and pelvic kinematics of their existing golf swings (EGS) with TOPS. The study involved four training sessions between two [pre and post] laboratory sessions. Eleven Qualisys cameras (400 Hz) tracked pelvic and thoracic markers for EGS and TOPS. The five fastest of ten trials recorded for each of two approach shot clubs (9-iron and 6-iron), were used. Three 2 x 2 repeated measures MANOVAs assessed club kinematics; and body kinematics associated with either performance or injury. Results: TOPS significantly ($p < .001$ for each club) shallowed the club's angle of approach and created a more in-to-out downswing club path, known to positively affect ball direction and trajectory. EGS' and TOPS' estimated marginal means (EMM) for angle of approach were (M±SE: 4.84 ± 0.49° vs 2.55 ± 0.57°), and for path were (0.13 ± 1.11° vs 3.53 ± 1.12°), across both clubs. Consistency of club speed (standard deviation) also improved slightly with TOPS (9-iron 0.57 vs 0.42; 6-iron 0.57 vs 0.54). Body kinematics for TOPS were found to be as taught. For EGS vs TOPS, three key mechanical factors associated with low back pain reduced significantly ($p < .01$) for each club. EMM across clubs (M±SE): (1) X-Factor (thorax vs pelvic rotation at the top of backswing) -45.27 ± 3.76° vs -36.8 ± 2.19°, (2) crunch (downswing lateral flexion range) 52.22 ± 2.48° vs 42.12 ± 2°, and (3) forward spinal tilt at address 36.01° ± 1.81° vs 30.47° ± 1.56°. Conclusions: Golfers could use TOPS for approach shots required to reach the green, as it may be able to produce club movements associated with straighter ball direction and better trajectory, with consistent club speed. It may also be used to reduce specific mechanical factors associated with low back pain.

45. DOES ANAEROBIC PERFORMANCE PREDICT TIME-TO-COMPLETION ON HIGH-INTENSITY FUNCTIONAL TRAINING WORKOUTS?

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Introduction: High-Intensity Functional Training (HIFT) is a training modality aimed at improving multiple components of physical fitness. These components of fitness have demonstrated to be important indicators of HIFT sport performance in which athletes compete to complete workouts as fast as possible for time, for as many repetitions as possible in an alotted time, or for maximal weight lifted. Anaerobic variables have previously revealed a relationship to performance in both functional and endurance trained athletes. However, few studies have focused solely on anaerobic performance as an indicator of HIFT workout time-to-completion. Purpose: The purpose of this study was to examine which anaerobic measurements are the best indicators of HIFT workout performance. Methods: 17 male (n = 12) and female (n = 5) functionally trained recreational athletes completed three HIFT workouts. Workout 1 consisted of 3 rounds of 21-15-9 repetitions of thrusters and pull-ups (95lb men/65lb women). Workout 2 consisted of 30 clean and jerks (135lb men/95lb women). Workout 3 consisted of 5 rounds of a 400m run and 15 barbell overhead squats (95lb men/65lb women). Anaerobic performance was measured by the 3 minute all-out test (3MT) to find anaerobic distance capacity (ADC), the finite capacity for running speeds above critical speed (CS), and a Wingate anaerobic test (WAnT) to assess anaerobic peak power (PP), mean power (MP), and Fatigue Index (FI). A Pearson's r test was performed to determine the relationship between anaerobic variables and HIFT performance. For each HIFT workout dependent variable, a stepwise multiple linear regression was created using significant correlative data. Data was reported as means and standard deviations with the alpha level set a priori at 0.05. Results: For Workout 1 (267.6±82.9s), WAnT MP (565.8±119.2 W) explained 24.3% of the variance, $F(1,15) = 4.804$ ($\beta = -0.493$, $p = 0.045$). For Workout 3 (858.5±85.6s), WAnT MP explained 44.4% of the variance, $F(1,15) = 11.958$ ($\beta = -0.67$, $p = 0.004$). No statistically significant relationship was displayed between Workout 2 and anaerobic performance variables. Conclusion: The ability to sustain high power outputs over a period of time may be an important indicator of HIFT performance. Athletes may benefit by aiming to improve anaerobic capacity in their training.

46. CLASSIFICATION OF GRADED PARTIAL WEIGHT-BEARING USING MOTION ANALYSIS MEASUREMENTS

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Purpose: The purpose of this study is to determine if graded partial weight-bearing with crutches can be classified by motion analysis sensors such as accelerometers. A partial weight-bearing protocol is normally prescribed after lower-extremity surgery. During this protocol, a patient increases weight-bearing on crutches throughout their rehabilitation to promote healthy bone healing (e.g. 0%, 10%, 40%, 70%). However, complications due to a lack of compliance with this protocol can lead to additional treatment or surgery. In this study, we investigate a novel method of monitoring partial weight-bearing using accelerometers and supervised machine learning techniques.
Methods: 8 healthy adult subjects participated in this pilot study. These subjects followed a typical weight-bearing protocol in the Motion Analysis Lab at Rady Children's Hospital in San Diego. The different weight-bearing classes tested on the left leg include 0%, 10%, 40%, and 70% weight-bearing, in addition to testing normal walking. This was validated against AMTI Force Plates. For each class, subjects placed the desired percentage of their body weight on a bathroom scale and recreated this dynamically across the force plates. During each trial, the subjects were also fitted with a smartphone tri-axial accelerometer at the ankle and at the hip on the left side. Time series data from these accelerometer readings were then compared to the force plate data to test and train supervised machine learning algorithms including Naive Bayes and Support Vector Machines.

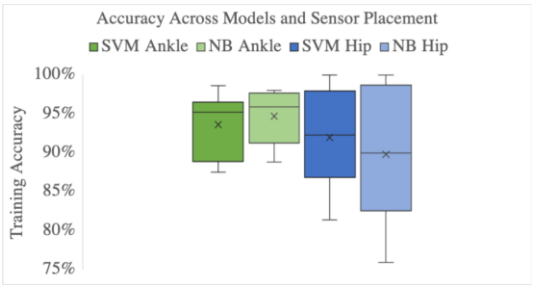

FIG 1. Box plot of training accuracy for each model at different sensor positions

Results: Using 10x cross-validation, accuracy is determined based on a true partial weight-bearing class derived from the force plates. Results are shown in FIG 1. The Naive Bayes model with ankle accelerometer measurements was the most precise and accurate, resulting in an average accuracy of 94.70±3.56% across all subjects.
Conclusions: These results indicate that partial weight-bearing can be successfully categorized with motion analysis sensors such as accelerometers, although further analysis can be done to increase accuracy. Ankle movement is a better indicator of weight-bearing than the hip, and both models tested are comparable. Further considerations include normalizing subject data to improve classification accuracy.

47. SPORT-RELATED CONCUSSIONS HAVE A MORE CONSERVATIVE STEPPING PATTERN DURING INSTRUMENTED TANDEM GAIT PERFORMANCE

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Tandem gait has emerged as a dynamic and clinically viable test of postural control following sport-related concussion (SRC). A myriad of tools are available to objectively assess gait kinematics. One piece of equipment, the Tekscan Strideway, uses individual load cells on a series of connected force platform tiles to quantify gait. No data exists that examines the performance of SRC using this device. Purpose: The purpose of this study was to evaluate the differences in center of pressure (CoP) performance during single-task (ST) and dual-task (DT) tandem gait within 24-48 hours post-SRC. Methods: 18 Division I SRC (age: 19±1.00 yr.) and 18 nearly matched controls (CON) completed the vestibular ocular motor screening exam (VOMS) and 3 trials of ST and DT (serial 7s) using the Tekscan Strideway (100Hz, Boston, MA). All SRC were diagnosed via the head team physician using somatic, cognitive, or physical self-reported symptoms following an appropriate mechanism as well as the Sport Concussion Assessment Tool-5th edition. The raw CoP trajectory for the best tandem gait trial of each condition (fastest overall) were exported and further analyzed using a custom MATLAB code. All turns during the tandem gait trials were removed and each straight path walking was composed together. The raw CoP data in AP and ML directions were smoothed using empirical mode decomposition and then excursion and velocity data were calculated. Results: SRC took significantly longer to complete the ST ($p=.006$; SRC=14.2±4.4s, CON=10.8±2.1s) but not DT ($p=.279$), had a larger VOMS near-point convergence ($p=.007$; SRC=9.5±5.5cm, CON=5.2±2.9cm) and a higher VOMS change score ($p<.001$; SRC=19.7±6.4 symptoms, CON=0±0 symptoms). A significant omnibus effect was noted in AP direction ($p=.015$) but not in the ML direction ($P=.996$) for the tandem gait CoP data. Follow up comparisons noted that in the AP direction during ST, SRC had slower CoP excursion ($p=.003$; SRC=1.6±0.2cm, CON=1.9±0.4cm) and slower CoP velocity ($p=.004$; SRC=54.2±7.7cm/s, CON=66.1±14.2cm/s) but no differences during DT. Conclusions: These results suggest that during instrumented ST tandem gait, SRC have a more conservative and slower heel-to-toe stepping pattern as compared to CON.

48. PRESEASON CONCUSSION EDUCATION IN ADOLESCENT ATHLETES

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Clinical Scenario: Concussions are a prevalent injury in sport, with diagnosis based off signs and symptoms, which are self-reported by the athlete. It is hypothesized that adolescent athletes under report signs and symptoms of concussion, thus affecting care and management of concussions. Multiple studies suggest that it is due to the lack of knowledge, however a causal relationship has not been established between preseason concussion education and likelihood of reporting concussion signs and symptoms. Clinical Question: Does the implementation of concussion education during an adolescent athlete's preseason increase the likelihood of them reporting concussion signs and symptoms compared to adolescent athletes who do not receive concussion education during their preseason? Summary of Key Findings: Four relevant studies were located to discuss preseason concussion education in adolescent athletes. One study reported concussion education having a positive influence on self-reporting concussion symptoms in adolescent athletes (Kay et. al 2015). One study indicated that preseason concussion education would be beneficial in improving self-reporting concussion symptoms (Mihalik et. al 2013). One study reported no changed behavior in self reporting signs and symptoms of concussion in adolescent athletes (Kurowski et. al 2014). One study suggested that concussion education during preseason should be mandated and uniform in order to improve self-reporting behavior of concussion symptoms in adolescent athletes (Carroll- Alfano 2017). Clinical Bottom Line: There is low evidence suggesting that implementation of concussion education during preseason will increase rates of symptom reporting in adolescent athletes. Other factors may contribute to concussion reporting such as age, sex, sport, previous history of concussion, and compliance. However, those involved with athletics, such as athletic trainer, coaches and parents, should discuss the topic of concussions with adolescent athletes to inform them about possible signs and symptoms in order to recognize the occurrence of a concussion. Strength of Recommendation: The articles were assessed using the Strength of Recommendation Taxonomy (SORT) scale. All of the articles were Level 3 quality, thus given a strength of recommendation of C.

49. A HISTORY OF RESISTANCE TRAINING DOES NOT ALTER PREFERRED VELOCITY IN INDIVIDUALS FOLLOWING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

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PURPOSE: Recovery following anterior cruciate ligament reconstruction has been extensively studied and it has been established that strength deficits persist following acute recovery. While resistance training may allow for improvements in strength the carry over to functional tasks, such as gait, is less clear. Preferred walking velocity is an objective clinical measurement that has been linked to overall health and life expectancy. Therefore, the purpose of this study was to determine if a history of resistance training influenced preferred walking velocity (PWV) or preferred running velocity (PRV) in individuals post anterior cruciate ligament reconstruction (ACLR). METHODS: Preferred velocity was measured in 16 individuals (22.4±4.3 yr, 1.70±0.10 m, 73.8±15.1kg) with unilateral ACLR. The RT group had individuals who resistance trained according to the American College of Sports Medicine's guidelines. The NRT group had individuals who had never resistance trained. Independent samples T-tests were used to compare preferred walking and running velocities between the resistance training (RT) group and non-resistance training (NRT) group. RESULTS: No differences were found between RT and NRT in preferred walking (1.24±0.08 m/s^{-1} vs 1.25±0.07 m/s^{-1}, p=0.89) or running velocity (2.90±0.48 m/s^{-1} vs 2.80±0.31 m/s^{-1}, p=0.68). CONCLUSION: Resistance training does not alter PWV or PRV for individuals with ACLR. Yet, it is important to note that the individuals in this study from both groups had slower PWV and PRV than previously reported values for healthy individuals with no history of ACL injury (1.4 m/s^{-1} and 3.4 m/s^{-1}). This may indicate a deficit to functional tasks that resistance training has not been able to improve.

