



**2015 Annual Meeting  
Central States Chapter  
Of the  
American College of Sports Medicine**



**October 15th & 16th, 2015  
University of Central Missouri  
Warrensburg, Missouri**



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2015 ACSM – Central States annual meeting.

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# Meeting Information

## *Intended Audience*

ACSM members, students and professionals interested in the field of sports medicine and exercise science.

## *Meeting Objectives*

At the conclusion of this activity, participants should be able to:

- Recognize contemporary controversial issues related to sports medicine, exercise science, and health promotion
- Apply knowledge of the effects of exercise on diseases such as Alzheimer's
- Demonstrate knowledge of cardiovascular disease risk in football players
- Be able to design and mater presentation techniques
- Identify new approaches to, and perspectives on, problems in exercise science and sports medicine through interaction among scientists and clinicians in related fields.
- Provide a forum for members and students to present research related to exercise science and sports medicine
- Recognize the importance of research in understanding problems related to physical inactivity.

## *ACSM continuing Education Credits (CEC's)*

The American College of Sports Medicine's Professional Education Committee certifies that this annual meeting meets the criteria for 10 credit hours of ACSM continuing education credit. Credit is awarded for these CECs by attending the Central States Chapter ACSM Annual Meeting. The Central States ACSM is an approved Provider of CEC for the ACSM. A certificate documenting completion of 10 CEC's is at the back of this program.

## *Name Badges*

Name badges must be worn at all times to gain admittance in the poster session, educational sessions, and ACSM social events. Please hold on to your badge!

## *Future Meeting Site*

The next meeting will be held in October 2016 under the direction of Dr. Michelle Gray, University of Arkansas in Fayetteville, AR.

**A special thank you to the Central States ACSM Board of Directors  
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**Central States Chapter  
Of the  
American College of Sports Medicine  
Fall 2015 MEETING SCHEDULE**

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**Thursday, October 15<sup>th</sup>, 2015**

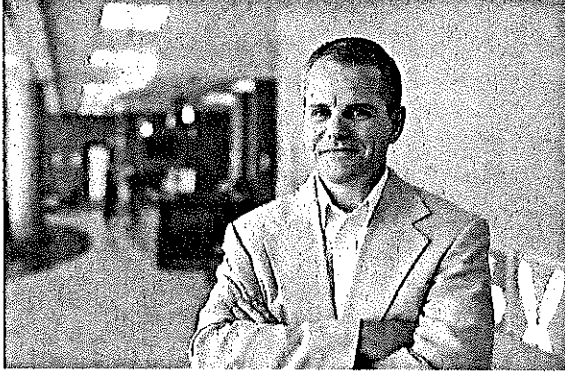
10:00-11:45	<b>Registration</b>	Hall Outside Union 236/238
11:45-12:00	Greetings from University of Central Missouri Dean of College of Health, Science, and Technology Alice Greife Opening remarks: Steve Burns PhD Conference Director	Union 236/238
12:00-1:00	Mike Israel, PhD, Temple University <i>Introducing the Maximum Recoverable Volume Concept</i>	Union 236/238
1:00-1:15	<b>Break</b>	
1:15-2:00	Max Paquette, PhD, University of Memphis <i>Are we Forgetting About Prolonged Efforts in Running Studies? Biomechanical and Metabolic Implications</i>	Union 236/238
2:00-2:45	John Thyfault, PhD, University of Kansas Medical Center <i>Fitness Impacts Susceptibility for Obesity and Metabolic Disease</i>	Union 236/238
2:45-3:00	<b>Break</b>	
3:00-4:30	Student Oral Presentations (See abstracts program pages 8-11)  <b>Undergraduate:</b> Lauren Wethington, Michelle Tedrowe <b>Masters:</b> David Lee, Megan Rosa <b>Doctoral:</b> Richard Perry, Lisa Jansen	Union 236/238
4:30-5:30	Student Poster Presentations	Union 236/238
5:30	Quiz Bowl Presider: Joe Pujol, PhD, FACSM Southeast Missouri State University	Union 236/238

## Friday, October 16<sup>th</sup>, 2015

8:30-8:45	Opening remarks: Steve Burns, PhD, Conference Director	Union 236/238
8:45-9:30	Jason Glassnap, PT, DPT, University of Central Missouri <i>Proximal Stability: A Regional Approach for Assessing and Treating Hip Abductor Weakness</i>	Union 236/238
9:30-10:15	Dave Burnett, PhD, University of Kansas Medical Center <i>Exercise Induced Bronchoconstriction in College Athletes</i>	Union 236/238
10:30-10:45	<b>Break</b>	
10:30-11:15	Jason Wagganer, PhD, Southeast Missouri State University <i>Should We HIT Cardiac Rehabilitation Patients?</i>	Union 236/238
11:30-1:30	<b>Lunch</b>	Union 240
12:15-1:15	Kevin Short, PhD, FACSM University of Oklahoma Medical Center <i>Diabetes in Youth: A Role for Exercise</i>	Union 240
1:30-2:30	<b>Professional Business Meeting</b> Michelle Gray, PhD, University of Arkansas	Union 240
1:30-2:30	<b>Student Meeting</b> Jason Wagganer, PhD and Jeremy Barnes, PhD Southeast Missouri State University <i>Employment Trends in the Fitness Industry</i>	Union 236
2:30-2:45	Closing Remarks Steve Burns, PhD, University of Central Missouri	Union 236/238

# Featured Keynote Speaker

## Kevin Short, PhD



Dr. Short is an Associate Professor, and holds the CMRI Choctaw Nation Chair in Pediatric Endocrinology in the Section of Diabetes and Endocrinology, Department of Pediatrics, at the University of Oklahoma Health Sciences Center (OUHSC) in Oklahoma City. He joined OUHSC in August 2006. His training and academic interests are in exercise physiology and human metabolism, particularly related to diabetes and

obesity. He completed his graduate degrees in exercise physiology at Purdue and Ball State Universities in Indiana and then worked as a post-doctoral fellow and junior faculty member in the Endocrinology Research Unit at Mayo Clinic in Rochester, Minnesota before moving to Oklahoma to help start a new metabolic research program.

Dr. Short's recent work has focused on the impact of exercise on diabetes prevention and treatment, particularly in children. One of his goals is to promote better fitness in young people who are at risk of developing obesity and diabetes in order to prevent or delay the future health problems. His current projects involve basic studies in the lab and behavioral interventions in the community.

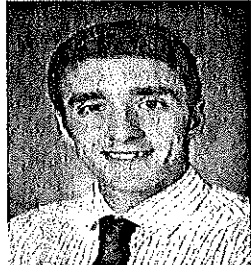


## Session Presenters



### **Mike Israel, PhD**

Dr. Mike Israel, born in Moscow, Russia, did his undergraduate work at the University of Michigan and his master's at Appalachian State University. In 2013, Michael completed his PhD in Sport Physiology at ETSU, where he also served as a strength coach, sport scientist and nutritional consultant to Division I Athletes. Mike's educational background complements his experiences as a competitive grappler and bodybuilder. While his greatest passion is teaching, Mike also takes great pride in his nutritional and training consultation to elite strength and combat athletes around the world, experiences which he regularly parlays into classroom lessons. Mike is currently an Assistant Professor for Exercise and Sport Science at Temple University in Philadelphia, PA.



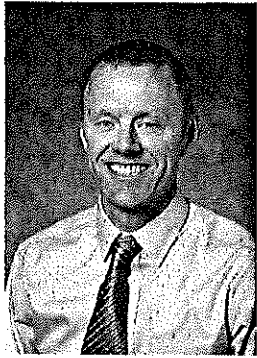
### **Max Paquette, PhD**

Dr. Paquette is currently an Assistant Professor in the Department of Health and Sport Sciences at The University of Memphis, where he teaches undergraduate and graduate exercise science and biomechanics classes. Dr. Paquette earned a Bachelor's Degree in Human Kinetics and a Master's Degree in Biomechanics from The University of Guelph (Ontario, Canada). He completed his PhD training at The University of Tennessee in the area of Biomechanics. His research interests are largely focused on the biomechanics of the lower limb for injury and musculoskeletal disease prevention. Specifically, he focuses on the effects of exercise interventions and gait modifications on joint mechanics, function and, quality of life in aging and knee osteoarthritis populations. Dr. Paquette actively collaborates with researchers from other institutions within the US and around the World. He is a member of the American College of Sports Medicine, the American Society for Biomechanics, the Canadian Society for Biomechanics and the National Strength and Conditioning Association. Dr. Paquette has consulted with high school, collegiate and World-class track and field athletes and their coaches to optimize performance and reduce injury risks.



### **John Thyfault, PhD**

Dr. Thyfault has a background and training in obesity, metabolism and exercise physiology using translational approaches in cells, animal models, and human subjects. Dr Thyfault was faculty at University of Missouri from 2005 to 2015 and recently moved his lab to Kansas University Medical Center and the KC Veterans Hospital in Kansas City. The broad theme of his research is on the regulation of glucose and lipid metabolism by physical activity and fitness



**Jason Glasnapp, PT, DPT**

Dr. Jason Glasnapp has been a Physical Therapist for 19 years specializing in the areas of both orthopedics and geriatric care. He earned his Bachelor of Science in Education and Sport Science from the University of Kansas in 1993, Masters in Physical Therapy from Wichita State University in 1996, and Doctorate in Physical Therapy from the University of Montana in 2010. His personal passion for staying active combined with years of clinical experience allow for a unique perspective when teaching. Glasnapp joined the University of Central Missouri in 2015 as an Assistant Professor. He teaches courses within the Health Studies and Athletic Training curriculum along with advising Health Studies Pre-PT/OT students. He will be conducting research utilizing the Functional Movement

System and Y-Balance Test focused on injury prevention, undergraduate biomechanical education, and student success variables.



**Dave Burnett, PhD**

Dr. Burnett earned his undergraduate degree in respiratory therapy. He then received his master's degree in exercise science from the University of Central Missouri and his doctorate in rehabilitation science from the University of Kansas. Having worked clinically as a registered respiratory therapist, Burnett has more than 20 years of experience in hospital, physician office, and rehabilitative settings. Currently Burnett is principal investigator on two asthma projects: exercise-induced bronchoconstriction (EIB) and community-based asthma self-management. Burnett is in collaboration with university members in Kansas and Missouri to study the prevalence of EIB and to help develop a screening program for identifying those at risk for EIB. In addition, Burnett partners with pulmonary physicians to help improve the health outcomes of

asthma patients and reduce the financial burden chronic respiratory conditions can have when not managed properly by patients. In summary, this collaboration includes community-based activity aimed at working with physicians in their practice and a patient-centric home model. Burnett is co-founder and director of the KU Asthma Center.



**Jason Wagganer, PhD**

Dr. Wagganer is an Associate Professor at Southeast Missouri State University, teaching courses within the undergraduate Health Management: Exercise Physiology major and graduate-level Nutrition and Exercise Science programs. These courses include Health Perspectives, Research Methods, Exercise Physiology, Kinesiology, Physiology of Conditioning, Exercise in Health and Disease and Cardiovascular Exercise Physiology. His research interests lie in the area of High-Intensity Interval Training in the cardiac rehabilitation setting, blood lipid and lipoprotein changes with exercise, and body composition analysis amongst various populations. He is the current Secretary/Treasurer for the Central States regional chapter of the American College of Sports Medicine (ACSM). In 2000, he obtained

the Certified Exercise Physiologist certification offered by ACSM. Prior to coming to Southeast, Dr. Wagganer was an Assistant Professor at Greensboro College while completing his PhD in Exercise Physiology at the University of North Carolina at Greensboro.

# Abstracts

## Undergraduate Student - Oral Presentations

Presentation Time-3:00 p.m.

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### THE ERGOGENIC EFFECTS OF ACUTE CITRULLINE MALATE SUPPLEMENTATION ON WEIGHTLIFTING PERFORMANCE IN TRAINED FEMALES

Lauren N. Wethington, Jordan M. Glenn, Matthew S. Stone, Jarrion Lawson, Michelle Gray University of Arkansas, Fayetteville, Arkansas

Females represent 50.8% of the United States population and 65% of female athletes use nutritional supplements during their college careers. Although, there are morphological differences between genders, previous investigations evaluating citrulline-malate (CM) supplementation involved male subjects. **PURPOSE:** This investigation evaluated the ergogenic effects of CM supplementation on upper-body (UB) and lower-body (LB) submaximal resistance exercise performance in trained females. **METHODS:** This study used a randomized, double-blind, crossover design. Based on previous literature, an *a priori* sample of 14 subjects was required, as a result, this study included 15 female volunteers (age=23±3 years, height=162.64±19.17, weight=67.06±6.96, body fat=25.84%±5.49%, training history=5.1±3.94 years). Inclusion criteria included: 18-30 years of age, training at least twice a week over one year, and no CM supplementation within one year. Subjects reported to the Human Performance Laboratory for 3 visits. On visit one, demographic/body composition, and one-repetition maximum (1-RM) strength were measured. On subsequent visits, subjects consumed CM (8 g dextrose+8 g CM) or placebo (8 g dextrose) before undergoing the exercise protocol. Exercise protocol included six sets of upper-body exercise and six sets of lower-body exercise at 80% 1-RM. One-minute rest was allotted between each upper- and lower-body set. Two-minutes rest was allowed when transitioning from upper- to lower-body exercises. Outcome measures included: repetitions lifted during each set, total repetitions completed, repetitions completed during initial (sets 1-3) and final (sets 4-6) halves of each exercise, and repetitions completed during initial (sets 1-2), middle (sets 3-4), and final (sets 5-6) thirds of each exercise. **RESULTS:** During the final half of upper-body exercise, subjects completed significantly ( $P=.038$ ) more repetitions when consuming CM (12.13±2.85) compared to placebo (11.13±2.75). Similar results were observed during lower-body exercise. Total repetitions (66.73±30.49 vs. 55.13±20.64,  $P=.027$ ), repetitions completed during the middle third (18.36±6.71 vs. 15.29±5.78,  $P=.048$ ), final third (17.57±7.19 vs. 14.21±7.15,  $P=.019$ ), and final half (26.50±10.70 vs. 21.71±9.76,  $P=.035$ ) of exercise were significantly greater for CM compared to placebo, respectively. **CONCLUSION:** In trained females, CM supplementation increased performance during submaximal resistance exercise. These data have attractive implications for female athletes competing in sports with strength-based requirements.