50. FATIGUE INDUCED ALTERATIONS IN MUSCULAR ACTIVITY AND HIP MECHANICS IN RECREATIONAL ROWING ATHLETES

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Purpose: Recreational rowing has the capability to induce musculoskeletal fatigue, which in turn can affect the biomechanics of the motion and possibly contribute to injury. The purpose of this study was to determine if musculoskeletal fatigue during rowing affects hip joint motion and muscular activity for recreational athletes. Methods: Recreational rowing has the capability to induce musculoskeletal fatigue. The goal of this study was to assess the effects of musculoskeletal fatigue on recreational rowing athletes. Five males and three females (average age: 21.3) consented to participate in the study. EMG electrodes were placed on the vastus medialis, erector spinae, and the upper trapezius, and retroreflective markers were placed using an Enhanced Helen Hayes Protocol. (;). After a two-minute warm-up period, participants completed two maximum effort, 100m rowing bouts that were followed by a fatigue-inducing rowing protocol. This protocol consisted of a six-minute, moderate intensity rowing effort where the participant's heart rate was monitored to ensure a heart rate between 70 and 80% of their age-predicted maximum heart rate. After the six-minute fatigue-inducing effort, the participants completed two more maximum effort, 100m rowing bouts. Participants were allotted a 60-second recovery period after each rowing bout. Hip angles and EMG data were determined using the Cortex (Motion Analysis, Rohnert Park CA) and Delsys (Natick, MA) software, respectively, during each maximal effort trial for every participant. Results: No significant difference in hip range of motion between pre- and post-fatigue was observed (p=0.837; CI: 95%), nor did the study find a significant difference in muscular activity of the vastus medialis, or erector spinae muscles (p=0.240; CI: 95%, p=0.574; CI: 95%). There was a significant decrease in upper trapezius muscle activity (p=0.014; CI: 95%). Conclusions: Statistical analysis of kinematic and electromyographic data failed to identify a significant relationship between hip range of motion, vastus medialis activity, or erector spinae activity and musculoskeletal fatigue. We did find a significant decrease in upper trapezius activity, indicating possible overuse of the upper back musculature in recreational rowers.
Key words: Rowing, Kinematics, Electromyography, Fatigue

51. PRACTICE EFFECT: THE INFLUENCE OF FAMILIARIZATION DURING A SEATED MEDICINE BALL THROW

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The Seated Medicine Ball Throw (SMBT) is a performance test used to assess upper body explosiveness and may be influenced by confounding factors like the practice effect, in which performance in a test improves from repeating the test. "Practice trials" are likely needed for the SMBT to ensure a subject's score is representative of their maximum ability because inadequate familiarization may add variability that may misrepresent relationships between variables of interest and obscure intervention effectiveness. Prior studies using the SMBT have not adequately documented the familiarization protocols, leaving a gap in the literature. Purpose: This research aims to establish a familiarization protocol for the SMBT and describe the number of trials needed for each subject to become familiarized. Methods: Twenty healthy, rested, recreationally active college students performed a dynamic warm up and were instructed on proper SMBT technique. In the SMBT, subjects sit on an upright bench, making sure their backs maintain contact. Starting with the medicine ball static against their chest, they throw the ball at approximately 45 degrees. The horizontal distance from the bench to where the ball first makes contact with the ground is recorded. Subjects were familiarized with the SMBT exercise by executing repeated trials using a 10lb medicine ball with a rest of 1 minute between each trial. After three consecutive throws were within 0.25 m of one another, subjects were considered to have attained familiarization. Descriptive statistics and intraclass correlations were calculated for the number of familiarization trials. Results: The average number of trials it took to familiarize a subject was 3.6 (SD = 2.5, range = 1 to 10). The final three trials were considered reliable (ICC = 0.99). Discussion: These data suggest the practice effect is a confounding factor in the SMBT and approximately 4 practice trials were needed familiarize participants. The large range of familiarization trials needed suggests individualized familiarization protocols may be justified. The protocol used in this study proved to be effective and suggests that participants should complete practice trials until three consecutive throws are within 0.25 m of one another to account for variation among the participants.

52. THE ACUTE EFFECT OF MODERATE INTENSITY STAIR-CLIMBING ON POSTPRANDIAL BLOOD GLUCOSE LEVELS

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Although prior studies have demonstrated the beneficial effects of 1, 3, and 10 minute moderate intensity stair climbing on reducing postprandial blood glucose (PPBG) responses after an OGTT, limited research has explored this effect after consumption of a meal. PURPOSE: This study aimed to evaluate the effects of short duration, moderate intensity stair climbing-descending on postprandial glucose levels following a high fat, high carbohydrate meal representative of the American diet. METHODS: Nine healthy participants (5 male, 4 female) with no cardiovascular disease risk factors consumed a standardized test meal with a macronutrient distribution of 55% carbohydrate, 30% fat, and 15% protein on 3 separate trial days. Following meal consumption, participants underwent seated rest (control), or walked up/down stairs at a self-selected pace for 1 minute and 3 minutes in randomized order. The stair climbing-descending intervention was implemented prior to each individual's postprandial glucose peak, as determined by their control blood glucose values. Venous blood draws were taken at baseline and 30 minutes, while blood glucose was measured by capillary sampling from finger sticks every 10 minutes for the duration of the 60-minute trial. RESULTS: Declines in peak blood glucose values from control to one-minute stair climb (meanΔ=2.3, 95% CI -14.0 to 5.9, $p < .367$) or the three-minute stair climb (6.5, 95% CI -17.2 to 5.0, $p < .232$) were not significant. Similarly, decreases in iAUC were for one minute compared to control (11.1, 95% CIΔ -1131.9 to 395.2, $p < .552$), and three-minute compared to control (153.5, 95% CIΔ -1516.5 to 465.2, $p < .446$) not significant. CONCLUSION: Dose dependent declines in PPBG following stair stepping did not reach significance; longer or more intense bouts may be necessary to improve PPBG response to a meal.

53. METHACHOLINE-ACTIVATED LOCAL SWEAT RATE: PROBLEMS WITH INTRADERMAL MICRODIALYSIS

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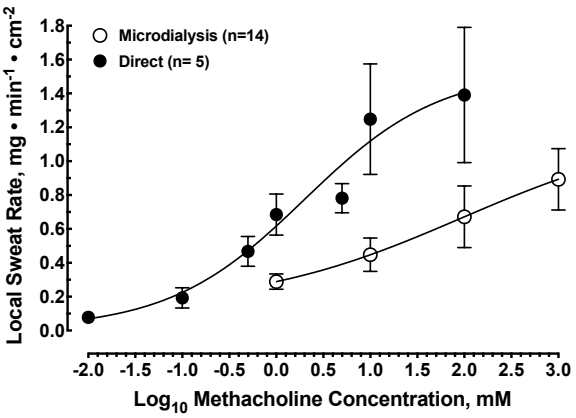
Purpose. A dose dependent cholinergic-activation of sweating in human skin can be accomplished using intradermal microdialysis. However, this method represents several limitation. First, the concentration of agonist delivered to the sweat gland is unknown and second, it does not consistently elicit a peak local sweat rate, even during delivery of methacholine (MCH) at concentrations as high as 1000 mM. Methods. We developed a novel approach to deliver MCH directly into the intradermal space using a small catheter constructed of polyimide tubing. The polyimide catheter is placed in the skin following the same procedures used for a microdialysis probe, with the tip located at the middle of the entrance and exit points of the guide needle. The sweat capsule is then mount directly over the tip of the polyimide catheter. Using this technique we deliver 5 doses of MCH (0.001, 0.1, 1.0, 10.0, and 100 mM MCH) at an infusion rate of 4 µl• min^{-1} at 5-minute intervals and compared this response to that seen during our standard intradermal microdialysis studies. Results. Dialysate collected during perfusion of intradermal microdialysis probes at 100 and 1000 mM MCH averaged 67.9 ± 12.0, and 612.3 ± 48.7 mM MCH respectively, indicating that only 34 ± 10% of the original perfusate is delivered to the skin. Using the direct delivery of MCH to the intradermal space we identified a sigmoid shaped stimulus-response curve (see Figure) with a plateau in the local sweating response at a dose of ≈100 mM MCH. The sweat rate response to direct delivery of MCH to the intradermal space was significantly higher than during intradermal microdialysis. Conclusion. Direct delivery of small volumes of MCH to the intradermal space provides a better representation of cholinergic-activated sweating than intradermal microdialysis delivery of MCH.



54. FABELLA SYNDROME IN A FEMALE RUNNER: A CASE REPORT

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History:
A 31-year old female presented with 1.5 years of posterior right leg pain. Her symptoms began with running; she had been running 2-3 miles 3-4 times per week for years but had to stop this activity after the onset of pain. She had seen multiple providers and received various diagnoses, including possible piriformis syndrome and radiculopathy before presenting to our clinic. She noted onset of posterior knee and proximal calf pain with running or resistance exercises, relieved by rest.
Physical examination:
Physical exam was grossly benign, with full knee ROM, no instability, locking/clicking, or positive provocative maneuvers such as McMurray's or Lachman's. The only finding was nonspecific posterior knee discomfort to palpation.
Differential Diagnosis:
1. Gastrocnemius strain/tear
2. Posterior meniscal tear
3. Popliteal artery entrapment syndrome
4. Exertional compartment syndrome
5. Popliteal artery aneurysm

Tests and Results:
X-ray showed preserved joint spaces and a small nonspecific posterior mineralization that Radiology questioned as an intra-articular body. MRI of the right knee showed no evidence of posterior knee soft tissue mass, normal caliber popliteal artery, no gastrocnemius tear or meniscal pathology. A lower extremity Doppler was also normal.
Due to lack of clear diagnosis, a diagnostic musculoskeletal ultrasound was performed in the clinic. Patient was able to localize her point of maximal tenderness that correlated to a calcification in the lateral gastroc; sonopalpation strongly reproduced her symptoms. Further review of the MRI was consistent with a fabella, not originally mentioned in the REPORT.
Final Working Diagnosis:
Fabella Syndrome
Treatment and outcomes:
She began using a compression brace with significant pain relief. Injection to the fabella region was discussed in the event of worsening symptoms, with surgical excision as a last resort. Fabella syndrome is a rare etiology of posterolateral knee pain. The fabella is a sesamoid with varying rates of prevalence in humans. It may cause mechanical irritation of soft tissues that presents as persistent posterolateral knee pain with exercise. A focused diagnostic MSK US was a key factor in detecting this rare diagnosis in a patient with multiple orthopedic complaints.

55. MUSCLE FIBER-TYPE DIFFERENCES IN MICE SELECTED FOR WHEEL RUNNING BEHAVIOR

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Purpose: The question of genetic vs environmental effects on phenotype is a long standing debate of each factor's influence. To assess this question we investigated this in a mouse system where laboratory selection on exercise behavior is ongoing. Isoform profiles of various hindlimb muscles were investigated in two selections of mice. These lines have been undergoing laboratory selection for high wheel-running behavior for over 20 years. We hypothesized that mice from the selected lines would typically contain the most Type 1 or Type 2a myosin forms, as these isoforms are often expressed in muscle with higher oxidative capacity. Methods: The two lines of mice consisted of selected mice profiled for high wheel running behavior and control mice whom were sedentary. We analyzed myosin isoform profiles in a number of muscles involved with locomotion from the breeders of selected and control groups. Our samples collected the quadriceps, soleus, medial and lateral gastrocnemius, tibialis anterior and plantaris from the breeders of generation 84 from both lines. SDS PAGE and densitometry were utilized post homogenization to quantify the myosin isoforms. Results: Preliminary analysis using densitometry shows that certain leg muscles of high-wheel running mice had a higher concentration of type 1 myosin, or in other cases, a shift towards slower type 2 fibers (i.e. 2x to 2a). The results support our hypothesis as this transition in fiber type allows for more efficiency and higher fatigue resistance when it comes to running. The findings were highly muscle-specific and indicate shifts in muscle protein expression are continuing under selection. Conclusions: Our new catalog of isoform profiles will serve as a baseline for comparison of two future studies - one following the development and subsequent senescence of muscle function with aging, and the second determining the effect of wheel running activity on both selected and control lines. All of the aspects of this study address the long-standing nature vs nurture debate, while also bearing on human muscle, disease, aging, and activity.

56. INFLUENCE OF MAXIMALIST FOOTWEAR ON PREFERRED RUNNING VELOCITY

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It is widely accepted that changes in running velocity coincide with changes in running mechanics. Therefore, when analyzing the effects of different footwear on running mechanics, it is important to determine whether preferred running velocity changes. Maximalist footwear has recently become more popular, yet the influence of this larger footwear on preferred movement is not yet well described. Purpose: The purpose of this study was to determine if preferred running velocity was different in different footwear conditions, including maximalist footwear. Methods: Twenty healthy recreational runners (Age: 43 ± 12.53 years, BMI: 24.02 ± 2.26, Miles/Week: 25.15 ± 13.88) completed running trials at a preferred velocity for three footwear conditions. Participants were asked to bring their own preferred running shoes and were provided a pair of neutral shoes and maximal cushioning shoes in their self-reported size. The order of conditions was randomized and preferred running velocities were measured using timing gates along a 10-m runway. A one-way repeated measures ANOVA was utilized to assess differences in preferred running velocities between different shoe conditions (α<0.05). Results: Preferred running velocity means were as followed: Own shoes= 3.75 ± 0.53 m/s, neutral shoes= 3.65 ± 0.51 m/s, and maximal cushioned shoes= 3.60 ± .51 m/s. Preferred running velocity was not significantly different between conditions ($F(2,57)=0.45$, $p=0.64$). Conclusion: These results suggest that footwear type does not influence an individual's preferred running velocity. As a result, if changes in running mechanics are discovered between different footwear conditions, it can be inferred that they are due to the footwear not changes in preferred running velocity.

57. EFFECTS OF FITNESS ON COGNITIVE FUNCTION

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Purpose: Previous research has focused on the effects of acute exercise on cognitive function with evidence of a positive effect on instruments such as the Stroop Color Word Interference test. However, there is little research on the relationship between cardiorespiratory fitness (CRF) and cognitive function performance. The purpose of this study is to see if CRF levels affects cognitive function with a variety of testing instruments. Methods: Based on ACSM VO2max standards, recreationally active college students were assigned to either a fit (F; 5 fem, 4 male; mean age 20.88 ± 2.3 yrs) or unfit group (UF; 5 fem, 7 male; mean age 22.33 ± 1.2 yrs). VO2max was determined for each subject during a graded exercise test (GXT), increasing treadmill speed or elevation each minute to volitional fatigue. VO2max was recorded at the highest oxygen consumption value as measured by a metabolic cart (Parvomedics True One, Sandy, UT). Before and after the GXT all subjects completed the Stroop test in two conditions, a memory test for speed and accuracy, and a spatial reasoning test. In the Stroop 1 (S1) condition subjects were to say the correct word regardless of ink color. In Stroop 2 (S2) they were to say the correct ink color regardless of the spelled word. For the memory test (MT) subjects were shown a card with several drawings, then were shown a card with several different drawings and were to identify the one drawing that was on both cards. For spatial reasoning subjects were shown a picture of an unfolded cube and had to determine which cube choice was impossible to form. Results: Comparing the fit and unfit groups revealed no significant differences between the groups for any variable. However, further breakdown of the data showed the excellent and good categories to have better S2 times than the poor category (54.49 ± 31.56 SEC; 59.83 ± 5.15 SEC; 60.24.83 ± 23.47 SEC, P = 0.0337). Conclusion: Most of the evidence shows that there is little relationship between fitness and cognitive function. With a small sample size, there is some improvement in S1 performance with increasing fitness.

59. A DIETARY KETONE ESTER REDUCES MARKERS OF HEPATIC STELLATE CELL ACTIVATION AND FIBROGENESIS IN HIGH-FAT DIET FED MICE

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PURPOSE: Macrophage metabolism of internally produced or exogenously administered acetoacetate (AcAc) is known to attenuate the hepatic fibrogenic response triggered by a high-fat diet (HFD). The purpose of this investigation was to determine whether dietary administration of the ketone ester, R,S-1,3-butanediol diacetoacetate (BD-AcAc2), attenuates markers of hepatic stellate cell (HSC) activation and hepatic fibrosis in the context of HFD-induced obesity.
METHODS: Five-week-old male C57BL/6J mice were placed on an ad libitum HFD (45% FAT, 32% CHO, 23% PRO) for 10 weeks. Mice were then randomized to 1 of 3 groups (n = 10 per group) for an additional 12 weeks: 1) control (CON), continuous HFD, 2) pair-fed (PF+HFD) to ketone ester (KE); and 3) KE (HFD +30% energy from BD-AcAc2, KE).
RESULTS: Mean energy intake was ,à¤26% lower in the KE vs CON group throughout the study (8.2±0.5 vs 11.2±0.7 kcal/d; p< 0.05). Despite the PF group being matched for energy provisions of KE, final body weight (26.8±3.6 vs 34.9±4.8 g; p< 0.001) and fat mass (5.2±1.2 vs 11.3±4.5 g; p < 0.001) of the KE group was significantly lower vs PF. Hepatic triglyceride concentrations were 1.7-fold lower in the KE vs. CON group (p<0.05), but were not significantly different between KE vs PF. KE increased hepatic markers of anti-inflammatory M2 macrophages (CD163) vs CON and PF (p,â§0.05), in the absence of changes in markers of total hepatic macrophages content (F4/80 and CD68; p>0.05). Further, dietary KE supplementation markedly reduced hepatic protein content of HSC activation and fibrogenesis markers (α-SMA, PDGF-β, TRAIL, MMP9) vs CON group (p<0.05), beyond reductions observed for PF vs CON.
CONCLUSIONS: These data highlight that the dietary ketone ester, BD-AcAc2, beneficially reduces markers of hepatic stellate cell activation and fibrogenesis in high fat diet fed mice. Future studies to explore potential mechanisms are warranted.

58. LOCAL HAND HEATING COMBINED WITH NEGATIVE PRESSURE LOWERS RESTING AND POSTPRANDIAL BLOOD GLUCOSE CONCENTRATIONS

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Purpose: Examine the effect of hand heating with negative pressure on postprandial blood glucose (PBG) and fasting blood glucose (FBG). Methods: Design: Double-blind randomized controlled trial. Subjects: PPG experiment: 13 healthy subjects (2 males). FBG experiment: 17 healthy subjects (4 males). Interventions: Devices included one providing heat only, one heat and negative pressure, and one acting as a sham. For the PPG experiment the devices were used for one hour during an oral glucose tolerance test (75 grams dextrose). For the FBG experiment the devices were used for 30 minutes. Outcome Measures: Blood glucose measurements were used to determine peak PBG, area under the curve (AUC), incremental AUC (iAUC), and change in FBG. Results: PBG: Compared to the sham device the heat only and heat plus vacuum device lowered peak blood glucose by 16±31mg/dL, p=0.092 and 18±28mg/dL, p=0.039, respectively. AUC and iAUC: Compared to the sham device, the heat only device and heat plus vacuum device lowered the AUC by 3.7±14%, p=0.234 and 7.7±11%, p=0.024 respectively and iAUC by 17.2±53%, p=0.178 and 20.5±34%, p=0.054, respectively. FBG: The decrease in fasting blood glucose from 0 min to 30 min for the heat only device and heat plus vacuum device was 1.8±4.8mg/dL, p=0.07 and 3.2±5.3mg/dL, p=0.01, respectively. The sham device had no effect on mean resting blood glucose as it was 92.6 mg/dL both pre and post-treatment (p=0.47). Conclusions: Local hand heating combined with negative pressure lowers fasting and postprandial blood glucose in healthy subjects.

60. EFFECTS OF EXERCISE ON HEPATIC SHORT CHAIN FATTY ACID OXIDATION (SCFAO)

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Purpose: Reductions in hepatic FAO have been linked to hepatic lipid accumulation which can result in tissue injury. A noninvasive stable isotope method quantifying human liver FAO was used to assess alterations in hepatic SCFAO in subjects with low and high liver fat (LLF & HLF) content following an exercise intervention.
Methods: 8 obese subjects with LLF (n = 4, intrahepatic lipid, IHL = 9.2 ± 1.0%, mean ± SEM) and HLF (n = 4, 25.8 ± 4.1%) completed a 4wk exercise intervention (high intensity interval & continuous moderate). IHL was measured by 1H-MRS and hepatic FAO was assessed using the SCFA, 13C-octanoate, which is absorbed from the enterocyte and transported to the liver. 13C-Octanoate (100 mg) was fed to subjects in a liquid meal (HyVee Enrich©, 500 calories, 60% carbohydrate, 22% fat, 18% protein) and breath samples were collected intermittently over 3 hours. Total CO2 production was measured by respiratory gas analysis (Parvo Medics) and 13CO2 enrichment (E) quantified by isotope ratio mass spectrometry.
Results: The LLF group had significantly lower IHL compared to the HLF group (P < 0.05) and training did not significantly change IHL in either group. No difference in hepatic FAO was observed between the HLF and LLF groups, although a positive trend was observed between IHL at baseline and cumulative percent octanoate oxidized following the intervention (P = 0.07, r2 = 0.45). The LLF group demonstrated a significant reduction in percentage of 13C-octanoate oxidation (P < 0.05) and the slope of the 13CO2%E curves after the exercise intervention (P < 0.05).
Conclusions: This is the first evaluation of the effects of exercise on hepatic SCFAO using an in vivo breath test. Our results indicate a 4wk exercise intervention did not increase hepatic FAO in subjects with a wide range of liver fat, in fact, a reduction was observed in the LLF group. The positive correlation between IHL and octanoate oxidized suggests that excess FAO in fatty liver is driven by excess liver fat storage. In data from a study currently underway, diet- and exercise-induced reductions in liver fat, occurring over 9 months is being tested. Preliminary results from two of these subjects demonstrated greater FAO after treatment and ongoing data collection will be compared to the results of the current study.