Funding provided by a Student Undergraduate Research Fellowship

Presentation Time-3:15 p.m.

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### EFFECTS OF DIET-INDUCED OBESITY ON MATRIX METALLOPROTEINASE GENE EXPRESSION AT THE ONSET OF SKELETAL MUSCLE REGENERATION

Michelle A. Tedrowe<sup>1</sup>, Lemuel A. Brown<sup>1</sup>, Richard A. Perry Jr.<sup>1</sup>, Megan E. Rosa<sup>1</sup>, Jacob L. Brown<sup>1</sup>, David E. Lee<sup>1</sup>, Nicholas P. Greene<sup>1</sup>, Tyrone A. Washington<sup>1</sup>. <sup>1</sup>University of Arkansas, Fayetteville, Arkansas; e-mail: materdrow@uarke.edu

Obesity negatively effects skeletal muscle's regenerative capacity. Optimal skeletal muscle regeneration includes inflammation, ECM remodeling, and myofiber growth. Disruption to any of these processes can negatively affect skeletal muscle regeneration. The extracellular matrix (ECM) acts as a scaffold for skeletal muscle fibers and also serves as a reservoir for proteins and growth factors that promote regeneration. Matrix metalloproteinases (MMPs) are zinc-dependent endopeptidases that degrade collagen fibrils within the ECM. MMP-2 and 9 are the most

abundant in skeletal muscle. **PURPOSE:** To determine if obesity alters MMP gene expression at the onset of skeletal muscle regeneration. **METHODS:** Twenty male C57BL/6J mice were randomly assigned to two groups: lean diet (10% fat) and high fat diet (HFD) (60% fat). Within those two groups, mice were randomly assigned to either a PBS (uninjured) group or a bupivacaine (injured) group. Bupivacaine is a myotoxin which induces injury to skeletal muscle. Bupivacaine or PBS was injected into the tibialis anterior (TA). Three days post-injection, the TAs were extracted and quantitative PCR was done to determine MMP-2 and MMP-9 gene expression. **RESULTS:** There was a significant decrease in TA muscle mass to body weight ratio in lean group ( $1.8 \pm 0.06$  mg/g vs.  $1.6 \pm 0.05$  mg/g,  $p < 0.05$ ) and the HFD group ( $1.5 \pm 0.1$  mg/g, vs.  $1.4 \pm 0.1$  mg/g  $p < 0.05$ ) 3 days post-injection. There was a 70% reduction in the collagen-III:I ratio in the lean injured group compared to the lean uninjured group ( $p < 0.05$ ) 3 days post-injection. However, there was a 4.5-fold increase in the collagen III:I ratio in the HFD injured group compared to the HFD uninjured group ( $p < 0.05$ ) 3 day post-injection. Obesity alone did not affect MMP-2 or 9 gene expression. There was no difference in MMP-2 gene expression ( $p > 0.05$ ) 3 days post-injection. There was a main effect of injury to increase MMP-9 ( $p < 0.05$ ) gene expression 3 day post-injection regardless of diet. **CONCLUSION:** Collagen III:I ratio differed between lean and obese at the onset of regeneration. It does not appear that MMPs 2 and 9 are responsible for this change in collagen III:I ratio. Future studies can include looking at other MMPs that play a role in skeletal muscle and other factors that may affect the change in collagen III:I ratio. Funding provided by a grant from the American Biosciences Institute

## Graduate Student - Oral Presentation

### Presentation Time-3:30 p.m.

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#### AGING AND OBESITY: MITOCHONDRIA AT THE HEART OF THE PROBLEM

David E. Lee, Richard A. Perry, Jr., Jacob L. Brown, Lemuel A. Brown, Megan E. Rosa, Tyrone A. Washington, & Nicholas P. Greene. University of Arkansas, Fayetteville, Arkansas; e-mail:Davidlee@uark.edu

The mitochondrial theory of aging implicates reactive oxygen species (ROS) produced during oxidative metabolism in damaging cardiac muscle cells and contributing to the physiological decline of aging. Mitochondrial DNA (mtDNA) is damaged by ROS and cannot be accurately transcribed or translated into proteins needed for oxidative metabolism leading to detriments in oxidative capacity of cardiac muscle with age. Obesity is also strongly associated with multiple cardiomyopathies and mitochondrial damage and may exacerbate effects of aging. If mitochondrial mRNA translation plays a role in the onset of cardiomyopathy is unclear. **PURPOSE:** The purpose of this investigation was to describe mitochondrial content (COX-IV), biogenesis (PGC-1 $\alpha$ , TFAM), mitochondrial mRNA translation machinery (12S and 16S rRNAs, mtIF2/3, TUFM, TACO1) and the mitochondrially encoded protein (CytB) during aging and obesity. **METHODS:** Four groups of C57BL/6J mice were used: Young Lean (3-4 weeks old, normal diet, n=10, YL), Young diet-induced obese (n=16, YO), Aged Lean (20-24 months old, n=8, AL), and Aged Obese (n=6, AO). Hearts were removed, weighed, snap-frozen, and processed for protein and RNA for immunoblotting and real time RT-PCR, respectively. **RESULTS:** COX-IV protein was ~30% greater in aged mice compared to young ( $p < 0.05$ ). PGC-1 $\alpha$  was ~100% higher in YO compared to YL ( $p < 0.05$ ) and ~75% higher in AL vs. YL ( $p < 0.05$ ) while TFAM protein was unchanged among groups ( $p > 0.05$ ). 12S was ~50% lower in aged compared to young ( $p < 0.05$ ) and ~30% lower in obese compared to lean ( $p < 0.05$ ). 16S content was ~30% lower in AL and AO vs. YL and ~70% lower in YO vs. YL ( $p < 0.05$ ). mtIF2 protein was ~40% less in aged vs. young ( $p < 0.05$ ). Obese mice showed ~25% less TACO1 protein compared to Lean ( $p < 0.05$ ). CytB protein was ~40% lower in aged vs. young ( $p < 0.05$ ). **CONCLUSION:** This investigation has taken clear steps showing alterations in mitochondrial content and mRNA translation machinery in aged hearts, concomitant with decreases in the content of mitochondrial encoded protein. These impairments in mitochondrial mRNA translation are indicative of greater oxidative stress in cardiac tissue during aging, which may directly impact the development of cardiomyopathies such as ventricular hypertrophy and cardiac fibrosis. Funding provided by the Arkansas Bioscience Institute

## Presentation Time- 3:45 p.m.

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### **AUTOPHAGY REGULATION AFTER DIET AND PHYSICAL ACTIVITY IN NON-ALCOHOLIC FATTY LIVER DISEASE**

Megan E. Rosa<sup>1</sup>, Matthew P. Harris<sup>2</sup>, David E. Lee<sup>1</sup>, Jacob L. Brown<sup>1</sup>, Kaylee E. Poole<sup>2</sup>, Andrew Seija<sup>2</sup>, Lemuel A. Brown<sup>1</sup>, Richard A. Perry Jr.<sup>1</sup>, Tyrone A. Washington<sup>1</sup>, Joshua S. Wooten<sup>2</sup>, Nicholas P. Greene<sup>1</sup>  
<sup>1</sup>University of Arkansas, <sup>2</sup>Southern Illinois University Edwardsville; e-mail: mrosa@uark.edu

Obesity remains a key threat to public health. Along with other detriments associated with obesity, liver disease, specifically Non-Alcoholic Fatty Liver Disease (NAFLD) has dramatically increased. NAFLD may begin with fat accumulation on the liver, but can progress to steatosis, fibrosis, and eventual cirrhosis. With no pharmacological treatment for steatosis, lifestyle interventions appear to be vital to maintaining liver health. Previous work has shown aberrant mitochondrial quality and autophagy in models of fatty liver. Exercise is known to increase basal autophagy levels in muscle as well as mitochondrial health, thus autophagy may be a key regulatory factor for treatment of obesity induced-NAFLD. **PURPOSE:** The purpose of the study was to examine how lifestyle modifications impact hepatic autophagy and mitochondrial content in a murine model of NAFLD. **METHODS:** 48 C57BL/6J mice were evenly divided into one of 4 groups: low fat diet (LFD, 10% fat, 18 wks), high fat diet (HFD, 60% fat diet, 18 wks.), diet (D, 60% fat diet for 10 wks then 10% fat diet for 8 wks) or diet and physical activity (D/PA, 60% fat diet for 10 wks, then 10% fat diet plus a running wheel for 8 wks). After interventions, animals were humanely euthanized and livers collected and snap frozen in liquid nitrogen for later analysis. Livers were homogenized and analyzed via immunoblotting for protein content of mitochondrial and autophagy related proteins. Results were analyzed via one-way analysis of variance, (ANOVA), with  $\alpha$  set at 0.05. **RESULTS:** COX-IV protein content was approximately 50% less in HFD compared to LFD, and was restored to LFD levels with D/PA. PGC-1 $\alpha$  content was 45% lower in HFD mice, D restored PGC-1 $\alpha$  content whereas D/PA resulted in ~60% greater PGC-1 $\alpha$  content than LFD. p62 protein content was 2.5 fold higher in HFD animals compared to LFD, D, and D/PA, with no further differences observed. BNIP3 content was 40% lower in HFD compared to LFD; D/PA had 50% more BNIP3 compared to LFD controls. **CONCLUSION:** Prolonged high-fat diet causes disruptions in mitochondrial content, mitophagy and macroautophagy. Combined diet and physical activity are able to restore these derangements.

## **Student Doctoral - Oral Presentations**

### Presentation Time- 4:00 p.m.

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### **DIFFERENTIAL EFFECTS OF AGE AND OBESITY ON MARKERS OF PROTEIN SYNTHESIS IN HEARTS OF C57BL/6J MICE**

Richard A. Perry, Jr., Lemuel A. Brown, David E. Lee, Jacob L. Brown, Megan E. Rosa, Nicholas P. Greene, Tyrone A. Washington, University of Arkansas, Fayetteville, Arkansas; e-mail: rap007@email.uark.edu

In 1990, 23.6% of the elderly population (60+ years old) was obese ( $\geq 30$  BMI). By 2010, it increased to 39.5%. Aging is typically associated with a reduction in lean mass. When this ailment is coupled with the gain in fat mass, the condition is referred to as sarcopenic obesity. Pathological, cardiac hypertrophy is highly associated with both age and obesity. As the prevalence of obesity in the elderly population continues to rise, a firmer understanding of how age and obesity interact to effect cardiac function is needed. **PURPOSE:** To examine how sarcopenic obesity affects markers of protein synthesis and inhibitors of protein synthesis. **METHODS:** Twenty-four C57BL/6J mice were evenly distributed into either a normal chow (17% kcals from fat) or high-fat (60% kcals from fat) diet after weaning. Twelve mice from each diet were euthanized at 12-16 weeks of age (young). The remaining 12 were sacrificed at 22-24 months of age (aged). The classification of the 4 groups is as follows: Young Lean (YL), Young Obese (YO), Aged Lean (AL), Aged Obese (AO) (n=6 per group). Whole hearts were excised at time of euthanasia,

snap-frozen, and were powdered and processed for use in protein and gene expression assays. Protein expression was measured using western blot. All protein targets are reported as a ratio of phosphorylated to total protein. Gene expression was measured using RT-qPCR. **RESULTS:** Heart weight:tibia length was increased in the YO and AO by 16% and 29%, respectively, compared to their lean counterparts ( $p < 0.05$ ). Additionally, AO was 27% greater than YO ( $p < 0.05$ ). There was a main effect for the obese groups to have approximately 70% higher pAkt/Akt expression compared to aged-matched controls ( $p < 0.05$ ). There was a main effect for the aged groups to have higher expression of pmTOR/mTOR ( $p < 0.05$ ). p4EBP-1/4EBP-1 expression was 45% lower in the young obese group compared to the young lean group ( $p < 0.05$ ). p4EBP-1/4EBP-1 expression was not different within the aged groups. pp70S6K/p70S6K expression was 31% lower in the AO compared to the YO ( $p < 0.05$ ). There was a main effect for the aged groups ( $p < 0.05$ ) and a trend for the obese groups ( $p < 0.09$ ) to have higher gene expression of TNF- $\alpha$ . In young mice, expression of pAMPK/AMPK was ~4-fold higher in the obese group whereas expression in AO was 50% lower than AL. **CONCLUSION:** Sarcopenic obesity induced differential expression of protein synthesis markers in cardiac muscle. AMPK may be acting as an inhibitor to protein synthesis in the young obese whereas TNF- $\alpha$  may be exerting an inhibitory effect during sarcopenic obesity.

## Presentation Time- 4:15 p.m.

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### EFFECTS OF PLASMA OSMOLALITY ON GLUCOSE REGULATION IN HEALTHY MALES – A PILOT STUDY

Lisa T. Jansen, J.D. Adams, Yasuki Sekiguchi, Jillian Fry, Allison Schroeder, Evan C. Johnson, Stavros Kavouras FACSM, University of Arkansas, Fayetteville, AR; e-mail: ltjansen@uark.edu

Poor glucose regulation is the defining characteristic of type II diabetes mellitus (T2DM). Preliminary data from experimental animal have linked dehydration to glucose dysregulation via the action of vasopressin. Also epidemiological data suggest that humans with low water intake are more prone to develop diabetes. **PURPOSE:** Therefore, the purpose of this study was to investigate the effects of cellular dehydration on glucose regulation in healthy males. **METHODS:** 4 non-diabetic males (28.4 y $\pm$ 1, HbA1c 5.6 $\pm$ 0.2%) were recruited for this preliminary study. Each subject underwent two experimental trials, consisting of a 2 h intravenous infusion of saline (ISO 0.9% and HYP 3.0% of NaCl; 0.1ml $\cdot$ kg $\cdot$ min $^{-1}$  infusion rate), followed by a 2 h oral glucose tolerance test. Blood samples were taken from an antecubital intravenous catheter in 30 min intervals starting at baseline. **RESULTS:** Mean plasma osmolality was raised to 300 $\pm$ 3 mmol/kg for the HYP trial, while ISO maintained a mean of 286 $\pm$  2 mmol/kg. Glycemic and insulin responses post glucose loading seemed to be delayed but spiked during HYP (150.6 mg/dl glucose at min 60) while displaying a normal response during ISO (136 mg/dl at min 60) trials. HOMA IR: HYP 0.93 $\pm$ 0.24 vs. ISO: 0.85 $\pm$  0.59 and MATSUDA Index: HYP 12.4 $\pm$ 5.9 vs. ISO 12.7 $\pm$ 6.5 were calculated utilizing glucose and insulin measurements for both trials. HYP seemed to cause increased insulin resistance and decreased insulin sensitivity compared to ISO. **CONCLUSION:** The present data might indicate the '43-49° C. Based upon their self-reported and measured activity levels and activity types participants were placed into the following groups: aerobically trained (AERO), resistance trained (RES), aerobic and resistance trained (A+R), and sedentary (SED). **RESULTS:** Total activity differed among the groups with the AERO (203 $\pm$ 83 min) and A+R (183 $\pm$ 28 min) groups accumulating more physical activity compared to the RES (39 $\pm$ 39 min;  $p < 0.05$ ) and SED (62 $\pm$ 32 min;  $p < 0.05$ ) groups. AERO (32 $\pm$ 13 min) and A+R (34 $\pm$ 7 min) also accumulated greater "vigorous" intensity activity than the RES (10 $\pm$ 4 min;  $p < 0.05$ ) and SED (12 $\pm$ 5 min) groups. Mean ratings of PI across all temperatures did not differ among activity groups for (6.0 $\pm$ 3.2, 7.4 $\pm$ 2.9, 6.6 $\pm$ 3.5, and 5.3 $\pm$ 3.3 for AERO, RES, A+R, and SED, respectively;  $p = 0.652$ ) nor did ratings of PU across all temperatures (4.1 $\pm$ 2.3, 4.6 $\pm$ 2.5, 4.5 $\pm$ 3.0, and 3.5 $\pm$ 2.4 for AERO, RES, A+R, and SED, respectively;  $p = 0.78$ ). **CONCLUSIONS:** Unlike previous results in middle-aged and older women where higher activity was associated with lower pain sensitivity, our results suggest pain sensitivity does not differ among individuals with differing activity levels in college-aged females. Additionally, we demonstrated pain sensitivity also did not differ among differing types of physical activity.

# Undergraduate Student Poster Presentations

## 1. EFFECT OF THORSTENSSON TEST DATA COLLECTION WINDOW ON SYNERGIST BETWEEN-MUSCLE EMG AMPLITUDE RELATIONSHIPS

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Repeated maximal effort isokinetic knee extension tests are common in fatigue research. The theory of common drive dictates that surface electromyographic (EMG) amplitude should be highly correlated between synergist muscles. However, researchers collect EMG data from different ROM (range-of-motion) windows. Different data collection windows will inherently result in different datasets from each trial. This may change the interpretation of the same test. **PURPOSE:** Quantify the relationship magnitudes of EMG RMS between the knee extensor muscles and determine if those relationships are affected by the ROM in which data is collected. **METHODS:** Nine healthy males and nine healthy females (age=21.1±1.4 y; height=173.8±12.4 cm; mass=72.1±14.7 kg) completed one bout of 50 repeated maximal effort concentric knee extensions at 180°/s with passive flexion on an isokinetic dynamometer. Position and EMG were sampled at 10k Hz. Custom LabVIEW software was used to analyze data. For the vastus lateralis (VL), rectus femoris (RF), and vastus medialis (VM), EMG data were captured in 3 different ROM windows: full ROM (F), 120°-150° (M), and load range (L). EMG amplitude was quantified via normalized root mean square (RMS) of the EMG signal in each ROM window. Between-muscle EMG amplitude Pearson correlations of the VL-VM, VL-RF, and RF-VM combinations over each window were calculated. Pearson correlation coefficient (r) values were analyzed via a two-way 3 (window) x 3 (muscle combination) ANOVA. Alpha was set at .05. **RESULTS:** There was no significant interaction between window and muscle. There was no main effect of muscle. There was a main effect of window where the F and LR windows yielded stronger between-muscle correlations than the M window. RMS amplitude data from F windows yielded stronger between-muscle correlations than LR windows. **CONCLUSIONS:** When processing repeated isokinetic knee extension data, surface EMG RMS data from the full concentric range of motion results in the strongest between-muscle correlations of synergist muscles. Assuming the task does not deviate from the theory of common drive, EMG RMS data gathered from larger ROM windows are probably better representative of the EMG amplitude during repeated maximal effort isokinetic knee extensions.

## 2. THE UTILIZATION OF POWER TO PREDICT CHANGES IN DYNAMIC BALANCE

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Power production and dynamic balance are important in maintaining and improving functionality in older adults. When working to improve exercise performance or activities of daily living (ADLs), older adults often encounter difficulty due to insufficient power or balance. While a relationship exists between power and dynamic balance, more research is necessary to further understand this connection. **PURPOSE:** The purpose of this study was to determine whether the ability to produce power predicted changes in performance on the 8-Foot Up-and-Go (UPGO) following 6 months of strength training at 80% 1RM in older adults. **METHODS:** Thirty-three older adults over the age of 65 ( $M=81.66\pm 5.91$ ) participated in a six month total body strength training program at 80% one-rep max (1RM). Power was assessed at pre-test using a velocity sensor system attached to a broomstick. Participants held the broomstick across their chest and performed a chair stand as quickly as possible. The mean output of 10 trials were recorded for average and peak power. The UPGO test was used to determine dynamic balance. Difference scores were calculated on the UPGO from pre- to post-test. A linear regression analysis was utilized. **RESULTS:** One outlier was removed from the dataset. UPGO improved by  $.30\pm .55$  seconds on average from pre- to post-test. Peak power ( $M=832.27\pm 201.56$  W) was a significant predictor of UPGO mean difference scores ( $\beta=.40$ ,  $t_{(30)}=2.45$ ,  $p=.02$ ), significantly accounting for 13.5% of the variance ( $R^2=.13$ ,  $F_{(1,31)}=5.98$ ,  $p=.02$ ). Average power ( $M=476.20\pm 137.21$  W) did not significantly predict changes in UPGO performance ( $p=.18$ ). **CONCLUSION:** While previous research has found a positive correlation between power and dynamic balance,

peak power may be a more significant contributor than average power. Furthermore, 86.5% of the variance was unexplained, suggesting dynamic balance may be predicted by multiple factors.

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### 3. THE EFFECTS OF PRE-WORKOUT ON ANAEROBIC POWER OUTPUT AND BLOOD LACTATE LEVELS

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Pre-workout supplementation has become a common practice among gym users and trained athletes due to claims of increased energy and endurance to achieve faster results. However, these claims have not been proven scientifically by a large variety of reliable sources. **PURPOSE:** The purpose of this study was to determine the effects of a pre-workout supplement on anaerobic power output, percent fatigue and blood lactate levels. **METHODS:** Participants included 5 males and 4 females (mean  $\pm$  SD age =  $21 \pm .87$  years). The research was conducted as a single blind study in which the subjects randomly consumed either pre-workout supplement (18 cc = 1 scoop) or a placebo (sugar free punch;  $\frac{1}{2}$  tbsp. cherry flavor; 1tbsp. tropical punch flavor ) for one of two, one hour sessions occurring one week apart. Thirty minutes after ingesting the supplement, peak anaerobic power output, average power output, and percent fatigue were measured using two 30 second protocol Wingate Tests per session. Blood was drawn at one and three minutes post exercise for lactate analysis. **RESULTS:** Subject's peak anaerobic power after ingestion of pre-workout supplement compared to the placebo were  $703.72 \pm 216.67$  W,  $674.17 \pm 188.70$  W respectively. Average power output remained about the same between both the supplement and placebo with no significant difference between the two ( $434.83 \pm 99.66$  W,  $434.39 \pm 88.70$  W). Percent fatigue was also similar between the supplement trial and placebo trial with no significant difference between the two ( $13.96 \pm 6.17$  W,  $13.22 \pm 5.87$  W). There was no significant difference in blood lactate levels after one minute ( $14.45 \pm 3.66$  mmo/L,  $14.71 \pm 3.63$  mmo/L) however, there was a significant difference in blood lactate levels 3 minutes post exercise ( $14.73 \pm 4.03$  mmo/L,  $12.70 \pm 3.47$  mmo/L) when given pre-workout compared to the placebo. **CONCLUSION:** The hypothesis that after ingesting pre-workout supplement, anaerobic power output would increase was not supported. Blood lactate levels after three minutes were significantly higher after taking the pre-workout supplement compared to the placebo which could correlate to the higher peak anaerobic output subject's demonstrated when given the pre-workout supplement.

### 4. COMPARISON OF EXERCISE MODALITY AT DIFFERING RATINGS OF PERCEIVED EXERTION ON ENERGY EXPENDITURE AND METABOLIC RESPONSES

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Sedentary behavior is prevalent in the population contributing to adverse health outcomes, thus it is important for individuals to engage in exercises they enjoy and which optimize their adherence to exercise recommendations. Knowledge regarding the metabolic response of differing exercise modalities can help users decide their best option. **PURPOSE:** The purpose of this study was to compare the oxygen cost, energy expenditure, and heart rate of treadmill running (TM), indoor rowing (R), burpees (B), and weighted sled pulls (S) at different exertion levels. **METHODS:** Twelve recreationally active males (Age  $20.7 \pm 1.8$  years, WT  $84.9 \pm 11.8$  kg, Body Comp  $18.9 \pm 4.3$  % fat,  $VO_{2peak}$   $55.7 \pm 4.5$  ml/kg/min) were recruited to participate in the study using a randomized, counterbalanced, crossover design, using a Latin-square. Participants first completed a  $VO_{2peak}$  test to determine maximal aerobic capacity followed by familiarization to each modality until participants were sufficiently familiar with the exercise. Each participant then performed three exercise work rates in succession for each modality with 72 hours between modalities. Work rates one and two consisted of 7 minutes at an RPE of 11 or 14 with 3 minutes of rest between. Final work rate commenced after 6 minutes of rest burning 130 calories as quickly as possible. Oxygen uptake, energy expenditure, and heart rate were measured. **RESULTS:** Steady state oxygen cost was achieved at RPE 11 and 14. At RPE 11, there was no significant difference of modality on average oxygen cost or energy expenditure but HR was significantly different. At RPE 14, there was no significant difference of modality on average oxygen cost, HR, or energy expenditure. Treadmill running was numerically the fastest to burn 130 calories and resulted in the highest oxygen cost and was significantly different than other modalities. Time: [TM 7min  $10.9s \pm 55.5s$ , R



7min 42.9s ± 44.6s, B 7min 31.3s ± 30.1s, S 8min 46.2s ± 55.2s ] Oxygen cost: [TM 3.82± 0.57 , R 3.45± 0.35 , B 3.50± 0.32, S 3.06 ± 0.28]. **CONCLUSION:** Exercise modalities in this study were equivocal at lower RPEs but deviate in metabolic cost at maximal intensities.