61. EXERCISE AS A NEW STRATEGY TO CHANGE BRAIN OXYGENATION IN OBESE INDIVIDUALS

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The preponderance of obesity is reaching epidemic proportion in North America (35.7% of young adults). Obesity has recently been associated with brain-related comorbidities. Exercise has long been preconized as a counter measure for cardiovascular diseases, but little is known on the effect of exercise on obese brain. Thus, it is important to better understand the effect of exercise on brain activity in obese individuals. Near infrared System (NIRS) is a noninvasive method to measure brain and muscle oxyhemoglobin (O2Hb) and deoxyhemoglobin (HHb). Purpose: to determine if obesity affects brain and muscle hemodynamics during a maximal exercise. We hypothesized that brain will compete with muscle O2Hb during a maximal exercise only in obese individuals. Methods:10 subjects (aged 21±8yrs) participated in this study (5 lean and 5 obese ; BMI>30). They performed an incremental exercise to maximal exhaustion (VO2max) on a Monark cycloergometer (Monark 828E). Brain and muscle hemodynamics were measured continuously using a NIRS system (Oxymon MKIII, Artinis, NH). NIRS optodes were placed on the frontal cortex to measure cerebral hemodynamics and on the vastus lateralis. Optodes were arranged in a 4x1 split and were regularly spaced at 35-mm to assure consistent measurement depth. A metabolic cart (Parvomedics 2400) was used to measure ventilatory parameters and heart rate was monitored using a Polar HR (wearlink coded 31). During the procedure, subjects were required to remain still during 2-minute (baseline), followed by a 5-minute exercise at 30-Watt (warm-up). Resistance was then increased at a rate of 30 W/2 minutes until subjects reached fatigue or were unable to maintain pedal cadence of 60 rpm. Results: We found that brain O2Hb was significantly different between obese and lean individuals at rest ($P<0.05$). There were no more differences for brain and muscle hemodynamics during maximal exercise. We found a significant correlation between VO2peak and brain HHb only for obese individuals ($P<0.05$). Conclusion: Our preliminary data are promising in showing that obesity is inducing changes in brain hemodynamics at rest and that exercise differently affects obese. Thus, it seems that the brain does not compete with muscle for O2 and exercise may be a good strategy to increase brain O2Hb in obese individuals.

63. EFFECT OF SPRINT INTERVAL EXERCISE IN HYPOXIA ON HYPOXIA-SENSITIVE GENE TRANSCRIPTION IN HUMAN SKELETAL MUSCLE

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Purpose: Repeated sprint training in hypoxia (RSTH) utilizes short bursts of supramaximal efforts followed by incomplete rest intervals. A recent meta-analysis by Brocherie (2017) showed that RSTH improves repeated sprint performance compared to non-training controls and repeated sprint training in normoxia. Because of the relatively short exposure to hypoxia compared to live high, train low approaches, the benefits of RSTH have been attributed to local muscular adaptations rather than hypoxia-induced erythropoiesis. It was suggested that these muscular adaptations underlie the repeated activation of the hypoxia-sensitive transcription factors HIF-1α and PGC-1α, and regulation of their gene targets. The purpose of this study was to investigate the transcriptional activation of HIF-1α and PGC-1α following repeated sprint exercise in normoxia and hypoxia. We hypothesized that the transcriptional activation of HIF-1α and PGC-1α and their targets would be higher following repeated sprint exercise in hypoxia vs. normoxia. Methods: Six recreationally active males (n=5) and one female (n=1) performed twenty, all-out sprints in normoxia (1600m) and hypoxia (hypobaric equivalent of 4600m) on a cycle ergometer on two days separated by 2 weeks. Skeletal muscle samples from the vastus lateralis was analyzed for mRNA levels of HIF-1α, PGC-1α BNIP3, PINK1, VEGF, PDK-M, and GLUT4 pre, post and 3 hours post exercise in hypoxia and normoxia. Results: There was a significant increase in HIF-1α and PGC-1α mRNA levels 3h post exercise in hypoxia ($p<.05$) but not normoxia. The HIF-1 α target VEGF, was higher in both hypoxia and normoxia ($p<.05$) but was not different between conditions. Conclusion: Acute sprint interval exercise in hypoxia induces an increase in hypoxia-sensitive transcription factors in HIF-1α and PGC-1α. Interestingly, the expression of the HIF-1α target, VEGF was greater following sprint exercise in both conditions. The large but not statistically significant increase in HIF-1α and PGC-1α mRNA levels following sprint exercise in normoxia suggest that that hypoxia may provide an additional stimulus to sprint exercise, although both augment the expression of hypoxia-sensitive genes. This transcriptional activation may underlie the benefits of RSTH.

62. EFFECTIVENESS OF AN EIGHT-MONTH WALKING PROGRAM ON MEETING THE SOCIAL AND PHYSICAL NEEDS OF COMMUNITY DWELLING OLDER ADULTS

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With an increasing older adult population, it is imperative to encourage physical activity and social interaction to maintain their health and independence.
Purpose: The purpose of this study was to evaluate the effectiveness of an eight-month walking program designed to connect older adults to their community.
Methods: This study was conducted over the course of eight months. Community dwelling older adults (N = 18, Mean Age = 78.06 +/5.98 years) participated in this study. Participants used local transportation to access points of interest in their community and walked on average 2.89 miles per walk. Participants were joined by research staff members for each community walk on the first Friday of every month. Pre- and post-intervention surveys and a post-intervention focus group were used to explore the participants' perceived community connectivity.
Results: Six themes and 11 sub-themes emerged from the post-intervention focus group: 1) Desire for more, 2) Benefits of group activity (sub-themes: make new friends, safety/comfort of group, and features like food and bathrooms), 3) Increased connections with walking program participants (sub-themes: GSM connections and research staff connections), 4) Connection to Long Beach community (sub-themes: new experiences/knowing neighborhood, good transit experiences, and pride in community), 5) Knowledge about transit, and 6) Personal well-being (sub-themes: program enjoyment, comradery, and physical/health). Local community and older adult/research staff community connection increased by 4.1% and 9%, respectively. The overall mean increase in community connection after the intervention was 3.7 percent.
Conclusion: The intervention provided valuable knowledge about connecting older adults with their community. Findings suggest that practitioners should combine social and physical activities in programs for older adults.

64. CONTROVERSIES IN RETURN-TO-PLAY AFTER HAMSTRING INJURY: A CLINICAL UPDATE

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Introduction:
When searching for protocols and return-to-play (RTP) guidelines following injuries in sports medicine, there is often a large variety of sources available- many suggesting different methods of predicting recovery timelines and rehabilitation regiments. With the hamstring injury serving as one of the most prevalent sport injuries, a cohesive and adequate return-to-sport protocol is crucially necessary to prevent reinjury. However, traditionally there has been disagreement among the ideal predictors and RTP recommendations.
Purpose: With the disagreements among RTP recommendations we sought out to present a summary of the literature findings and offer a recommendation for a hamstring return-to-play-protocol.
Methods: A literature review search through the PubMed database was performed with the key words "Hamstring Return to Play" in September 2019. The literature was scoured for rehabilitation guidelines and prognosis in order to recommend an elaborate return-to-play protocol following hamstring injuries.
Results: The literature analyzed presented conflicting assessments, as some reviews suggested that the use of an MRI assessment was a useful predictor of prognosis while others suggested otherwise. The use of a ROM assessment was seen as a useful indicator in some studies as well but challenged in others. The literature supports the use of pain as a predictor of recovery length and appears to favor the use of eccentric exercises over stretching exercises. There was overall a poor consensus on RTP.
Conclusion: Recovery protocols vary drastically, some focusing on stretching techniques, others focusing on eccentric strengthening after pain has ceased. Yet there is even more uncertainty in prognosis and providing a time table at the time of injury. There is no agreement in the literature. A consensus on a proper protocol for return-to-play activities would be most beneficial- and such awaits further clinical studies to determine. Here we suggest the integration of an injury scale in which to monitor the assessment of different return-to-play protocols, while suggesting the utilization of a protocol focusing on rest until pain has ceased, then focusing on eccentric exercises of the hamstring.

65. EFFECTS OF ACUTE RESISTANCE EXERCISE ON PLASMA ESTRADIOL AND IL-6 IN PRE AND POST-MENOPAUSAL WOMEN

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PURPOSE: Recent reports have suggested that interleukin-6 (IL-6), a multi-functional protein secreted during exercise, may help relieve some of the metabolic dysfunction brought on by reduced estradiol production during menopause. To date, however, the vast majority of these studies have only used aerobic exercise, leaving resistance exercise (RE) poorly understood. Therefore, the purpose of this study is to examine the effects of resistance exercise on estradiol and IL-6 levels in pre and post-menopausal women.
METHODS: Twelve female participants, six pre-menopausal (age 20.33 ± 0.52 years, 157.00 ± 3.79 centimeters, 57.12 ± 5.98 kilograms) and six post-menopausal (64 ± 3.27 years, 166.76 ± 10.80 centimeters, 74.00 ± 10.71 kilograms), completed two testing sessions separated by 48 hours: (1) familiarization and ten-repetition max (RM) testing, and (2) RE protocol. The RE protocol used air pneumatic resistance machines and consisted of three sets of ten repetitions for each of the following exercises: leg press, chest press and back row (at the pre-determined ten RM load). Venous blood samples were collected at the following timepoints for plasma IL-6 and estradiol quantification: pre, immediately post, one hour, twenty-four hours and forty-eight hours post-RE.
RESULTS: Neither estradiol nor IL-6 was statistically different between groups or at any time points (p=0.554 and p=0.882, respectively).
CONCLUSIONS: The RE protocol did not alter estradiol or IL-6 concentrations in either group. Future investigations should focus on varying the volume load while also differentiating effects between trained and untrained post-menopausal women.

66. TOTAL BODY STRENGTH AS AN INDICATOR OF WEIGHTLIFTING PERFORMANCE IN A HIGH-INTENSITY FUNCTIONAL TRAINING WORKOUT

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Introduction: High-Intensity Functional Training (HIFT) is a training modality that incorporates weightlifting, gymnastics, and metabolic conditioning into a competitive sport. Athletes complete workouts for time to completion, maximum repetitions, or for maximum weight lifted. Few studies have explored the influence of strength on HIFT workout performance, therefore further investigation is warranted to support strength measures as predictors of HIFT workout performance. Purpose: The purpose of this study was to identify which strength measure, if any, is the best indicator of HIFT workout performance. Methods: 17 male subjects (age: 29.535.614; body fat%: 15.325.31; weight: 89.2411.46 kg; experience: 46.9432.05 months) completed 3 standardized HIFT workouts. Workout 1 consisted of 3 rounds (21-15-9 repetitions) of thrusters and pull-ups (95lb). Workout 2 consisted of 30 clean and jerks (135lb). Workout 3 consisted of 5 rounds of a 400m run and 15 barbell overhead squats (95lb). Participants completed a one-repetition maximum (1RM) back squat, strict shoulder-press, and deadlift, with the combined total for each lift recorded as total body strength (TBS). A Pearson's r test was conducted to examine the relationship between strength and workout time to completion. A stepwise linear regression was created for each HIFT dependent variable that displayed a significant correlation to the independent strength variables. Data are reported as means and standard deviations with the alpha level set a priori at 0.05. Results: For Workout 2 (155.71±42.035 s), TBS (432.2549.44 kg) explained 62.5% of the variance, $F(1,15) = 24.95$ ($\beta = -0.790$, $p = <0.001$). No statistically significant correlations were displayed for Workouts 1 and 3. Conclusion: In conclusion, greater TBS may improve performance in HIFT workouts involving weightlifting movements. Therefore, it may be beneficial for HIFT athletes to train to improve whole body strength.

67. EFFECTS OF BLOOD FLOW RESTRICTION AND NEUROMUSCULAR ELECTRICAL STIMULATION ON MUSCLE AND ADIPOSE TISSUE THICKNESS OF THE CALVES

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Muscle atrophy losses are important factors to consider in several different environments such as spaceflight, paralysis, immobilization, and aging. The purpose of this research is to assess muscle size and adipose tissue in the calf muscles while using the novel training methods of blood flow restriction (BFR) and neuromuscular electrical stimulation (NMES). Six sedentary participants (4 males and 2 females; 20.5 ± 1.38 yr, 73.5± 13.75 kg) underwent 6 weeks of calf training with each leg randomly assigned to one of three conditions: 1) BFR (n=4), 2) NMES (n=3), and 3) combined BFR+NMES (n=5). At the beginning and end of the training, participants' tissue thickness was assessed using skinfolds and ultrasound. Skinfold measurements of the medial and lateral calf revealed no significant effect of training on subcutaneous fat. No differences were found in muscle thickness for both the medial and lateral gastrocnemius, however, there was a significant main effect for soleus muscle thickness. Post-hoc comparisons showed a significant increase in soleus muscle thickness with the BFR+NMES condition (p=0.0179) but not in the BFR (p=0.1371) or NMES (p=0.7146) conditions. These results suggest that when used together, BFR+NMES increases soleus muscle thickness with 6 weeks of training.

68. RELATIONSHIPS BETWEEN PERFORMANCE ON A CROSSFIT© BENCHMARK TEST AND BODY COMPOSITION, BONE MINERAL DENSITY, AND VO2MAX

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Purpose: Many CrossFit© designed performance tests combine multiple physical demands (endurance, strength, power, skill, etc.). However, the relationships between physiological characteristics and success on these tests are either unclear or unexplored. The purpose was therefore to examine the relationships between performance on a CrossFit© benchmark test ("Fran") and body composition, bone mineral density, and maximal aerobic capacity (VO2max).
Methods: Experienced (6 months) CrossFit-trained men (n = 51, age = 31.49 ± 6.995, height = 177.28 ± 7.63 cm, weight = 84.9 ± 8.58 kg) and women (n = 32, age = 29.28 ± 6.33, height = 166.07 ± 6.27 cm, weight = 66.26 ± 8.04 kg) participated in the study. Individuals arrived having refrained from caffeine and exercise for 12 hours and food for 4 hours. Body composition and bone measurements were taken using a Dual-Energy X-Ray Absorptiometry (DXA). A graded treadmill test (running at a self-selected pace with increases in percent grade by 1% every minute until exhaustion or volitional fatigue) was utilized to determine VO2max. Fran time (according to CrossFit© standards) was self-reported and used to divide participants into terciles (beginner, intermediate, advanced). Results: For men, advanced athletes had significantly less android fat (p<0.001), gynoid fat (p=0.003), total body fat (p<0.001), region fat (p=0.001), and total fat mass (p=0.030), more relative fat free mass (p=0.001), total fat free mass (p=0.000), bone mineral density (p=0.026), and bone mineral content (p=0.015), and a higher VO2max (p=0.015) than beginners. Advanced also had significantly less gynoid fat (p=0.041), total body fat (p=0.037), and region fat (p=0.022) with more relative (p=0.022) and total fat free mass (p=0.012) than intermediate. For women, advanced had significantly less gynoid fat (p=0.002), total body fat (p=0.011), and region fat (p=0.036) and more relative fat free mass (p=0.036) than beginners. Intermediate also had significantly less gynoid fat (p=0.014) and total body fat (p=0.023) than beginners. Conclusion: Practitioners may consider these findings when assessing and prescribing exercise plans for individuals engaging and competing in this type of physical activity. Future research could help explain the slight differences noted between the men and women across groups.

69. MAGNESIUM INTAKE COMPARISIONS DURING THE PREMENSTRUAL PHASE AND MID-PROLIFERATIVE PHASE IN FEMALE ATHLETES PRESENTING PREMENSTRUAL SYNDROME.

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PURPOSE: This study aimed to identify potential differences in Mg intake based on athletes presenting PMS or not and different phases of the menstrual cycle.
METHODS: Participants were 30 NCAA Division I eumenorrheic female athletes from Southern California ages 18-22 years (height: 168.5 ± 8.7cm, body mass: 67.0 ±10.8 kg and body mass index: 23.5 ±2.8 kg/m2). Exclusion criteria included current or three-month history use of oral contraceptives. To classify the participants as presenting PMS or not, the Premenstrual Symptoms Screen tool was used. Participants received training sessions for tracking their menstrual cycle and completing a 3-day dietary log. Participants completed dietary logs (two weekdays and one weekend day) during the week after menstruation (mid-proliferative phase) and during the week before their next expected menstruation (premenstrual phase). Dietary Logs were analyzed for total caloric intake, carbohydrates, protein, dairy, fruits, vegetables, and magnesium. Two (PMS= 7, Non-PMS= 23) by two factorial ANOVAs were used to determine differences in Mg intake in athletes who presented PMS compared to those who did not present PMS and between the premenstrual phase (Pre) and mid-proliferative phase (Mid) of their menstrual cycle.
RESULTS: Ten % of the athletes were dieting (n= 3) and 30% (n=9) used daily multivitamins supplements that included Mg (50mg- 100mg). All athletes failed to meet the gender and age specific recommended dietary allowance (RDA) of magnesium (310 mg/d). No differences between athletes for total calories (PMS: 2038.4± 228.8 vs. non-PMS: 2462.3± 126.2 kcals/day), carbohydrates (PMS:265.1±27 vs. non-PMS: 301.7±15 g), protein (PMS: 79.0±13.4 vs. non-PMS: 99.5± 7.4g),dairy (PMS :0.7±.0.2 vs. non-PMS: 0.8±0.1 cups), fruits (PMS :1.1±.0.3 vs. non-PMS: 0.9±0.1 cups), vegetables (PMS: 0.9± 3.1 vs. non-PMS: 3.3± 1.7 cups) and Mg intake (PMS: 217.4± 29.1 vs. non-PMS: 197.1±16 mg) were found. There were also no differences between phases for total calories (Pre: 2138.8± 184.8 vs. Mid: 2361.8± 184.8 kcals/day), carbohydrates (Pre: 284.6± 21.8 vs. Mid:242.1±21.8g), protein (Pre:78.2± 10.8 vs. Mid:100.3± 10.8g), dairy (Pre:0.8±0.1 vs. Mid:0.6±0.1cups) fruits (Pre:1.1±0.2 vs. Mid:0.9±0.2 cups), vegetables (Pre:1.05±2.5 vs. Mid:3.2±2.5cups), and magnesium (Pre: 195±23.5vs. Mid: 219.5± 23.5mg).
CONCLUSION: Mg and nutritional intake in athletes were neither influenced by PMS nor the different phases of the menstrual cycle. However, Mg intake was below RDA in all athletes. Further investigation of the variables that influence Mg intake is needed to reinforce athletes to meet Mg recommendations.

71. PREVALENCE OF SCAPULAR DYSKINESIS IN SURFERS VS. NON SURFERS

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Purpose: Scapular dyskinesis is observed in many shoulder injuries and may be an underlying factor in the development of chronic shoulder pain. Surfers experience a high incidence of shoulder injury, yet the prevalence of scapular dyskinesis has not been examined in these athletes. The purpose of this study was to compare the occurrence of dyskinesis in a sample of surfers and non-surfers. Hypothesis: It was hypothesized that scapular dyskinesis would be observed with greater frequency in individuals with a history of participation in the sport of surfing. Methods: Forty six surfers and forty two non-surfers were video recorded while performing bilateral shoulder flexion, abduction, and scaption. Coordination of scapular and glenohumeral joint motion was evaluated by an experienced therapist. Video recordings were classified as either positive or negative for dyskinesis, according to criteria outlined in a previously validated and commonly used clinical test. Chi-square analysis was utilized to evaluate differences in frequency of a positive result among surfers and non-surfers. Results: 67.4% of surfers and 66.6% of non-surfers had a positive result for scapular dyskinesis in at least one shoulder (X^2= 0.005, p=0.9424). Relative risk of surfing on the development of scapular dyskinesis was 1.01. Conclusion: These data suggest that participation in the sport of surfing does not increase the risk of developing scapular dyskinesis.

70. DIFFERENCES IN AFFECTIVE VALENCE AND ENJOYMENT BETWEEN ROWING AND CYCLING

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Public health guidelines for moderate intensity continuous training (MICT) recommend 150 minutes per week to elicit various health benefits. Potential modalities of MICT include running, walking, cycling, and rowing. It is evident that fat and carbohydrate oxidation and blood lactate accumulation vary between cycling and running, which is likely due to differences in muscle mass activated during the activity. The dual-mode theory postulates that exercise becomes more aversive at supra-threshold intensities, when increasing ATP demand requires greater non-oxidative ATP contribution, leading to a decline in affective valence. AIM: The purpose of this study was to compare the perceptual response between two non-weight bearing exercise modalities requiring different size muscle mass, rowing and cycle ergometry. METHODS: Active men and women (N = 22, age and body mass index = 27.4 ± 7.7 yr and 23.6 ± 2.8 kg/m2) performed graded exercise on both the cycle ergometer and rowing ergometer to determine maximal oxygen uptake (VO2max). At least 48 h following VO2max testing on separate days, subjects performed 30 minutes of progressive exercise on both modalities at power outputs ranging from 60 - 85 % HRmax. Affective valence (+5 to -5), rating of perceived exertion (6 - 20 RPE), and enjoyment (PACES) were measured. RESULTS: There was no difference (p = 0.36) in VO2max between cycling (39 ± 6 mL/kg/min) and rowing (39 ± 5 mL/kg/min) which led to exercise being completed at similar heart rates on each modality. RPE (p = 0.53), affective valence (p = 0.72), and enjoyment (86.3 ± 18.6 vs. 84.3 ± 19.4, p = 0.67) were not significantly different between cycling and rowing. However, 13 of 22 participants preferring rowing. CONCLUSION: Results demonstrated that perceptual responses to rowing and cycling are similar; however, further research is needed to determine if this lack of difference also exists in more diverse populations.

72. EFFECT OF AN ACUTE BOUT OF RESISTANCE EXERCISE AT DIFFERENT VOLUME LOAD ON PLASMA INTERLEUKIN-6

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Purpose This study aimed to compare the plasma levels of interleukin-6 (IL-6) after an acute bout of resistance exercise (RE) at different intensities and volumes to assess the relationship between RE volume load (VL) (repetitions, x sets x load) and plasma IL-6.
Methods Ten healthy (seven males and three females), sedentary subjects (age: 37.9 ± 3.6 years; height: 170.81 ± 3.53 cm; weight: 71.36 ± 3.56 Kg) participated in three randomized RE protocols of varying VL: high VL (HVL) (5 sets x 20 repetitions at 45% 1-repetition maximum (1-RM), medium VL (MVL) (3x12 at 75% 1-RM), and low VL (LVL) (2x4 at 90% 1-RM). HVL, MVL, and LVL were separated by 96 hours. Capillary blood was drawn immediately pre-RE, immediately post-exercise, and 1- and 2-hours post-RE for IL-6 quantification.
Results A two-way repeated-measures analysis of variance (ANOVA) showed no significant differences in plasma IL-6 between exercise condition (HVL, MVL, LVL) or at any time point (p=0.422 and p=0.870, respectively).
Conclusion Neither LVL, MVL, nor HVL affected plasma concentrations of IL-6; therefore, the effect of RE on IL-6 appears to be limited.

73. COMPARISON BETWEEN BARBELL AND DUMBBELL COMPLEX CONTRAST TRAINING ON REPEATED SPRINT ABILITY, JUMP PERFORMANCE AND STRENGTH IN NCAA DIVISION I VOLLEYBALL AND SOCCER PLAYERS.