## 5. EFFECTS OF CONCENTRIC AND ECCENTRIC EXERCISE ON MUSCLE FATIGUE

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Several published studies show that the concentric phase of an exercise will cause greater fatigue, if performed alone, than the eccentric phase. **PURPOSE:** The purpose of this study was to determine which phase of a bicep curl induced fatigue more quickly. **METHODS:** Ten college students, ages 18-24, were recruited to perform the concentric and eccentric phases of a bicep curl, separately, at 50% of their one-repetition max, until fatigued. One-repetition maxes were determined for concentric and eccentric phases. **RESULTS:** The results showed that participants were able to complete more concentric repetitions before fatigue than eccentric repetitions. The average number of concentric repetitions completed before fatigue was 75.33 ± 44.19. The average number of eccentric repetitions completed before fatigue was 50.11 ± 28.07. A paired t-test revealed significant differences between the means (p<0.05). **CONCLUSION:** The hypothesis that participants would be able to complete more repetitions eccentrically before fatigue was not supported. As a whole, subjects were able to perform more repetitions concentrically than eccentrically.

## 6. FOOTSTRIKE AND FLEXIBILITY AMONG COLLEGIATE CROSS-COUNTRY RUNNERS

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**Introduction:** The purpose of this study was to examine difference in hip, knee, and ankle flexibility between cross-country athletes with forefoot and heel foot strike patterns. **Methods:** Participants for this study 9 cross-country runners, 6 male and 3 female, from a Division II private liberal arts university. Footstrike patterns were determined using in-shoe pressure analysis system in the insoles during a treadmill running protocol. The protocol consisted of four separate one-minute bouts of runs at four pre-determined speeds. Footstrike was determined based on which part the foot hit the ground first, the heel of the foot was a heel strike and if the balls of the feet hit first it was a fore footstrike. Flexibility was assessed using the sit-and-reach test for hamstring flexibility and goniometers measures of range of motion at the hip, knee, and ankle joints. Independent t-tests were conducted to determine differences in flexibility between those with forefoot strike and heel strike patterns. **Results:** Upon evaluation of the in-shoe pressure analysis system pressure data, two participants had forefoot strikes and seven had heel strikes. No significant differences in flexibility were observed between the two groups (p > .05). **Conclusion:** Our results indicate no difference in flexibility between forefoot strikers and heel striker among experience cross-country runners. This study is limited by the sample size and the number of participants with forefoot strike patterns. Further study of this topic is recommended with a larger sample size. It may also be beneficial to examine gender differences as our study revealed no females with a forefoot strike pattern.

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## 7. EFFECTS OF SIMULATED ALTITUDE TRAINING ON AEROBIC FITNESS

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A method that is used to facilitate improvements in an individual's aerobic fitness is altitude training. Most increases in aerobic fitness within altitude training are seen at 8,000 to 10,000 feet (Goods et al., 2014). The most recent device in altitude training is the Elevation Training Mask 2.0. **PURPOSE:** Therefore, the purpose of this study was to examine the extent to which an individual's aerobic fitness was increased while training with the Elevation Training Mask 2.0 compared to a control group training without a mask. **METHODS:** Nine female participants' (mean age = 21 years) ran a VO<sub>2Max</sub> test to measure their aerobic fitness baseline. Each participant was then randomized into either an experimental or control group. Both groups completed the same evidence-based

High Intensity Interval Training (HIIT) three days a week for four weeks. The experimental group wore the Elevation Training Mask 2.0 during HIIT, while the control group wore no breathing apparatus. The resistance upon the mask was increased from 3,000 feet to 6,000 feet during week three of training. After four weeks of training, the participants' aerobic fitness was again assessed using a  $VO_{2Max}$  test. One participant dropped out of the study due to musculoskeletal injury. The data was analyzed with paired t-tests and Cohen's d effect sizes were computed. **RESULTS:** There was no significant differences across the experimental and control group's relative change in  $VO_{2max}$  scores ( $t(6)=-0.05$ ,  $p<0.48$ ) with little to no effect ( $d=0.03$ ). Within the experimental group from pre to post  $VO_{2max}$  there was a moderate positive effect size ( $d=0.54$ ) but there was no statistical significance ( $t(8)=-0.86$ ,  $p<0$ ). **CONCLUSION:** The Elevation Training Mask 2.0 did not significantly increase the individual's aerobic fitness over the course of four weeks when compared to the control group at a 3,000 to 6,000 feet elevation setting. However, effect sizes indicated a moderate effect within the experimental group for increases in aerobic fitness. The Elevation Training Mask 2.0 shows promise for facilitating increases in aerobic training when used in conjunction with an evidence-based HIIT training protocol.

#### 8. TABATA INTERVAL VS. ELLIPTICAL INTERVAL TOTAL WORK AND RER

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Tabata interval training, a form of high intensity interval training (HIIT), has become increasingly popular in the past few years. Tabata targets the anaerobic endurance of individuals with a goal that short bursts of high intensity work will be beneficial. **PURPOSE:** The purpose of this study was to compare two different interval workouts, Tabata intervals and elliptical intervals, and determine which workout had a higher total work output and a higher overall anaerobic component. **METHODS:** Ten regularly active male students between the ages of 18 and 27 from the University of Central Missouri were recruited as subjects to perform two twenty minute interval workout sessions on two occasions separated by at least 3 days. Before beginning the workouts, the subjects performed a warm-up consisting of a ¼ mile jog and several dynamic stretches. The Tabata workout consisted of eight rounds of high-intensity exercises in a specific 20-seconds-on, 10-seconds-off interval work. The exercises performed were kettle bell swings, burpees, sprinting in place, split lunges, and lateral shuffling on a speed ladder. The elliptical interval workout was a preset computerized workout that was set on the 15<sup>th</sup> level of difficulty out of 20 with a rest level intensity of 3. Ventilatory gases were collected and analyzed to determine both total work and intensity. **RESULTS:** The results indicated that a tabata interval workout had a higher overall total work output ( $292.1 \pm 51.7$  kcals) than the elliptical interval workout ( $234.2 \pm 62.38$  kcals). RER of the ten subjects were also higher when they performed the tabata workout ( $0.99 \pm 0.06$ ) than they were during the elliptical workout ( $0.96 \pm 0.07$ ). **CONCLUSION:** The hypothesis that the tabata interval workout would have a higher total work output and higher mean RER value compared to the elliptical interval workout was supported.

#### 9. EFFECT OF ACUTE CITRULLINE – MALATE SUPPLEMENTATION'S ON MUSCULAR POWER

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Citrulline-malate (CM) is a nonessential amino acid that acts as a precursor to l-arginine in the nitric-oxide pathway and may increase exercise performance. While CM is shown to decrease fatigue and improve muscular endurance, there are no data evaluating the effects of CM regarding the effects on muscular power. **PURPOSE:** Therefore, the purpose of this investigation was to evaluate the effects of acute CM supplementation on muscular power in recreationally active females. **METHODS:** Fifteen females ( $20.6 \pm 0.8$  years) completed two randomized, double blind trials consuming either CM (8 g dextrose+8 g CM) or a placebo (8 g dextrose). One hour after supplement consumption, participants performed a protocol consisting of four exercises designed to assess muscular power. Tests included vertical jump, lower-body isokinetic exercise (ISO; 5 repetition and 50 repetition protocols), and a standard Wingate cycling test. **RESULTS:** Throughout the 5 repetition ISO, participants experienced significantly less fatigue ( $p=.02$ ), as well as substantially increasing work completed in the last third ( $p=.03$ ). The Wingate cycling test found subjects significantly increased average power ( $p=.03$ ), anaerobic capacity ( $p=.02$ ), and total work

completed ( $p=.02$ ). **CONCLUSION:** Acute CM supplementation in females increased power and total work while mitigating fatigue. These data indicate athletes may benefit from acutely supplementing CM if they are competing in sports where increases in max anaerobic capacity, power, or decreases in fatigue are beneficial.

#### 10. ACUTE EFFECTS OF PASSIVE STRETCHING ON THE ELECTROMECHANICAL DELAY AT SHORT AND LONG MUSCLE LENGTHS

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Electromechanical delay (EMD) is a measure of the time lag between the initial electrical stimulus and the onset of torque production. The EMD has been reported to increase following 20 mins of passive stretching (PS) of the plantarflexors at a 90° degree joint angle (neutral), which is believed to be the result of a decrease in muscle stiffness. However, it is unknown the influence that PS of the plantarflexors has on the EMD at short and long muscle lengths. **PURPOSE:** The purpose of this study was to examine the effects of 4 minutes of PS on the EMD at a short and long muscle length before (pre-) and after (post-) PS. **METHODS:** Thirteen healthy men (age =  $21.54 \pm 2.67$  yrs;) performed the EMD assessments before and after 8 passive stretches that lasted 30 seconds each for a total of 4 minutes of PS. To measure EMD (ms), a single electrical stimulus was applied to the tibial nerve. The resulting twitch torque was measured with the torque signal from the isokinetic dynamometer. An electromyographic (EMG) sensor was placed on the soleus to measure the M-wave from the electrical stimulus. The short muscle length was 20° plantarflexion (PF) from neutral, whereas, the long muscle length was 15° dorsiflexion (DF) from neutral. The difference in time from the start of the M-wave to the onset of torque production was calculated manually by an experienced investigator (LM) with a custom written LabVIEW (v 11) software program. For the statistical analysis, a 2-way repeated-measures ANOVA (time [pre-PS vs. post-PS] x muscle length [PF vs. DF]) was used to analyze possible differences in the EMD as a result of PS. **RESULTS:** There was no 2-way interaction ( $p = 0.089$ ) and no main effect for time ( $p = 0.239$ ), however, there was a main effect for length ( $p < 0.001$ ). The EMD for the long muscle length ( $6.64 \pm 0.94$  ms) was greater than the short muscle length ( $4.67 \pm 1.07$  ms). There were not significant differences in EMD pre- to post-PS. **CONCLUSION:** The lack of a significant increase in EMG following PS may be the result of a relatively short duration of PS (i.e., 20 vs 4 mins). In addition, the transmission of force at DF is an longer absolute distance than PF and, therefore, EMD duration was greater.

#### 11. AUTOPHAGY FOLLOWING MULTIPLE BOUTS OF HINDLIMB UNLOADING

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Muscular disuse affects an abundance of people with sedentary lifestyles and/or chronic diseases. Disuse has proven to cause severe muscular atrophy and disrupt mitochondrial quality. Autophagy is a cellular mechanism used to remove wasteful or damaged materials, mitophagy is the process of autophagically removing presumably damaged mitochondria. Beclin1 and Atg7 are machinery for autophagy, while Bnip3 specifically regulates mitophagy. Any dysregulation of autophagic processes may significantly impair cellular health following muscle disuse. **PURPOSE:** The purpose of this study was to investigate whether multiple bouts of muscle disuse (hindlimb unloading, HU) affect the expression of markers for autophagy. **METHODS:** Sprague-Dawley rats were subjected to chronic disuse atrophy by hindlimb unloading (28-d, 1HU) followed by ambulatory recovery (56-d) (1HU+REC). To mimic repeated bouts of disuse, the animals were subjected to a second bout of HU (28-d, 2HU) and then allowed ambulatory recovery (2HU+REC). Control (CON) animals were allowed normal cage activity throughout. Samples were analyzed for *Beclin1*, *Atg7*, and *Bnip3* mRNA content by real time RT-PCR. To verify if HU impacted autophagy markers pre-planned T-tests were performed comparing CON and 1HU. To test if multiple bouts of

disuse and reloading impacted regulators of autophagy, a one-way ANOVA across all groups was employed with  $\alpha$  set at  $p < 0.05$ . **RESULTS:** *Beclin1*, *Atg7*, and *Bnip3* mRNA contents were not different, 270% greater, and ~50% lower following 1HU compared to CON, respectively. Across all conditions, *Beclin1* was unchanged. *Atg7* was not different from CON in 1HU+REC, 2HU, and 2HU+REC groups. *Atg7* was ~30% of 1HU in 1HU+REC and 2HU groups. *Bnip3* showed no further differences among conditions. **CONCLUSION:** A single bout of HU enhanced the capacity for general autophagy, while diminishing the capacity for mitophagy. Recovery from repeated bouts of HU did not alter mRNA levels of autophagic markers relative to CON. These data show that autophagic markers are dysregulated with HU, and that animals adapted to multiple bouts of HU, which dampened the impact of subsequent HU on autophagic markers.