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The current research's aim was to compare the effects of barbell and dumbbell complex contrast training on sprint ability, jump performance, strength and power in 22 collegiate male soccer players (mean ± SD; 20.2 ± 1.3 years; 182.2 ± 7.4 cm; 77.7 ± 10 kg) and female volleyball players (19.6 ± 1.4 years; 179.3 ± 6 cm; 73.3 ± 6 kg) with 2 years of strength training experience. Prior to training intervention, participants completed a health pre-screen, familiarization with testing protocols as well as the explosive type-training, and 3 repetition maximum (RM), repeated shuttle sprint ability (RSSA) and vertical jump (CMJ) on a jump mat. Participants were randomly assigned to 1 of 2 groups: Barbell Complex Contrast Training (CCTB) or Dumbbell Complex Contrast Training (CCTD). One week after testing procedures, subjects performed the experimental protocol that consisted of: three strength exercises (BB Back Squat, High Pull, Rear-Foot Elevated Split Squat or DB Squat, Deadlift, Rear-Foot Elevated Split Squat) paired with 3 of the 9 varying plyometric exercises (Linear Sprint, Depth Jump, Split Squat Jump, Depth Broad Jump, Depth Box Jump, Single-Leg Box Jump, High Knee Sprint, Hurdle Jumps, Single-Leg Hurdle Jumps). Strength and plyometric exercises were prescribed volume based on training day during week: Monday (3 x 6 @80% 1RM; 3 x 8, respectively), Wednesday (4 x 2 @90% 1RM; 4 x 4), and Friday (2 x 8 @70% 1RM; 2 x 10). Load progression of prescribed strength exercises was velocity based and tracked using TENDO velocity units. After participants completed four weeks of training intervention 3RM, RSSA and CMJ were reevaluated. Independent samples t-tests analyzed physical characteristics (p ,â§ 0.05). Two-way Anova was used to determine significant effects for the conditions of training (CCTB and CCTD) pre and post-intervention, with partial eta-squared used to determine effect sizes under the criteria: small 0.01, moderate 0.09, and large 0.25. There were no physical or training differences observed between groups. Significant improvements ($p < 0.05$) were found between pre and post-intervention testing for both groups across all variables, with the exception of %RSSAdec in the CCTD group. Although not statistically significant, two interesting interactions were found between groups in CMJ and %RSSAdec pre to post-intervention. CCTD trended (p=0.16) toward greater enhanced performance in CMJ height than CCTB, while CCTB tren

75. THE EFFECTS OF FITNESS LEVEL ON ACADEMIC CONFIDENCE

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Purpose: Previous research has focused on the effects of cardiorespiratory fitness (CRF) and confidence on academic achievement. However, there is little research on the relationship between CRF and confidence. The purpose of this study is to see if CRF level affects academic confidence. Methods: Based on ACSM VO2max standards, recreationally active college students were assigned to either a fit (F; 5 fem, 4 male; mean age 20.88 ± 2.3 yrs) or unfit group (UF; 5 fem, 7 male; mean age 22.33 ± 1.2 yrs). VO2max was determined for each subject during a graded exercise test (GXT), increasing treadmill speed or elevation each minute to volitional fatigue. VO2max was recorded at the highest oxygen consumption value as measured by a metabolic cart (Parvomedics True One, Sandy, UT). Before the GXT all subjects completed the Academic Behavioral Confidence (ABC) survey, the Individual learning Profile, and the Memory and Reasoning Competency Inventory. All surveys used a Likert type scale with increasing numbers indicating higher ability or confidence. Results: The UF group had a significantly higher ABC score than the F group (97.83 ± 12.9 vs 85.56 ± 7.04; P = 0.01847). Further breakdown showed the fair category to have higher MARCI scores than the good category (69.3 ± 7.66 vs 54.28 ± 13.85; P = 0.0337). There were no significant difference between fitness groups for the ILP survey. Conclusion: We had hypothesized that the higher the fitness of an individual the higher the academic confidence would be. However, the pilot data shows that lower fit individuals scored higher on our measures of confidence. The ABC and MARCI have questions probing an individual's attitude and approach to various learning scenarios. Speculation is open as to why a more fit individual might be less confident on some aspects of these survey instruments.

74. INFLUENCE OF AGE DIFFERENCE ON ALCOHOL USE WITHIN COUPLES

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Introduction: The social learning theory (Bandura & Walters, 1963) holds that it is the behavior of valued individuals that is modeled. Therefore, we hypothesized that the influence of peers would be stronger in the context of a relatively good dyadic relationship than in the context of a relatively poor relationship (Andrews, Tildesley, Hops, Li, 2002). Purpose: This study focused on the correlations between the amount of alcohol use and the influence of age difference within couples in a committed relationship. Research focused on whether a person under the age of 21 is more tempted to drink alcohol if they are in a committed relationship with someone 21 and older, or less tempted. Methods: Data was collected through an online survey at Miami University, Oxford campus, sent out to students either via email or a web link using the "snowball method." It was completely voluntary and anonymous. Results: 302 students completed the survey, 235 students were under 21 years old and 67 students were either age 21 or older. Of the 33.1% of students who answered to their partners drinking alcohol, 24.1% said yes. Of the 31.6% students who answered whether or not their alcohol consumption has changed since they've been in a relationship, 24.4% said that their consumption stayed the same. Students' alcohol consumption revealed to not show any significant changes when in a committed relationship, especially if their partner was age 21 or older. Conclusion: The results conclude that being in a committed relationship with someone of age 21 or older while still under age 21 does not change one's drinking behaviors to consume more alcohol. In fact, data revealed that alcohol consumption levels stay the same in these conditions. This research topic is essential in making the inference that underage drinking is a serious public health concern, especially in college when easily influenced by their peers.

76. EFFECT OF SKIN TONE ON HEART RATE MEASUREMENT ACCURACY IN WRIST-WORN DEVICES

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Wrist-worn fitness trackers are becoming increasingly popular. However, research has shown that the reliability and accuracy of these trackers can vary. Darker skin tone has been suggested as one cause of error among these LED based measurement devices. PURPOSE: The purpose of this study was to determine whether skin tone has an effect on the accuracy of heart rate (HR) measurements in these wearable trackers. METHODS: Participants with light skin tone (n=20) and participants with dark skin tone (n=20) [classified as a Von Luschan Chromatic Scale (VLCS) score less than or greater than/equal to 18, respectively] were recruited. Each participated in 10 minutes of rest and 10 minutes of moderately-hard steady-state stationary cycling, during which HR was recorded during the final 5 minutes. Average HR of each tracker was compared to the criterion measure (Polar RS300 chest strap HR monitor). The trackers examined were the Fitbit Ionic and Garmin Vivoactive 3 wrist-worn fitness trackers. Error was determined by subtracting the criterion HR from the tracker HR. Paired T-tests were then used to determine if there were differences among skin tone groups in the amount of error for each tracker at rest or during exercise. RESULTS: When all participants were combined, the Garmin significantly overestimated resting HR [0.85 (±3.73) bpm; p=0.041]. No significant differences were found when comparing the amount of error for HR measures between the skin tone groups for either rest or exercise. Comparison of each tracker to the criterion within each skin tone group showed significant underestimation among the dark skin tone group for Garmin exercise HR [-7.95 (±11.52) bpm, p=0.006] and among the light skin tone group for Fitbit resting and exercise HR [-1.10 (±1.74) bpm, p=0.011; -5.25 (±10.11) bpm, p=0.031, respectively]. CONCLUSIONS: Regardless of skin tone, these trackers are suitable for measuring submaximal exercise HR. They are also suitable for measuring resting HR if +1 bpm is acceptable error. Between groups, skin tone did not impact the amount of error in HR measures of these trackers. Within groups, the Fitbit Ionic had less error for those with darker skin tones, while the Garmin Vivoactive 3 had less error for those with lighter skin tones. This could be taken into consideration when purchasing a wrist-worn fitness tracker.

77. MODELING WITH VERBAL CUEING VS. MODELING ALONE: EFFECTIVENESS IN LEARNING A NOVEL KNOT-TYING TASK

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Purpose: The rehabilitation of upper-extremity injury presents a unique challenge to physical therapists, occupational therapists, and researchers. While there are benefits to regaining neuromuscular control and range of motion through the use of traditional rehabilitation exercises, there are also advantages to integrating motor learning theories into clinical practice. Previous research demonstrates that modeling leads to improved motor learning in simple tasks. The purpose of this preliminary study is to determine whether modeling with verbal cueing is more beneficial than modeling alone for a knot-tying task, with the goal of developing more effective rehabilitation strategies. Methods: This preliminary study included 42 college students enrolled in a motor learning course (19 females, 23 males, age 19-24 years). The task was to tie a bowline knot, which was a novel task to all participants. Participants were randomly assigned to one of two groups: modeling only (group 1), or modeling with verbal cueing (group 2). Participants in group 1 were shown a 30-second video demonstrating the proper technique for tying the knot. Participants in group 2 were shown the same video, but with the addition of associated verbal cueing. The verbal cues were provided incrementally in 6 steps throughout the video. Upon completion of the task, the knots were scored by trained individuals. The maximum score that could be achieved (max score = 6) was based on the presence of characteristics associated with each step. The task was completed and scored a total of 10 times, and the average score was calculated for each individual. Average scores were compared between groups using independent t-tests, α=0.05. Results: The average score for group 2 (score=4.58) was significantly higher than group 1 (score=3.71; t(40)= 2.83, p=0.007). Conclusions: The results of this study demonstrate that the combination of verbal cueing with modeling was more effective for learning motor behavior while completing a novel task. These results highlight the importance of providing verbal instruction in motor learning tasks, and may be applied to the learning of proper movement patterns after injury. Future research will determine the extent of verbal cueing necessary in the rehabilitation of upper-extremity injuries.

79. HEART RATE VARIABILITY AND HYPERTENSION IN DOCTOR OF PHYSICAL THERAPY STUDENTS

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Purpose: For students enrolled in health science professional degree programs, stress-related symptomology is increasingly common. Of these symptoms, chronically elevated blood pressure may be especially deleterious, as hypertension (HTN) has been implicated in academic burnout and is a major risk factor for cardiovascular disease. Reduced heart rate variability (HRV), a measure of cardiac autonomic function, has been associated with HTN in apparently healthy middle-aged and older adults, but data are limited in young adults. Thus, this study examined the association between HRV and blood pressure and evaluated differences in HRV between hypertensive and normotensive students in a Doctor of Physical Therapy program.
Methods: A total of 18 females (24.9 ± 2.0 yr) and 14 males (26.5 ± 2.2 yr) performed study measurements in one visit. Assessments included 10-minute seated HRV collection using a wearable sensor (BioHarness-3, Zephyr Technologies), blood pressure and physical activity level. HRV data were filtered and visually inspected for artifacts, with the root mean square of successive differences in the time domain (RMSSD) used as the variable of interest. Physical activity levels were calculated from the International Physical Activity Questionnaire. Multiple linear regression was used to investigate the association between RMSSD and systolic blood pressure, adjusted for sex and physical activity level. Independent t-tests were used to examine differences in normally distributed RMSSD values between groups.
Results: RMSSD was inversely associated with systolic blood pressure (p=0.018, β=-1.37), and significantly influenced by physical activity level (p=0.02). HRV was significantly reduced in HTN (58.2 ± 32.0 ms) compared to normotensive (87.8 ± 34.3 ms) students (p=0.02).
Conclusions: In this limited sample of Doctor of Physical Therapy students, our data suggest that HTN have less favorable HRV values than normotensive students. Additionally, lower HRV was associated with higher systolic blood pressure. Further research is needed to determine whether additional factors, such as race disparities, metabolic variables or mental well-being, may influence HRV. If demonstrated to be effective, HRV could offer an easily obtained measurement for the early prediction of burnout and CVD risk in graduate students enrolled in health science professional programs.

78. THE RELATIONSHIP BETWEEN HEART RATE ONSET AND MARKERS FOR CARDIOVASCULAR DISEASE IN CAREER FIREFIGHTERS

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Purpose: Cardiac autonomic dysfunction is linked to deleterious cardiovascular/hemodynamic profiles, increased risk for cardiovascular disease (CVD)/sudden cardiac death (SCD), and increased mortality risk. Previous studies have shown career firefighters to have an increased risk for both SCD and CVD due to morphological changes to the heart and hemodynamic issues associated with acute fire suppression as well as sedentary lifestyles. The current study examined the relationship between heart rate onset (a measure of autonomic dysfunction) and markers of cardiovascular disease risk in career male firefighters.
Methods: Participants (n=35) performed a submaximal exercise test on a cycle ergometer to examine heart rate (HR) response to the initial minute of exercise with minimal resistance. Measurements of HR, blood pressure (BP) and arterial stiffness were obtained prior to exercise; with HR and BP also obtained during exercise. For analysis, a stepwise linear regression was used to examine the linear relationship between DHR1minute and variables. An independent sample t-test was used to examine differences between groups using a previously determined DHR1 minute [< 14 (group 1) or 14 bpm (group 2)]. Effect sizes were calculated using Cohen's d methods.
Results: The results of the stepwise linear regression revealed a significant relationship between DHR1 minute and arterial stiffness (β=0.51, p=0.007) as well as resting DBP (β=0.31, p=0.02). A significant, moderate correlation was found for the overall regression model (r=0.54, r2=0.24, p=0.004). The results of the t-test indicated significant differences between group 1 and group 2 in the scores for the following variables: age (p = .05), resting DBP (p = .03), resting MAP (p = .05), DBP during stage 2 (p = .01) AND DBP during stage 3 (p = .02). Group differences for arterial stiffness did not achieve statistical significance but were clinically meaningful (mean difference = -2.73, p = .06).
Conclusion: The current study further confirms the utility of DHR1minute, a marker of autonomic dysfunction, as a simple, non-invasive predictor of several cardiovascular measures. It is suggested that the use of DHR1minute as a predictor of CVD mortality/SCD still needs to be examined among career firefighters.

80. THE SEARCH FOR A MEASURE OF AUTOMATIC ASSOCIATIONS WITH EXERCI KNEE KINEMATICS FOR THE CONTRALATERAL LEG OF TRANSTIBIAL AMPUTEES IN GAIT AND CYCLING

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Purpose
Transtibial (TT) amputees have increased risk of contralateral (intact) knee osteoarthritis (OA) that may be influenced by abnormal kinematics [1]. Previous studies have measured knee angles for TT amputees in gait (G) and cycling (C) but none have corrected for soft tissue artifact (STA), a primary source of error using skin-based marker systems. This study used a triangular Cosserat point element (TCPE) method [2] and Principal Component Analysis (PCA) (3) to reduce STA and crosstalk errors, respectively. The hypothesis was that knee angles will differ in G but not C between TT amputee and control participants.
Methods
Protocols were IRB approved. Experiments were conducted with 4 amputee (aged 18-37) and 4 control (aged 18-25) participants. Kinematic data were collected for 44 markers using a 12-camera motion analysis system (Motion Analysis, CA). Kinetic data were collected using 4 force plates (AMTI, MA) for G and a stationary bike (Life Fitness, IL) with pedals containing 6-axis load cells (AMTI) for C. G was conducted at self-selected walking speeds and C was conducted at 70 RPM with moderate resistance. A floating axis joint coordinate system [4] was used to define flexion/extension (FE), internal/external (IE) rotation, and adduction/abduction (AA) angles. MatLab (MathWorks, MA) was used to perform TCPE and PCA analyses. Significant differences between participant groups were determined by two factor ANOVA with a post-hoc Tukey test ($p < 0.05$).
Results
Differences existed between control and amputee maximum AA angles for G (Fig. 1) and no differences existed for C.
Conclusions
Results suggest that C may be a preferred exercise for TT amputees due to maintenance of normal knee kinematics. Limitations include small sample size.
Acknowledgments
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81. SHEAR WAVE ELASTOGRAPHY OF THE RECTUS FEMORIS THROUGH MULTIPLE HIP AND KNEE JOINT ANGLES

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BACKGROUND: Recently ultrasound shear wave elastography (SWE) is becoming a common method to measure estimated changes in muscle stiffness of an individual muscle. SWE has been shown to be sensitive to muscle length changes, however, data on expected SWE values for specific joint angles of individual muscles is lacking. To date, the gastroc and soleus have been studied extensively, and some good initial data for the quadriceps group, but no study to date has looked at the effect of both hip and knee angles on the rectus femoris (RF) which is a bi-articulate muscle. This study aimed to determine the change in SWE of the RF at a combination of 3 hip and 4 knee angles.
SUBJECTS & METHODS: Eighteen subjects (9M : 9 F) participated in this study (mean 22.11 ± 2.0 yrs, 69.39 ± 4.2 inches, 154.5 ± 29 lbs). All SWE measurements were taken using a GE Logiq S8 ultrasound machine with a 9L transducer head. SWE of the RF was taken at 12 positions for each subject in this order: Hip 0º flexion with each increasing knee angle (0º, 30º, 60º, 90º), then hip at 45º flexion with the same order of knee angles, and lastly hip at 90o flexion with the same order of knee angles.
STATS & RESULTS: A repeated measures analysis of variance (RMANOVA) showed SWE significantly changed within subjects (p<.001). Pairwise comparisons showed that as knee angles changed from 0º to 30º there was no significance between SWE values at all 3 hip angles (p<.709, p<.728, p<.468). With the subject seated at hip angles of 45º and 90º flexion there was no significance between SWE values from 0º to 60º knee angles. At 0º hip flexion with knee angles 60º and 90º flexion there was a significant increase in SWE values (p<.033, p<.000).
CONCLUSION: Data shows that SWE values are sensitive to changes in passive lengthening of the RF, especially when a subject is laying down (hip angle at 0º flexion). SWE values appear to increase at a faster rate when laying supine as compared to seated at 45º or 90º hip flexion. Based on our data, resting values of SWE for the RF could best be made with subjects sitting at a 45º or 90º hip flexion, giving little variability in SWE values with knee movement. This study is limited to subjects who are at full rest without any applied intervention, such as stretching or warm-up.

83. COMPARISON OF MUSCLE ACTIVATION BETWEEN THE CONVENTIONAL, SUMO AND STIFF-LEG DEADLIFT

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Purpose
The purpose of this study was to compare differences in muscle activation of the primary agonist muscles during three variations of deadlift - sumo (SDL), stiff-leg (SLDL), and conventional (DL) - in both men and women.
Methods
Twelve recreationally trained subjects (six males, six females; age: 23 ± 0.5 years, height: 182 ± 3.2 cm, body mass: 74 ± 6.1kg, DL 1-RM: 128 ± 53.6kg, SDL 1-RM: 127 ± 56.8 kg, SLDL 1-RM: 117 ± 49.6 kg) participated in this within-subject crossover design. Electromyographic (EMG), activity of the DL, SDL, and SLDL for the vastus lateralis (VL), vastus medialis (VM), biceps femoris (BF), medial hamstring group (MH), and erector spinae (ES) was measured. Gender differences were evaluated, comparing the difference in the H:Q ratio between male and female. For the second session, participants completed three repetitions at 80% of their 1RM for each lift as EMG data was collected. Raw EMG data was smoothed and rectified with NORAXON software (150 Hz) and mean peak activation was expressed as the root mean square (RMS). EMG values obtained during the 3 repetition experimental session were averaged then normalized to the EMG values achieved in the 1RM.
Results
Results showed no significant differences (p>0.05) in normalized EMG values between the five measured muscles during the DL, SDL and SLDL. No significant difference (p > 0.05) was found in HQ ratios between males to females; however, there was a statistical trend in the SLDL that indicated sex differences in the HQ ratio, with males having the higher HQ ratio (p=0.063).
Conclusions
This study revealed that no variation is superior in activating the quadriceps, hamstrings, or low back, indicating all three variations are acceptable methods to train the aforementioned musculature. Moreover, the lack of significant disparity between males and females suggests women are not quadriceps-dominant and display similar activation patterns to males.

82. THE EFFECTS OF FOAM ROLLING ON EXERCISE-INDUCED MUSCLE DAMAGE

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Exercise-induced muscle damage (EIMD) occurs following strenuous and unaccustomed exercise. EIMD is associated with elevated creatine kinase (CK) blood concentrations, limitations in range of motion (ROM), and cellular swelling. EIMD may negatively affect training quality and performance thus methods to mitigate EIMD may be useful to resistance training populations. Self-myofascial release, in particular foam rolling (FR), has been utilized by competitive and recreational athletes to ameliorate the effects of EIMD. However, the effect of FR on EIMD has yet to be established. PURPOSE: The purpose of this study is to investigate the effect of FR on markers of EIMD after an acute bout of high volume resistance exercise. METHODS: Eight participants (five males and three females), between the ages of 18 and 35, completed two acute resistance exercise bouts (10 sets of 10 repetitions barbell back squat at 60% 1RM) separated by a minimum of seven days. Following one exercise bout, subjects performed FR targeting the thigh (i.e hamstrings and quadriceps), the shank (i.e. calf and tibialis anterior), and the gluteus maximus immediately post, 24, and 48 hours post exercise, while no FR was performed following the alternate bout (CON). In both conditions, participants were asked to refrain from additional recovery methods following exercise. Outcome measures included serum CK, hip ROM, knee ROM, and thigh circumference. All measurements were pre-exercise, immediately post, 24, and 48 hours post. RESULTS: Serum CK increased at 24 (p = 0.04) and 48 hours (p = 0.04) post-exercise while hip ROM (p = 0.02) and knee ROM (p = 0.03) decreased and thigh circumference (p = 0.03) increased 48 hours post exercise. No significant differences between FR and CON were found. CONCLUSION: FR does not attenuate markers of muscle damage (i.e. serum CK, hip ROM, knee ROM, and thigh circumference) after an acute bout of high volume resistance training. This study suggests that despite its common practice, FR may not be an effective strategy for mitigating muscle damage.

84. EFFECT OF EXTRACELLULAR MATRIX HYDROGEL INJECTION PLUS SURGICAL REPAIR ON MUSCLE REGENERATION IN RABBIT MODEL OF CHRONIC ROTATOR CUFF INJURY

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Purpose
Rotator cuff tear (RCT) leads to degenerative changes in rotator cuff muscles including fat infiltration, myofiber atrophy, and fibrosis that extend beyond disuse atrophy and persist even after repair/ re-loading. This project sought to use a novel adjunct to surgical repair to improve muscle recovery and function.
Methods
Simulation of chronic RCT was achieved via supraspinatus (SSP) tenotomy in New Zealand white rabbits. Following anesthetization and intubation, the SSP tendon was transected at its insertion on the humerus, and a Penrose drain was sutured around the tendon stump to prevent scarring and premature reattachment.
Surgical repair was performed 8 weeks after tenotomy by suturing the tendon stump back onto the humerus via creation of two bony tunnels in the greater tuberosity. Experimental animals received 100ul injections of porcine skeletal muscle-derived extracellular matrix (ECM) in 10 locations of the SSP muscle belly, while control animals received saline injections.
Groups of animals were sacrificed at various time points after tenotomy and repair. SSP muscles were harvested and histologically analyzed. Muscle fiber cross sectional area (CSA) and number of centralized nuclei (CN) were stereologically determined, and compared using univariate one-way ANOVAs.
Results
Fiber CSA decreased after tenotomy of SSP tendon compared to sham operated controls, with further reduction in myofiber CSA initially after rotator cuff repair (Figure 1A). No differences in number of CN were seen after tenotomy or repair compared with controls (Figure 1B). Changes in muscle quality after tenotomy and surgical repair are histologically evident (Figure 2, 3). ECM injection with repair reduced fiber CSA compared with saline control 8 weeks post-repair, and did not increase CN (Figure 4). Injection of ECM was associated with generally worse muscle quality and increased fibrosis compared with saline (Figure 5).
Conclusions
Degenerative changes seen in SSP muscle after tenotomy in these rabbits support this model of human chronic rotator cuff injury. ECM injection at the time of surgical repair failed to increase fiber area or number of centralized nuclei (a marker for muscle regeneration), and thus does not appear to aid SSP muscle recovery.