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## 12. THE ABILITY OF THE FUNCTIONAL MOVEMENT SCREENING TO PREDICT FUTURE SOFT TISSUE INJURIES IN COLLEGIATE FOOTBALL PLAYERS

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The Functional Movement Screen (FMS) was created in 1995 to gather information on movement patterns and use that knowledge to predict future injuries. The majority of past studies indicate an FMS score of  $\leq 14$  as an indicator of a higher chance for soft tissue injury. **PURPOSE:** Therefore, the purpose of this study was to assess the accuracy of pre-season FMS scores, obtained from collegiate football players, to predict in-season soft tissue injuries. **METHODS:** Division 1 FBS Football players ( $n=96$ ; Age= $20.4 \pm 2.6$  years) had their FMS scores ( $14.0 \pm 2.5$ ) immediately prior to and all injuries sustained ( $n=30$ ) during the 2014-2015 season recorded. **RESULTS:** Final results showed an overall FMS score of  $\leq 14$  as the cutoff for predicting an increased risk for potentially suffering an in-season soft tissue injury, as determined by a ROC Curve (Area = 0.54). Several subtests were significant in predicting injury location, hurdle step ( $p=.045$ ) and active straight leg raise asymmetry ( $p=.029$ ), and grade, hurdle step ( $p=.029$ ) and hurdle step asymmetry ( $p=.007$ ). **CONCLUSION:** While the ROC Curve produced a similar cut-off point for the total FMS score as past research, the area under the curve for this study was not strong. However, more favorably than total FMS score, a few subtests showed the potential ability to indicate different grades and locations of injuries. Nearly half the players who had a hurdle step asymmetry ( $n=12$ ) and half of whom scored a one in hurdle step ( $n=5$ ) had injuries that prevented football related activities for more than 3 weeks. The players who exhibited active straight leg raise asymmetry ( $n=14$ ) later experienced either a lower leg/ankle injury ( $n=3$ ) or an upper extremity injury ( $n=4$ ). In conclusion, the ROC Curve exhibited a weak area under the curve for accurately predicting a soft tissue injury risk cut off point for total FMS score. However, individual FMS subtests showed significance in potentially predicting future soft tissue injuries. It is important to note that since football is a collision based sport, unmeasurable confounding variables can significantly skew the ability of the FMS to accurately predict future soft tissue injury risk.

## 13. EFFECTS OF A HIGH PROTEIN, HIGH FIBER, OR HIGH SUGAR BREAKFAST ON SATIATION, LUNCHTIME CALORIC INTAKE, AND ACADEMIC METRICS IN PRE ADOLESCENTS

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It is known that the consistent daily ingestion of nutrients meeting recommendations are necessary for the growth and development of children with breakfast being reported as a key factor in overall diet quality. While the general recommendation to habitually consume breakfast is sound, the optimal macronutrient composition of this meal with regard to academic performance and satiety has yet to be fully elucidated, especially in children. **PURPOSE:** The purpose of this study was to investigate whether a calorie matched high protein, high sugar, or high fiber breakfast is effective for academic metrics (arithmetic, memory, focus) and/or satiety (satiation, hunger-fullness, lunchtime caloric intake, and total caloric intake) in children. **METHODS:** Twenty healthy preadolescents (age 5-11) volunteered for this study. After familiarization to testing protocol (sample academic tests, satiety story and instrument), children were split into the treatment groups using a randomized, counterbalanced design. Breakfast meals consisted of 320 calories by design (PROT [P 30g/F 6g/C 27g/Fib 3g] / FIB [P 11g/F 5g/C 59g/Fib 8g] / SUG

[P 8g/F 6g/C 59g/Fib 1g]). Data collection occurred at the same time of day on three separate occasions 1 week apart. After familiarization to the survey pre-trial, each participant completed a satiety survey preceding and following the breakfast treatment and at intervals throughout the morning and after ad libitum lunch. Participants completed tests to measure academic performance, memory, and focus immediately prior to the lunch meal.

**RESULTS:** Breakfasts were designed and pretested as described but during trials the actual average nutrient intake were as follows: PROT [P 19g/F 4g/C 24g/Fib 1g/224 Cal] / FIB [P 8g/F 3g/C 42g/Fib 5g/230 Cal] / SUG [P 6g/F 5g/C 51g/Fib .75g/275 Cal]. There were no significant main effects on academic tests or satiety surveys. Participants consumed PROT $610\pm 42$  /  $870\pm 248$ , FIB $613\pm 53$  /  $888\pm 273$ , and SUG $618\pm 48$  /  $943\pm 263$  calories at lunch and total. **CONCLUSION:** There was no effect of breakfast type on measured outcomes. However, some participants did not consume the treatment as designed resulting in high variability in individual macronutrient intake. The amount of familiarity to satiety scales was variable among individuals and may require additional time stabilizing in children.

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#### 14. THE EFFECTS OF PASSIVE STRETCHING PLUS VIBRATION ON VOLUNTARY INACTIVATION AND PEAK TORQUE OF THE PLANTAR FLEXORS AT A SHORT AND LONG MUSCLE LENGTH

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**PURPOSE:** Passive stretching (PS) has been reported to reduce peak torque (PT) due to increases in percent voluntary inactivation (%VI) and mechanical mechanisms. Conversely, prolonged vibration (VIB) solely reduces PT as a result of %VI. It remains unclear the influence PS may have on PT and %VI at short and long muscle lengths. Therefore, this study examined the effects of PS, in conjunction with VIB, on PT and %VI of the plantar flexors (PF) at a short and long muscle length. **METHODS:** 14 healthy men (Age =  $21.9 \pm 3.5$  yrs) volunteered for this study. Subjects completed 1 familiarization and 2 randomized visits (control [CON] and VIB). The CON visit consisted of 8, 30-s PS of the PF, whereas the VIB visit consisted of PS with VIB during the post-testing. VIB was applied to the Achilles tendon and 55 Hz 2-m before post-testing and continued during the remainder of testing. Subjects completed maximal voluntary contractions (MVC) of the right PF at an ankle joint of  $70^\circ$  plantarflexion (short muscle length [PF]) and  $105^\circ$  dorsiflexion (long muscle length, [DF]) in random order pre- and post-PS. During MVCs, an evoked doublet stimulus was applied to the tibial nerve to calculate %VI. PT was determined from a 0.25-s epoch during the MVC (Nm) prior to stimulation. Two separate 3-way ANOVAs (treatment [CON vs. VIB] x time [Pre vs. Post] x muscle length [PF vs. DF]) were used to examine differences in PT and %VI. **RESULTS:** For %VI, there were no significant 3- or 2-way interactions ( $p > 0.05$ ). There were significant main effects for time ( $p = 0.003$ ) and length ( $p = 0.007$ ). %VI was greater post- ( $10.2 \pm 9.7\%$ ) than pre-PS ( $5.5 \pm 5.5\%$ ) and at the DF ( $10.9 \pm 8.7\%$ ) than PF ( $4.8 \pm 7.7\%$ ). For PT, there was no 3-way interaction. There was a significant 2-way interaction (time x treatment;  $p = 0.008$ ). PT decreased pre- to post-CON ( $p = 0.016$ , pre =  $109.8 \pm 27.9$  Nm, post =  $101.7 \pm 28.0$  Nm) and -VIB ( $p < 0.001$ , pre =  $113.3 \pm 33.8$  Nm, post =  $92.8 \pm 31.9$  Nm). In addition, PT was greater at the DF ( $122.4 \pm 37.8$  Nm) than PF ( $86.4 \pm 20.9$  Nm). **CONCLUSION:** No further decreases in PT or increases %VI occurred with VIB following PS and, therefore, suggested that strength losses following PS is primarily neural. In addition, muscle activation deficiencies were present at the longer muscle length despite greater PT in comparison to the shorter muscle length.

#### 15. TO WEAR OR NOT TO WEAR: DO COMPRESSION PANTS AFFECT MUSCLE RECOVERY?

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**Purpose:** Published research is divided on the efficacy of compression pants for recovery post exercise. The purpose of this study was to examine if the use of compression pants affects muscle recovery. **Methods:** Six recreationally active participants (4 female, 2 male) were in this study. Subjects performed a Wingate test, 3 sets of 10 vertical

jumps, and 60 reps at 60% of their 1RM on a leg-extension machine. Following exercise, subjects wore either a Nike-brand compression pant (COMP) or loose-fitting shorts (NONCOMP) during the 60-minute recovery phase. Blood markers evaluated during the recovery phase were creatine kinase and lactate. The recovery phase consisted of: creatine kinase blood draws at 0 and 60 minutes; lactate finger pricks at 0, 15, 30, 45, and 60 minutes; and perceived muscle soreness ratings at 30 and 60 minutes. Subjects subjectively rated their muscle soreness on a scale of 1-10. Subjects returned to the lab at 24 and 48 hours post exercise for an additional blood draw and perceived muscle soreness assessment. Subjects completed this protocol a total of two times wearing both conditions. **Results:** Mean  $\pm$  SD values for creatine kinase at baseline-60 minutes for COMP versus NONCOMP ( $7.6 \pm 49.6$  vs.  $12.5 \pm 37.8$  U/L); at baseline-24 hours ( $60.3 \pm 236.4$  vs.  $16.6 \pm 44.5$  U/L); and, at baseline-48 hours ( $223.9 \pm 559.6$  vs.  $11.1 \pm 54.5$  U/L). Values for lactate at baseline-15 minutes ( $0.7 \pm 2.2$  vs.  $1.6 \pm 2.2$  MMOL/dl); at baseline-30 minutes ( $3.2 \pm 2.2$  vs.  $4.1 \pm 1.1$  MMOL/dl); at baseline-45 minutes ( $3.7 \pm 1.5$  vs.  $3.0 \pm 1.6$  MMOL/dl); and, at baseline-60 minutes ( $4.4 \pm 2.7$  vs.  $4.7 \pm 2.6$  MMOL/dl). Values for perceived muscle soreness at 30 minutes at 30 minutes ( $2.3 \pm 1.4$  vs.  $3.2 \pm 0.4$ ); at 60 minutes ( $2.2 \pm 1.4$  vs.  $3.0 \pm 0.6$ ); at 24 hours ( $1.7 \pm 2.0$  vs.  $1.3 \pm 0.6$ ); and, at 48 hours ( $1.0 \pm 0.0$  vs.  $1.1 \pm 0.2$ ). Paired t-tests for creatine kinase, lactate, and perceived muscle soreness showed no significant difference between the conditions. **Conclusion:** There were no benefits to wearing compression pants.

## 16. EFFECT OF FATIGUE INDEX CALCULATION METHOD ON THE QUANTIFICATION OF FATIGUE

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Repeated maximal effort isokinetic knee extension tests are common in exercise physiology research. However, not all researchers analyze torque data from the same range-of-motion (ROM). Furthermore, fatigue quantification methods of the torque data also differ between studies. The lack of consistent between-study measurement windows and analysis methods may lead to differing interpretations of the same data. **PURPOSE:** Determine if there is an effect of torque analysis method on the quantification of fatigue index (FI) during repeated maximal effort isokinetic knee extensions. **METHODS:** Nine healthy males and nine healthy females (age= $21.1 \pm 1.4$  y; height= $173.8 \pm 12.4$  cm; mass= $72.1 \pm 14.7$  kg) completed one bout of 50 repeated maximal effort concentric knee extensions at 180°/s with passive flexion on an isokinetic dynamometer. Position and torque were sampled at 10k Hz. Custom LabVIEW software was used to analyze data. Torque was defined as either peak torque (PT), torque at 135 degrees (T135), torque integral (TI) for the full ROM (TI<sub>F</sub>), TI for the middle ROM (TI<sub>M</sub>), or TI for isokinetic load range (TI<sub>L</sub>). FI was calculated using the following formula: [(start torque – end torque) / start torque]. Four types of FI were calculated using different starting and end torques, respectively: the average torque of repetitions (reps) 1-3 and 48-50 (F3), the average torque of reps 1-5 and 46-50 (F5), the highest three rep torque average and the average torque of reps 48-50 (P3), and the highest five rep torque average and the average torque of reps 46-50 (P5). A four (FI method) x five (torque variable) ANOVA was used. **RESULTS:** There was a significant interaction between FI method and torque variable. For all torque variables, P3 was greater than F3, F5, and P5. Collapsed across torque variables, the greatest difference was between P3 and F3 (~6%). For torque variables T135, TI<sub>M</sub> and TI<sub>L</sub>, F3 was equal to F5. For PT and TI<sub>F</sub>, F3 was equal to F5 and to P5. For T135 and TI<sub>F</sub>, P5 was greater than F3 and F5. For TI<sub>M</sub> and TI<sub>L</sub>, P5 was less than F3 and F5. For PT, P5 was greater than F5. **CONCLUSIONS:** Using the data from the same test, for all torque variables, the quantification of fatigue is affected by the repetitions chosen for analysis with the most noticeable effect being P3 suggesting greater fatigue than the other three FI's for all torque analysis methods.

## 17. EFFECT OF THORSTENSSON DATA COLLECTION WINDOW AND MUSCLE ON EMG MEDIAN POWER FREQUENCY SLOPE

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Repeated maximal effort isokinetic knee extension tests are commonly used to examine fatigue. Electromyographic (EMG) median power frequency (MPF) is thought to be related to peripheral fatigue. Multiple synergist muscles contribute to knee extension torque, and multiple range-of-motion (ROM) windows have been used to collect surface EMG data. MPF data taken from different ROM windows could alter the interpretation of magnitude of muscle-specific fatigue. **PURPOSE:** Quantify the EMG MPF slopes of three knee extensor muscles over three ROM windows commonly used in isokinetic tests. **METHODS:** Nine healthy males and nine healthy females (age=21.1±1.4 y; height=173.8±12.4 cm; mass=72.1±14.7 kg) performed 50 maximal effort concentric knee extensions at 180°/s, with passive flexion, on an isokinetic dynamometer. Custom LabVIEW software collected position and EMG data for each repetition at 10 Hz. For the vastus lateralis (VL), rectus femoris (RF), and vastus medialis (VM), normalized EMG MPF data were captured in 3 different ROM windows: full ROM (F), 120°-150° (M), and load range (L). Pearson correlations of normalized EMG MPF and repetition number were calculated for each muscle over each ROM window. Pearson correlation coefficient (r) values were analyzed via a two-way (3) muscle x (3) window ANOVA. Alpha was set at .05. **RESULTS:** There was no significant (p=.516) interaction between muscle and window. There was no significant (p=.577) main effect of window on EMG MPF slope across repetitions. There was a significant (p=.022) main effect of muscle, where normalized EMG MPF slopes for RF were more negative than VL (95% CI for difference: -.244 to -.103) and VM (95% CI for difference: -.212 to -.016). There was no significant (p=???) difference between VL and VM EMG MPF slopes (95% CI for difference: -.074 to .102). **CONCLUSION:** EMG MPF slope data suggests that, during a 50-repetition repeated maximal effort knee extension test, the RF muscle experiences more fatigue than the VL and VM muscles. Furthermore, when analyzing EMG MPF, ROM window does not affect the interpretation of MPF slope.