85. RELATIONSHIP PARTNER'S DESCRIPTIVE DRINKING NORMS: IF YOU THINK THEY DRINK, YOU WON'T DATE THEM

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Introduction: Social norm perceptions are associated with alcohol consumption, such that perceiving others to drink heavier and more frequently is positively associated with one's own drinking behavior (Borsari & Carey, 2003). Descriptive drinking norms refer to the participant's perception of other people's drinking behaviors (Neighbors et al., 2004). Purpose: Extending the research, this study asked students how they perceived the drinking habits of themselves, along with other social groups on campus. The study focused on the correlations between the amount of alcohol use and the relationship partner's descriptive norms. In addition, the research also focused on whether a person is more likely to get into a relationship based on the perceived descriptive norms of a potential partner. More specifically, this study asks the question, "Is a person more likely to become involved with someone who they perceive to drink less than them?" Methods: Data was collected through an online survey at a mid-sized midwestern university, sent out to students either via email or a web link using the "snowball method." A modified scale of the Core Institute Campus Survey of Alcohol and Other Drugs Norms at Southern Illinois University added the following questions estimating a) how often over a one to six month period and b) how much during a typical weekday and/or weekend different types of people drink including: (1) Your most recent/current committed relationship partner; (2) The person you were most recently "talking" to; (3) Your most recent/current. Results: A chi-square examining the participants' drinking compared to their perception of a committed relationship partner's drinking was significant, X^2 (49, n=155) = 286.56, p<.001. A chi-square examining the participants' drinking compared to their perception of a committed relationship partner's drinking was significant, X^2(25, n=130) = 83.81, p<.001. Conclusion: The results conclude that people perceive themselves to drink more than the people that they are romantically involved with. The results would be influential in discovering if people choose to be in relationships with people who drink less than them.

87. PHYSIOLOGICAL AND/OR ANTHROPOMETRIC VARIABLES AS INDICATORS OF HIGH INTENSITY FUNCTIONAL TRAINING PERFORMANCE

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Introduction: High-Intensity Functional Training (HIFT) involves a variety of movements including weightlifting, metabolic conditioning, and gymnastics. Data from our lab has previously demonstrated that anthropometric and physiological variables may be significant indicators of HIFT performance, though, no study has examined both anthropometric and physiological variables together. The influence of both anthropometric measurements as well as physiological factors warrant further investigation into the best indicator of HIFT performance. Purpose: Therefore, the purpose of this study was to determine which physiological and/or anthropometric factors best predict performance in HIFT workouts. Methods: 11 functionally trained male participants (Age: 28±6 years) performed three workouts. Workout 1 consisted of 3 rounds of 21-15-9 reps of thrusters and pull-ups (95lb). Workout 2 consisted of 30 clean and jerks (135lb). Workout 3 consisted of 5 rounds of a 400m run and 15 overhead squats with a barbell (95lb). Body composition, measurements of VO2 at varying thresholds, upper and lower limb length, and 1-repetition maximum (1RM) of back squat, deadlift, and strict press were recorded. A Pearson's r test was performed to determine the relationship between the variables and workout performance. For each HIFT workout dependent variable, a stepwise multiple linear regression was created using significant correlative data. Data are reported as means and standard deviations with the alpha level set a priori at 0.05. Results: For Workout 1 (217.8±46.8 s), VO2 at ventilatory threshold (33.9±7.0 ml/kg/min) explained 54.2% of the variance, F (1,9) = 10.65 (β = -0.736, p = 0.010). For Workout 2 (156.3±57.5 s), 1RM deadlift (185.2±24.2 kg) explained 71.7% of the variance, F(1,9) = 22.817 (β = -0.847, p = 0.001). For Workout 3 (814.2±57.5 s), VO2 max (49.5±6.7 ml/kg/min) explained 45.2% of the variance, F (1,9) = 7.429 (β = -0.672, p = 0.023). Conclusion: The lack of commonality between the best predictors of HIFT performance indicated that while physiological factors may be better indicators of performance than anthropometrics, the nature of the workout may dictate which physiological factor will be the best predictor.

86. DOES GAME-LIKE PHYSICAL ACTIVITY PRIOR TO STANDARDIZED EXAMS IMPROVE ACADEMIC PERFORMANCES?

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Evidence indicates physical activity (PA) and improved cognitive function are positively related (Dewar 2016). The type, intensity and duration of activity has yet to be well defined in terms of academic benefit. PURPOSE: This study was designed to determine whether a short term, game-like, high intensity PA intervention could be linked to improved standardized academic exam scores. METHODS: Scores from 515 school-administered academic standardized exams were recorded from two charter schools, grades 7 through 9, of similar demographic populations. One campus did not participate in the PA intervention (NonPAI, n=352) while the other school participated in a PA intervention (PAI) just prior to the exams (PAI, n=163). The PAI was introduced immediately prior to exams and consisted of 3 x 3 minute rounds of aerobic game-play with 30 second rest between each round. A measure of PA intensity was acquired as PAI students recorded their pre and post-game heart rate (HR). Exam scores between PAI and NonPAI students were compared, and correlations between post-PA HR and exam scores were used to evaluate the potential impact of intensity on academic outcomes. RESULTS: PAI students had lower exam scores compared to NonPAI students, 22.44 ± 8.47 vs. 25.40 ± 8.76 respectively, (p=0.000). When separated by grade, PAI students in grades 7 and 8 had lower scores, with no significant difference in exam scores among grade 9 (p=0.341). Within the PAI group, there was a positive correlation between post-PA HR measures and exam scores for all students combined (r=0.270, p=0.000) and when separated by sex. CONCLUSIONS: Game-like PA introduced prior to an academic exam may be more of a distraction than a benefit, especially for younger students. There may be an intensity threshold necessary for academic improvement in these age groups that still needs to be defined. To optimize benefits, intervention familiarity, HR measurement tools, and activity resulting in higher post-PA HR should be considered.

88. COMPARING SLEEP PATTERN ESTIMATES FROM DIFFERENT MONITOR METHODS

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PURPOSE: There is a strong association between irregular sleep schedules and increased risk for chronic diseases, but many studies rely on self-report questionnaires to assess sleep. New wearable monitors estimate sleep quantity and quality, but it is not clear how these monitor estimates of sleep compare to self-report logs. The purpose of this study was to 1) compare sleep estimates collected by the activity monitors and the self-report logs, and 2) determine if self-report or monitor estimates of sleep duration are different between individuals classified as "good" and "poor" sleepers.
METHODS: In this cross-sectional observational study, participants (n=26, average age = 30 y, 16 females) simultaneously wore an ActiGraph (AG) on the wrist and activPal (AP) on the thigh for seven consecutive days and tracked their daily wake and sleep times using a daily sleep log (SL). At the end of the seven days, they completed the Pittsburgh Sleep Quality Index (PSQI) questionnaire, which classified their sleep quality as "good" or "poor." Repeated measures ANOVA and Pearson correlations were used to compare average sleep duration across monitors, and an independent t-test was used to compare the sleep duration estimates between "poor" and "good" sleepers.
RESULTS: There was a significant difference between the sleep duration estimates collected by the activity monitors (AP=557.8 ± 78.5 min; AG=564.4 ± 53.2 min) and the self-report logs (SL=492.2 ± 43 min; PSQI=472 ± 55.2 min) (p<0.0001). There was a strong significant positive correlation of 0.6 between the sleep duration estimates collected by the PSQI and the sleep log. When comparing "good" and "poor" sleepers, there was no significant difference in sleep pattern estimates.
CONCLUSIONS: Sleep duration estimates collected by the activity monitors tended to be higher than self-report estimates. This difference may be due partially to bias in self-reporting sleep, or inconsistencies in the monitor classifications of lying time (e.g., watching TV classified as sleep time). Sleep duration did not differ between those with "good" or "poor" sleep quality, highlighting that sleep is a multidimensional physiological construct. In order to ensure coherent public health translation in sleep studies, there is a need to develop standardized methods that will produce comparable estimates of sleep across wearable monitor and self-report data.

89. NOVEL METHOD TO VISUALIZE AMPK PROTEIN LOCALIZATION IN HUMAN SINGLE MUSCLE FIBERS VIA CONFOCAL MICROSCOPY

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Purpose: AMP-activated protein kinase (AMPK) is the energy regulator of skeletal muscle cells. Current methods can identify the magnitude of AMPK expression in skeletal muscle cells via Western blotting and Capillary Nano-Immunoassay (CNIA); however, these methods lack the ability to visually identify AMPK localization within single muscle fibers. Therefore, we aimed to develop a novel confocal microscopy method to identify AMPK protein expression (relative intensity) and localization within human single muscle fibers. Methods: A vastus lateralis muscle biopsy was obtained from a healthy male and immediately fixed in 4% paraformaldehyde. Twenty fibers were isolated, placed on microscope slides, incubated in 0.1% Triton (15min), then incubated in 5% normal goat serum (blocking solution; 4h). This was followed by exposure to a 1°antibody (Ab) (anti-AMPKα2) in 5% bovine serum albumin (14h at 4°C). Fibers were then exposed to a 2°Ab (anti-rabbit IgG conjugated w/AlexaFluor 488) and phalloidin (AlexaFluor 568) to label actin (2h). Finally, fibers were mounted under coverslips with AntiFade Gold w/DAPI for myonuclei detection. Confocal microscopy imaging was conducted using a Zeiss LSM 710 with 63x plan apochromatic objective (oil emersion). Images were processed via ImageJ. Results: Muscle fiber contractile proteins (actin; red), myonuclei (blue), and AMPK proteins (green) were successfully visually identified in the human muscle fibers. To ensure that no auto-fluorescence or non-specific binding was observed, images were compared to control slides: 1) DAPI only, 2) 1°Ab only, 3) 2°Ab only, and 4) no staining. Conclusion: These method allow for the successful visualization (relative intensity) and localization of AMPK proteins within single human muscle fibers. This method could be used to determine AMPK co-localization with myonuclei in response to high intensity exercise or other interventions.

90. THE EFFECTS OF A TREADMILL EXERCISE TEST TO VOLITIONAL FATIGUE ON COGNITIVE FUNCTION

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Purpose: Acute moderate intensity exercise has been found to enhance cognitive function as measured with the Stroop color word test. Research has also shown that acute high intensity exercise has little effect on various aspects of cognitive function, however the Stroop test was not used as a dependent variable. The purpose of this study was to evaluate the effects of acute high intensity exercise on two Stroop test conditions and a memory test. Methods: Recreationally active college students were assigned to either an exercise (E) (fem = 10, male = 11, mean age = 21.7 ± 1.87; mean BMI = 22.9 ± 2.62 kg/m2) or control (C) (fem = 10, male = 9, mean age = 21.5 ± 2.26; mean BMI = 24.6 ± 3.34 kg/m2) group. All subjects performed the Stroop and memory tests before and after an intervention. In the Stroop 1 (S1) condition subjects were to say the correct word regardless of ink color. In Stroop 2 (S2) they were to say the correct ink color regardless of the spelled word. For the memory test subjects were shown a card with several drawings, then were shown a card with several different drawings and were to identify the one drawing that was similar on both cards. For the intervention, the E group performed a graded exercise test (GXT) on a treadmill, with intensity or grade being increased each minute until volitional fatigue. The C group watched a TV show for about 40 minutes. This time was chosen to match the time between pre and post tests for the E group. Results: There were no statistically significant differences from pre to post test or between groups for S1 or the memory test. Both groups decreased their S2 times pre to post test (E pre = 63.2 ± 12.3 sec, post = 55.6 ± 9.8 sec; C pre = 62.6 ± 8.9 sec, post = 57.5 ± 9.1 sec, $P<0.001$), however there were no significant differences between groups. Conclusion: These results add to the current evidence that high intensity acute exercise in the form of a GXT does not enhance various aspects of cognitive function. Also, the complex nature of the S2 resulted in a learning effect for both groups.