## 18. THE EFFECTS OF A HIGH-FAT DIET ON NEURONAL INFLAMMATION

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Diabetic neuropathy is a common complication of diabetes that reduces the quality of life for millions of Americans. Overweight humans with dyslipidemia develop neuropathy before developing overt diabetes. In addition, recent evidence indicates a high-fat diet induces signs of neuropathy in rodents and may contribute to the development of neuropathy in pre-diabetic and/or diabetic humans, but mechanisms underlying high-fat diet induced neuropathy have not been elucidated. **PURPOSE:** The overall aim was to identify neuronal inflammation as a potential mechanism underlying the pathogenesis of high-fat diet-induced neuropathy. These experiments tested the hypothesis that a HF diet induces neuronal inflammation. **METHODS:** Male C57Bl/6 mice were randomized to two groups and fed a standard (Std) or high-fat diet (HF) for 8 weeks. The lumbar dorsal root ganglia were harvested and inflammatory mediators (IL-1 $\alpha$ , IL-1 $\beta$ , IL-2, IL-3, IL-4, IL-5, IL-6, IL-10, IL-12p70, IL-17, MCP-1, IFN- $\gamma$ , TNF- $\gamma$ , MIP-1 $\alpha$ , GM-CSF, and RANTES) were analyzed using a Multiplex ELISA. Neuropathy was characterized using the von Frey test for hindpaw mechanical sensitivity at baseline and every other week thereafter. **RESULTS:** At the end of the 8 wk intervention, the HF fed mice had significantly higher bodyweight and fasting blood glucose levels. Hindpaw mechanical sensitivity was not significantly different between groups at any timepoint. However, hindpaw mechanical sensitivity trended toward an increase from baseline (56.3 ± 0.05%) to wk 8 (70.8 ± 0.06%) in HF (p = 0.055) compared to Std (baseline: 56.9 ± 0.05% ; wk 8 : 61.4 ± 0.07%). MCP-1 was significantly higher in HF compared to Std after the 8 wk intervention. There were no other significant differences in inflammatory mediators between the groups. **CONCLUSION:** Although hindpaw mechanical hypersensitivity is characteristic of HF feeding in mice, the mild increase in hindpaw mechanical sensitivity did not reach statistical significance in this cohort. The HF fed mice exhibited elevated MCP-1 levels compared to Std fed mice which is suggestive of diet-induced inflammation. MCP-1 is understood to play a crucial role in the recruitment of inflammatory mediators, which suggests diet-induced inflammation may play a role in establishing neuropathy.

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### 19. RATE OF PERFORMANCE INCREASE IN AMERICAN FEMALE WEIGHTLIFTERS OVER TEN YEARS OF COMPETITION

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There is little data on reasonable performance increases for female Weightlifters. **PURPOSE:** Evaluate rates of performance change for American female weightlifters over 10 years of competition. **METHODS:** Public domain data (<http://www.teamusa.org/USA-Weightlifting>) was delimited to athletes ( $N \geq 895$ ) having competed in Youth or Junior Nationals to ensure athletes were <21yrs old at the time of the first competition. Competition results were converted to strength to mass (SM) ratios to control for the effect of bodyweight on performance. Starting with the first competition date, the highest SM for the snatch (SNT), clean and jerk (CJ) and combined total (T), within six month windows over 10 years, were recorded. The observed percentage change in SM and Cohen's *d* effect size (ES) between each 6-month window, for the SNT, CJ and T was determined. Each athlete's data was only included in the current window's average if the preceding window contained data for comparison. **RESULTS:** Positive change in rate of performance peaked between windows one (baseline to 6mo) and two (7mo to 12mo) for the SNT (+8.7%, SM  $0.68 \pm 0.19$  to  $0.74 \pm 0.19$ , ES=0.34), CJ (+7.7%, SM  $0.90 \pm 0.24$  to  $0.97 \pm 0.24$ , ES=0.31) and T (+8.2%, SM  $1.57 \pm 0.41$  to  $1.71 \pm 0.42$  ES=0.34). Negative change in rate of performance peaked in the SNT between windows 17 (Year 8.0 to 8.5) and 18 (year 8.5 to 9.0) (-2.1%, SM  $1.17 \pm 0.19$  to  $1.15 \pm 0.20$ , ES=-1.12) and windows 18 (year 8.5 to 9.0) and 19 (year 9.0 to 9.5) for the CJ (-3.1%, SM  $1.45 \pm 0.26$  to  $1.41 \pm 0.31$ , ES=-0.15) and T (-2.45%, SM  $2.60 \pm 0.46$  to  $2.54 \pm 0.55$ , ES=-0.12). Total performance increase over 10 years for the SNT was 27.7% (Year 1 SM  $0.68 \pm 0.18$ , year 10 SM  $1.13 \pm 0.24$ , ES=0.96), the CJ 22.2% (Year 1 SM  $0.90 \pm 0.23$ , year 10 SM  $1.40 \pm 0.30$ , ES=0.84), and T 25.0% (Year 1 SM  $1.56 \pm 0.41$ , year 10 SM  $2.53 \pm 0.53$ , ES=0.91). **CONCLUSION:** The SNT was initially 75.4% of the CJ, and peaked in year 10 at 81.2%, highlighting increased technical demands of the SNT as compared to the CJ. This study quantifies the rate of performance change for American female Weightlifters over 10yrs of competition; useful for talent identification and program evaluation.

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### 20. AUTOPHAGY AND PHYSICAL ACTIVITY IN HEPATIC FUNCTION OF WESTERN DIET-INDUCED OBESITY

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Obesity is a known risk factor promoting the development fatty liver disease. In the United States, non-alcoholic Fatty Liver Disease (NAFLD) is key contributor for the dramatic rise in liver derangements. NAFLD is often the initial manifestation of liver malfunction, and can progress into further liver detriments such as steatosis, and cirrhosis. With no known pharmacological solution, further investigation has gone into selective autophagy due to its known effects on hepatic health and maintenance of cellular functioning. **Purpose:** The purpose of this study was to investigate regulation of autophagy in liver following Western Diet-induced obesity and 4 weeks voluntary physical activity. **Methods:** Forty C57BL/6J mice were divided into two groups and fed Western Diet (WD) or normal chow (NC) for 4 weeks; afterwards, the groups were further divided into voluntary wheel running (VWR) or sedentary (SED) conditions for an additional 4 weeks while on assigned diet. VWR animals were given a free moving running wheel. At 16 weeks of age, animals were euthanized and livers were collected and snap-frozen in liquid nitrogen. Livers were homogenized and analyzed for mRNA and protein content of autophagy markers. Data was analyzed via 2X2 ANOVA with a Tukey-Kramer post hoc adjustment,  $\alpha$  was set at 0.05. **Results:** mRNA of autophagy machinery *Beclin* was approximately 50% lower in WD-SED and WD-VWR compared to controls. *Bnip3*, a marker of mitochondrial specific autophagy, mRNA content was 75% lower in WD-SED compared to controls. BNIP3 protein content was 30% less in WD animals compared to NC animals. Basal autophagy flux was increased in VWR animals as measured by LC3II/I ratio and p62 protein content. Yet, WD animals exhibited lower total content of LC3, possibly suggesting a reduced autophagy capacity. **Conclusions:** Our data demonstrate



apparent reductions in autophagic capacity following WD-induced obesity. We are the first, however, to provide evidence of physical activity-induced enhanced autophagic flux. This study provides evidence for moderate physical activity promotion of autophagy flux in the liver, potentially helping to prevent liver derangements.

## Masters Student Poster Presentations

### 21. THE VALIDITY OF URINE COLOR SELF-ASSESSMENT AS AN INDEX OF HYDRATION IN MALES

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Urine color (UC) is a practical tool for hydration assessment. To date no study has found if the general population can accurately assess their UC. **PURPOSE:** Therefore, the purpose of this study was to examine the accuracy of self-assessed UC as an index of hydration in males. **METHODS:** Seventy six males ( $24 \pm 5$  y;  $83.9 \pm 16.0$  kg;  $1.79 \pm 0.76$  m) participated in the study. Participants were instructed to provide a single void into a specially constructed urinal which drained into a dark, plastic urine container. Participants were asked to compare their urine to an eight-point color scale. Hydration status was assessed by an experienced technician via urine osmolality (UOsm) and UC via the eight-point and two-point color scales. **RESULTS:** Mean UC was  $3 \pm 1$  and UOsm  $661 \pm 247$  mmol/kg. UC displayed a positive relationship as a predictor of UOsm ( $R^2 = 0.21$ ;  $P < 0.001$ ). The diagnostic ability of self-assessed urine color for hydration state was assessed via receiver operating curve. A cut-off point of  $< 800$  mmol/kg of urine osmolality was defined as hypohydration. UC had a poor overall diagnostic ability (area under the curve 65%), with excellent sensitivity (91%), and poor specificity (35%). Further threshold analysis indicated that the optimal self-assessed UC threshold for hypohydration was  $\geq 3$ . **CONCLUSION:** Even though self-assessed UC had “poor” overall diagnostic ability for assessing hydration, the diagnosis of hypohydration with a UC of  $\geq 3$  was excellent, but assessing euhydration was inaccurate.

### 22. THE PREVALENCE OF SPORTS-RELATED CONCUSSION IN INTRAMURAL AND CLUB ATHLETES AT THE COLLEGIATE LEVEL

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Sport-related concussions (SRC) are a serious brain injury that influences physical, cognitive, emotional, and social functioning, and may impair academic performance when undetected or clinically mismanaged. To date, the majority of concussion research has exclusively focused on varsity university athletes, which is a small representation of the overall university student body compared to intramural and club sport participants. It is unknown how many SRC occur at the intramural level, however, it has been estimated to be significantly higher than the approximately 5% at the varsity intercollegiate level. The lack of research is problematic because it puts a large, understudied population at risk for increased physical, cognitive and academic difficulties following SRC. **PURPOSE:** This study investigates the instances of mild traumatic brain injury in collegiate intramural athletes as well as accessibility to medical care and knowledge of the injury. **METHODS** A total of 655 male and female collegiate aged intramural and club sport athletes at four southern universities completed a survey that assessed demographic information, previous concussion history, concussion knowledge, and barriers to seeking medical care for concussion. Descriptive statistics (e.g., means, standard deviations, percentages) were used to describe demographics, concussion history, concussion knowledge, and barriers to medical care among respondents. **RESULTS:** Approximately 6.4% of 655 athletes reported a medically diagnosed concussion during club sport or intramural sport participation. In addition, 64.2% of this group reported experiencing academic difficulties and 81.4% did not seek academic accommodations. 36.6% of athletes reported having his or her “bell rung” during a game or practice with 9.5% of this group experiencing academic difficulties. Of this group 57% had medical coverage at games. **CONCLUSIONS:** Intramural and club athletes are a large population that is often not taken into

consideration when researching SRC. However, these groups report a higher incidence of SRC than in varsity athletes (5.5%) and deserve to be part of the discussion.

### **23. BASELINE NORMATIVE DATA AND TEST-RETEST RELIABILITY OF THE VESTIBULAR/OCULAR MOTOR SCREENING (VOMS) ASSESSMENT FOR HIGH SCHOOL ATHLETES**

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Dizziness occurs in 50% of athletes with sport-related concussion (SRC) and is indicative of vestibular and oculomotor dysfunction. The Vestibular/Ocular-Motor Screening (VOMS) assessment is a brief, screening tool designed to detect vestibular and ocular motor impairment and symptoms following SRC. Currently there are no normative data for this measure and test-retest reliability has yet to be documented. **PURPOSE:** This study documented baseline (i.e., pre-season) performance and pre-season to postseason test-retest reliability for the VOMS in high school athletes. **METHODS:** A total of 468 HS athletes completed baseline VOMS testing and 58 of these athletes completed a second, postseason administration of the VOMS approximately 99 days apart. The VOMS is comprised of a series of vestibular (e.g., vestibular oculomotor reflex) and ocular motor components (e.g., saccadic eye movement, near point convergence distance). Symptom ratings for headache, dizziness, nausea, and foginess are recorded at the completion of each component. Descriptive statistics were used to document normative performance for the total sample and among males and females. The percentage of baseline scores above clinical cut-offs were tabulated for each component of the VOMS. Paired samples t-tests and Intra-class Correlation Coefficients (ICCs) were performed comparing preseason and postseason scores. **RESULTS:** Approximately 83% of baseline VOMS scores were below clinical cutoffs. There were no significant changes from pre- to postseason on any VOMS component scores ( $p \leq .001$ ) and ICCs ranged from .29 to .71. **CONCLUSION:** The VOMS has an acceptable false positive rate in high school athletes and the stability over the course of one high school season ranges from fair to good (.40-.75).

### **24. RATE PRESSURE PRODUCT RESPONSE TO UPPER VERSUS LOWER EXTREMITY EXERCISE**

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Movements emphasizing lower extremity involvement such as walking, running, and cycling have traditionally been used as the activity mode during physiological exercise testing. Limited previous research on upper extremity exercise utilized upper body cycle ergometry or a standard push-pull rowing movement. Few upper extremity studies reported rate-pressure product values. Rate Pressure Product (RPP) is a well validated index of myocardial oxygen consumption. **PURPOSE:** The purpose of this study was to compare RPP between primarily lower extremity exercise utilizing an upright cycle ergometer and primarily upper extremity exercise utilizing a double arm swing ski ergometer. **METHODS:** Rate Pressure Product was measured using an automated motion tolerant monitor validated for medical exercise testing. The study utilized one dependent variable (rate-pressure product) and four independent variables (exercise mode, exercise intensity, age group and gender). Twenty-one total participants (6 females age 20-30, 4 females age 50-60; 5 males age 20-30 and 6 males age 50-60) completed the exercise protocol. A repeated measures ANOVA was conducted to determine the effects of exercise mode, gender and age on RPP at identical absolute exercise workloads (25, 35, 45, 55, & 65 watts) during a single graded exercise test. **RESULTS:** Significant differences in RPP were found for exercise mode (lower body peak RPP =  $184.2 \pm 33$ , upper body peak =  $255 \pm 33.6$ ), but not for gender or group. Mean rate-pressure product increase for each workload was then compared using the Tukey LSD post hoc test. Rate-pressure product increase during each workload of upper extremity (RPP per stage =  $28.7 \pm 36.4$ ) was significantly greater than during the corresponding lower extremity workload (RPP per stage =  $15.2 \pm 28.9$ ). Rate Pressure Product was consistently higher for females vs. males and younger vs. older individuals, but the differences did not reach significance criteria in this study. **CONCLUSION:** These findings provide further evidence that higher RPP during upper extremity exercise is a

generalized response which occurs in response to isolated upper extremity exercise independent of the exact arm movement or specific muscle involvement. The findings also indicate greater hemodynamic response to upper extremity exercise may be independent of gender or age.

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## **25. FITNESS ADAPTATIONS AFTER SIX WEEKS OF MODERATE INTENSITY OR HIGH-INTENSITY EXERCISE TRAINING IN OLDER ADULTS.**

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High intensity training has regained popularity in recent years with the advent of new exercise programs. These types of programs are in contrast to the more traditional training programs recommended by many governing bodies. While some research has been conducted to examine the body composition and cardiovascular adaptations to these types of high intensity programs, few studies have examined the effects on muscular strength and endurance. **PURPOSE:** This study investigated the maximal strength, muscular endurance and cardiovascular endurance adaptations after six weeks of performing either traditionally structured exercise training or high intensity, constantly varied exercise training. **METHODS:** Two groups of 8 healthy, untrained older adults (40-72 yrs) volunteered for this study. After two familiarization sessions, initial assessments were conducted to determine maximal strength (Deadlift=DL), muscular endurance (Push-Up test = PU) and cardiovascular endurance (Queen's College Step Test=VO<sub>2</sub>max). The groups were then randomly assigned to either the traditional (moderate intensity) or non-traditional (high intensity) training group, in which they performed six weeks of exercise training (2 sessions/week). After six weeks, the same assessments were conducted again. **RESULTS:** Both groups noticed significant improvements in maximal strength, muscular endurance and cardiovascular endurance (Mean improvement for DL = 30.63 lbs.; mean improvement for PU = 12.38 reps; mean VO<sub>2</sub>max improvement = 4.35 ml/kg/min.). There were no significant differences in muscular strength, muscular endurance or cardiovascular endurance between the two groups. **CONCLUSIONS:** Healthy older adults are capable of performing high intensity exercise training, if administered properly. However, high intensity training did not result in greater strength or cardiovascular gains. Both moderate intensity and high intensity workouts can improve overall fitness levels in older adults. Thus, workout type is dependent upon the preference of the individual. High intensity training may appeal to populations that experience problems adhering to a workout regimen due to the variety and shorter duration of the workouts.

## **26. THE EFFECTS OF HIGH-VELOCITY RESISTANCE OR DUAL-TASK BALANCE TRAINING ON CONFIDENCE AND EXECUTIVE FUNCTION**

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Fear of falling may detrimentally impact balancing capabilities and physical activity participation in older adults. Impairment in cognitive resources from dual-tasking or a limited ability to produce quick postural reactions may further exacerbate falls risk. Strong evidence exists regarding the requirement of cognitive resources for balancing, but the impacts of high-velocity resistance training (HVR) and dual-task balance training (DTB) are not well understood. **PURPOSE:** The purpose of this study was to compare the effects of HVR and DTB on balance confidence and executive function. Participants were randomly assigned to a high-velocity (HV,  $n=5$ ), dual-task (DT,  $n=9$ ), or control (CG,  $n=8$ ) group. The HV performed five different lower extremity exercises at 40% 1RM. The DT performed cognitive and physical tasks simultaneously. Both groups trained twice a week for 30 minutes over 16 weeks. Executive function was assessed using the Trail-Making Test part B (TMT-B). The Activities Specific Balance Confidence Scale (ABC) evaluated balance confidence. Participants were assessed at pre-test and post-test. A repeated measures ANOVA was used to analyze data. **RESULTS:** No significant group x time interactions occurred on the TMT-B ( $F_{8, 21}=1.59, p=.23$ ) or ABC ( $F_{10, 21}=1.64, p=.20$ ). The HV group experienced a moderate change ( $d=0.38$ ) on the TMT-B from pre- to post-test. A large effect was observed for balance confidence ( $d=.82$ ) in the HV group. No moderate or large effects were observed in the CG. **CONCLUSIONS:** HVR may cause greater improvements in balance confidence and executive function than other

methods of physical activity. Future research should further investigate the impact that HVR has on cognitive resources and confidence levels.

#### **27. ARE NATIVE AMERICAN/ALASKA NATIVE/HAWAIIAN NATIVE STUDENTS GETTING ENOUGH PHYSICAL ACTIVITY?**

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Low levels of physical activity have been linked to an elevated risk of developing diseases related to sedentary lifestyles. For groups of Indigenous people in the United States, standard levels of recommended exercise are not always achieved. Inactivity and increased rates of type II diabetes continue to contribute to health problems among Indigenous populations in the United States. **PURPOSE:** The purpose of this study was to examine if Native American, Alaska Native, and Hawaiian Native students at the University of Central Oklahoma (UCO) were acquiring the recommended amount of weekly exercise based on the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) guidelines. **METHODS:** Data from the Spring 2014 American College Health Assessment II was analyzed in a cross tabulation model to examine the relationship between Native American (NA), Alaska Native (AN), Hawaiian Native (HN) students at UCO and their self-reported exercise habits. A sample size of 76 UCO students that identified their race as Native American, Alaska Native, and Hawaiian Native were used as subjects of study. Percentage figures were utilized to report the amount of physical activity reported by students that identified their race as Native American, Alaska Native, and Hawaiian Native. **RESULTS:** The cross tabulation model revealed that 70.3% of all NA/AN/HN students were not meeting the recommended 30 minutes of moderate intensity exercise, while only 29.8% were meeting the recommended 30 minutes of moderate intensity aerobic exercise. Among non-HA/AN/HN students, 78.9% were not meeting the moderate intensity aerobic exercise guidelines, while 21.2% did meet the guidelines. **CONCLUSION:** The findings in this research revealed that a majority of Native American, Alaska Native, or Hawaiian Native UCO students do not meet the recommended amount of exercise. While these rates are actually lower than average for other students, it still warrants further examination and targeted programming. The results of this study may be used as a catalyst to generate physical activity programs for these specific subpopulations of students who possess an elevated risk of developing diseases related to sedentary lifestyles and obesity, such as diabetes and cardiovascular disease.

#### **28. PGC-1 $\alpha$ 4 GENE EXPRESSION IS SUPPRESSED BY THE IL-6-ERK1/2 MAPK SIGNALING AXIS**

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Maintenance and promotion of skeletal muscle mass and function are critical for both daily living and exercise performance. Lost muscle mass and function are associated with reduced quality of life in many disease conditions. Recently, the peroxisome proliferator-activated receptor  $\gamma$  coactivator-1 $\alpha$ 4 (PGC-1 $\alpha$ 4) isoform has been shown to play a key role in the promotion of skeletal muscle mass; however its specific regulation under normal and stress (inflammatory) conditions is still unknown. **PURPOSE:** To elicit signaling mechanisms regulating the gene expression of *Pgc-1 $\alpha$ 4* during inflammation and particularly by IL-6. **METHODS:** Female C57BL/6J (WT) and C57BL/6J  $\times$  IL-6<sup>-/-</sup> (IL-6 KO) mice were euthanized and tibialis anterior muscles were excised, snap-frozen in liquid nitrogen and processed for gene expression analysis. To further determine the underlying mechanisms by which IL-6 governs PGC-1 $\alpha$ 4 expression, C2C12 myotubes were treated with recombinant IL-6 (50 ng/ml), recombinant TNF- $\alpha$  (20 ng/ml), Pyrrolidine dithiocarbamate (PDTC, 50  $\mu$ M) and PD098059 (20  $\mu$ M; MEK1/2 inhibitor preventing ERK1/2 activity). RNA was isolated from WT and IL-6 KO mice as well as C2C12 myotubes. RNA was analyzed by real time RT PCR for mRNA content analysis of *18S* and *Pgc-1 $\alpha$ 4*. Protein analysis was performed by immunoblot for P-STAT3, STAT3, P-ERK 1/2 and ERK 1/2 and normalized to Ponceau S. A student t-test or one way ANOVA was employed as appropriate with  $\alpha$  set at 0.05. **RESULTS:** *Pgc-1 $\alpha$ 4* mRNA content was 10-fold greater in IL-6 KO mice compared to WT. In C2C12 myotubes, IL-6 significantly repressed *Pgc-1 $\alpha$ 4* mRNA content by ~70% while TNF- $\alpha$  and PDTC treated cells were not different from control. In the following experiment, similar IL-6 repression of *Pgc-1 $\alpha$ 4* mRNA was abrogated when IL-6 was combined with ERK1/2

inhibition via MEK (PD098059 + IL6). There was a significant 40% increase in the P-STAT3/STAT3 ratio and the P-ERK/ ERK ratio with IL-6 treatment while inhibitors of STAT3 (PDTC) and ERK 1/2 (PD098059) significantly decreased these ratios by 30% and 50 %, respectively. **CONCLUSION:** PGC-1 $\alpha$ 4 expression is repressed by IL-6 through the ERK1/2 signaling axis. These findings may have significant impact in treatment to prevent and ameliorate muscle wasting conditions.

## **29. SARCOPENIC OBESITY ALTERS EXTRACELLULAR MATRIX GENE EXPRESSION IN MICE SKELETAL MUSCLE**

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Sarcopenic obesity is a metabolic syndrome where excessive adipose tissue and a decline of muscle mass leads to reduced mobility and is associated with an increased risk of disability. This is alarming in the United States because older adults are a rapidly growing obese population. In addition, sarcopenic obese individuals have chronic systemic low grade inflammation and decreased insulin sensitivity which negatively impacts signaling pathways that preserve muscle tissue. The extracellular matrix (ECM) in skeletal muscle is essential because it assists in stability and force transmission. Both sarcopenia and obesity are associated with increased fibrosis, however it is not known how these co-morbidities interact during sarcopenic obesity to affect ECM gene expression. **PURPOSE:** To determine if skeletal muscle ECM gene expression and its regulation is impaired in sarcopenic obese mice. **METHODS:** Twelve young (3-4 months old) male C57/BL6J mice and twelve aged (22-24 months old) male mice were randomly assigned a normal chow or a high-fat diet (HFD, 60% fat) after 4 weeks of age. The gastrocnemius was excised for further analysis. Gene expression of ECM and ECM related markers were determined by qPCR. Data were analyzed by two-way ANOVA and post hoc Fisher's LSD. **RESULTS:** There were significant interactions in collagen I, collagen III, fibronectin, and matrix metalloproteinase 2 (MMP-2) ( $p < 0.05$ ). There was a 9-fold increase in collagen I gene expression in young HFD mice compared to young lean mice ( $p < 0.05$ ). However, there was no differences in collagen I gene expression in aged HFD and aged lean mice. There was a 6-fold increase in collagen III gene expression in young HFD mice compared to young lean mice ( $p < 0.05$ ). However, there was a 73% reduction in collagen III in aged HFD mice compared to aged lean mice ( $p < 0.05$ ). There was a 2-fold increase in fibronectin gene expression in young HFD mice compared to young lean mice ( $p < 0.05$ ). However, there was no difference in fibronectin in aged HFD and aged lean mice ( $p < 0.05$ ). There was a 2-fold increase in MMP-2 gene expression in young HFD mice compared to young lean mice ( $p < 0.05$ ). However, there was a 45% reduction in MMP-2 in aged HFD mice compared to aged lean mice ( $p < 0.05$ ). There was a main effect of diet to decrease MMP-9 in obese mice ( $p < 0.05$ ). There were no differences in TGF- $\beta$ . **CONCLUSION:** Sarcopenic obesity altered gene expression of ECM proteins and proteases that are involved with ECM degradation. However, TGF- $\beta$ , a potent inducer of collagen synthesis was unchanged in age or diet. It appears that MMPs may be partially responsible for the changes involved with sarcopenic obese mice that will alter ECM gene expression.

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## **30. COMPARISON OF BENCH PRESS PEAK FORCE AT VARIOUS INTENSITIES BETWEEN THE TSUNAMI BARBELL AND AN OLYMPIC STANDARD BARBELL**

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Non-standard resistance training equipment (medicine balls, chains, resistance bands, etc.) have been used as methods of strength and power development for decades. One such new product, the Tsunami Barbell, claims to increase muscle activation and force production due to its ability to flex and bend during the lift. **PURPOSE:** To determine whether there is a difference in peak force production when performing a bench press with a flexible barbell versus an Olympic barbell. **METHODS:** 18 healthy male subjects volunteered to perform 5 sets of 1 repetition as fast and controlled as possible for both eccentric and concentric phases at loads of 40, 50, 60, 70, and 80% of their self-reported 1 RMs on the bench press. The bar was not allowed to contact the chest for any repetition. Testing order (Tsunami vs. Olympic bar) was randomized by subject on different testing days. Force was measured using a ceiling-mounted UniMeasure position transducer attached next to the hand placement on the bar, with the

bench placed on a uni-axial RoughDeck force plate. Data were collected via a BioPac data acquisition system. A 2x5 (bar x intensity) RMANOVA was performed to test for significant interactions ( $p \leq 0.05$ ). **RESULTS:** No main effect was found for bar type ( $p = 0.803$ ). No interaction was found between bar type and intensity ( $p = .383$ ). A main effect was found for intensity, indicating that peak force production at 40 and 50% 1RM was significantly different from all other loads. 60% 1RM was significantly different from other loads except for 70% 1RM ( $2321 \pm 27$  N vs.  $2363 \pm 80$  N,  $p = 0.138$ ). 70% 1RM was significantly different from all loads except for 60% and 80% 1RM ( $2363 \pm 80$  N vs.  $2388 \pm 79$  N,  $p = 0.197$ ). **CONCLUSION:** The results of this study suggest that there was no significant difference in peak force production between bars. The Tsunami Bar does not seem to be more effective at eliciting greater peak force production at specific loads as used in the present study. Further examination is needed to compare other characteristics of the resulting force-time curves.

### 31. THE EFFECTS OF WATCHING A VIDEO VS. WATCHING A STATIC IMAGE WHILE RUNNING

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Gyms and workout centers often have TV's mounted on the walls or built into the workout equipment in their facilities. This brings about a question as to whether or not watching a video vs. watching a static image could have an effect on performance. **PURPOSE:** The purpose of this study was to determine if watching a video or watching a static image while running on a treadmill would have an effect on performance. **METHODS:** A total of 8 volunteers were recruited to participate. The initial test consisted of performing a VO<sub>2</sub>max test while running on a treadmill (VO<sub>2</sub>max =  $45.6 \pm 7.3$  ml/kg/min). Participants then performed two tests running a treadmill while watching either a video or static image. On the subsequent testing days, participants ran at a speed which corresponded to their anaerobic threshold based on the VO<sub>2</sub>max test. These trials were 48-96hrs apart and incorporated watching either a video or a static image while running. The order of the video or static image was chosen at random and each participant performed the second trial using the other condition. **RESULTS:** Results showed that there was not a significant difference in heart rate between trials (video =  $178.8 \pm 9.8$  vs. photo =  $175.6 \pm 13.5$ ); however there was a difference in RPE (video =  $14.3 \pm 1.4$  vs. photo =  $15.4 \pm 2.1$ ). **CONCLUSION:** The results seem to indicate that viewing a video while running may be more enjoyable or reduce the perceived exertion when compared to viewing a static image.

### 32. EFFECT OF CAFFEINE ON RECOVERY FROM AN ENDURANCE CYCLING EVENT

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Muscle soreness is commonly experienced following prolonged endurance exercise, especially among recreational exercisers. Caffeine can improve endurance performance and reduce muscle pain during exercise. However, the effects of caffeine on recovery from a demanding exercise bout have not been elucidated. **PURPOSE:** The purpose of this study was to investigate the effects of caffeine supplementation on rating of perceived muscle soreness (RPMS) and total mood disturbance (TMD) following the completion of a 100-mile endurance cycling event. **METHODS:** Males ( $n=26$ ;  $53 \pm 10$  years old) and females ( $n=6$ ;  $46 \pm 11$  years old) who were participating in the Hotter'n Hell Hundred bicycle ride volunteered for this research study. Immediately following the ride 20 subjects, in a double-blinded randomized fashion, were provided with 3 mg/kg body mass caffeine; 12 subjects ingested identical looking placebo pills. Participants continued ingestion of their assigned pills for the next 3 mornings (i.e., ~800 hrs) and afternoons (i.e., ~1200 hrs), and abstained from all food/fluid sources of caffeine. Before the cycling event, and prior to each ingestion of pills, RPMS and TMD was assessed via questionnaires. Leg and overall RPMS were rated on a 1-to-6 scale where 1 was the absence of soreness and 6 was severe pain that limited movement. TMD was assessed using the Brunell University Mood Scale and is a combination of self-assessed fatigue, vigor, depression, confusion, anger, and tension. Differences between treatment groups over time were assessed with a

two-way repeated measures ANOVA. **RESULTS:** Changes over time in measures of TMD and RPMS were not dependent on treatment group (i.e., non-significant interaction;  $p > 0.050$ ). However, the caffeine group, independent of specific day, tended to have a lower morning RPMS in the legs [ $0.9 \pm 0.1$  vs  $0.5 \pm 0.2$  arbitrary units (AU) for placebo and caffeine, respectively;  $p = 0.084$ ] and overall ( $0.8 \pm 0.1$  vs  $0.4 \pm 0.2$  AU  $p = 0.071$ ). The same trend for the caffeine group to have lower RPMS in the legs was present in afternoon measures ( $1.0 \pm 0.2$  vs  $0.5 \pm 0.2$ , respectively;  $p = 0.070$ ). Afternoon RPMS was lower overall in the caffeine group (i.e., main effect of condition;  $0.8 \pm 0.1$  vs  $0.3 \pm 0.2$ ;  $p = 0.017$ ). There were no effects of condition on TMD ( $P > 0.050$ ) **CONCLUSION:** These data suggest caffeine may reduce perceived soreness following an endurance cycling event. Caffeine was beneficial when muscle soreness was assessed in the afternoon when caffeine levels were higher. Given there were some perceptual benefits to caffeine ingestion, it may be recommended that caffeine be utilized to aid in recovery from an endurance cycling event.

### 33. PHYSICAL ACTIVITY AND ACADEMIC PERFORMANCE OF COLLEGE STUDENTS

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**PURPOSE:** The purpose of this study was to examine physical activity levels and academic performance among college students. **METHODS:** The National College Health Assessment (NCHA) survey was administered to student volunteers enrolled in a general health education course in the Spring of 2014. Participants were asked to indicate the number of days in the past week they participated in moderate aerobic activity for at least 30 minutes, vigorous activity for at least 20 minutes, and strength training of 8-10 exercises for 8-12 repetitions. GPA was categorized as  $< 2.0$ ,  $2.0$  to  $3.0$  and  $3.0 < 4.0$ . **RESULTS:** Among students with a GPA  $< 2.0$  with 35.8% participated in 0 days of moderate activity, 39.7% that participated in 0 days of vigorous activity and 58.2% participated in 0 days of resistance training. Percentages of students reporting 0 days of activity were lower among students with a GPA of  $2.0$  to  $3.0$  (25.4%, 36.1%, and 42.7% respectively for moderate aerobic, vigorous aerobic, and strength training). Among students indicating a GPA  $> 3.0$ , 21.7% reported 0 days of participation in moderate aerobic activity, 36.5% reported 0 days of vigorous aerobic activity, and 43.9% reported 0 days of strength training. Among all GPA categories, the percentage of students indicating participation in physical activities decreased as the number of days increased with the lowest percentages reported for 7 days. **CONCLUSION:** Students with a GPA  $< 2.0$  were more likely to report 0 days of moderate aerobic, vigorous aerobic, and strength training than students with higher GPAs. The data also suggests that students with a higher GPA are more likely to be physically active with the strongest trend existing for moderate aerobic activity. These results, while preliminary, support the potential link between physical activity and academic performance. Future studies utilizing experimental design and gathering of objective physical activity and GPA data are recommended. These results, while preliminary, support the potential link between physical activity and academic performance. Future studies utilizing experimental design and gathering of objective physical activity and GPA data are recommended.

### 34. EFFECTS OF IBUPROFEN ON THE PASSIVE PROPERTIES OF MUSCULOTENDINOUS STIFFNESS IN THE PLANTAR FLEXOR MUSCLE GROUP

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Ibuprofen, a non-steroidal anti-inflammatory drug, is one of the most commonly used over the counter drugs. Ibuprofen has been shown increase skeletal muscle hypertrophy/strength while at the same time decreasing measures of delayed onset muscle soreness and inflammation. Ibuprofen has a number of effects on the properties of skeletal muscle, yet few studies have investigated changes musculetendinous stiffness (MTS) resulting from Ibuprofen ingestion. **PURPOSE:** Therefore, the purpose of this study was to investigate the effects of ibuprofen (IBU) intake on musculetendinous stiffness (MTS) in the plantar flexors. **METHODS:** 15 participants (age 18-30) completed the study (8 male; 7 female). Subjects visited the lab on two separate occasions. Each visit consisted of two maximum voluntary contractions (MVC) followed by three passive range of motion tests (ROM), on a Biodex System 3 Isokinetic Dynamometer. On the first visit, subjects were given either a placebo or maximum over the counter dose of ibuprofen (1200mg/day) to be ingested in three doses (400mg/dose). Ibuprofen was taken for three days. Multifactorial ANOVA's were used for all analyses; significance was set at  $p < .05$ . **RESULTS:** There were no significant treatment by time interactions for ROM, MTS, or Torque. No significant individual interactions for time or treatment existed for ROM, MTS, or Torque. There were no significant changes in MVC. **CONCLUSION:**

Ingesting maximal values of Ibuprofen for a 3-day period does not appear to impact MTS and related measures. Given chronic ingestion is commonly recommended by healthcare professionals for maladies from headache to muscle pain to menstrual cramps, it is recommended that future research investigate the impact of chronic ingestion at maximal and supra-maximal doses. With the propensity of tears in the Achilles tendon and other soft tissue in adults who chronically ingest ibuprofen, this research could provide pertinent information as to the mechanism of tendon matrix remodeling as well as a safe timeframe for consumption.

### **35. AN INVESTIGATION OF INJURY RATES AND PERCEPTIONS OF CONCUSSION IN YOUTH FOOTBALL**

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Youth athletes demonstrate longer recovery from concussion, which has led to increased media attention surrounding this injury. This has led to an increased awareness of concussion for parents of youth athletes that may result in an increase in knowledge, attitudes, and behaviors for concussion. This awareness may increase the incidence rate of concussion in youth. There are limited data on injury rates for concussion in youth, and additional work examining parent knowledge, attitudes and behaviors is needed. **PURPOSE:** To document injury rates for SRC in youth football and examine SRC knowledge, attitudes, and reporting behaviors for SRC in youth football parents and coaches. **METHODS:** One hundred ninety-two youth football athletes (5-13 years) and 170 youth football parents/legal guardians and coaches participated in this study. Athlete exposures (AEs) for SRC were gathered for all practices and games, and all parents/legal guardians and coaches completed a validated survey on SRC knowledge, attitudes, and reporting behaviors. Injury rates for SRC among practice and games were calculated and descriptive statistics were performed to describe current knowledge, attitudes, and reporting behaviors. **RESULTS:** Two concussions occurred during the season and a total of 3,573 AEs were recorded for practices and game yielding an overall injury rate of 0.56 SRC/1,000 AEs. Approximately 50% (81/161) of parents reported talking to their child about concussion and more than half 57% (96/163) of parents reported considering not allowing their child to play youth tackle football. **CONCLUSION:** Incidence rates for SRC in youth football players are lower than documented rates in high school and college athletes, however the majority of parents report considering not allowing their children to play football.

### **36. A COMPARISON OF SKINFOLDS TO DUAL ENERGY X-RAY ABSORPTIOMETRY FOR BODY COMPOSITION ANALYSIS IN DIVISION 1 COLLEGIATE BASKETBALL PLAYERS.**

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Body composition (BC) is a frequently assessed component of fitness in Division 1 collegiate athletes. Many different field methods are used to estimate BC but bioelectrical impedance analysis (BIA) or skinfolds (SKF) are typically utilized due to cost and ease of use.

**PURPOSE:** The purpose of this study was to determine the validity of the SKF method compared to dual-energy X-ray absorptiometry (DXA) for estimating percent body fat (%fat) in Division 1 collegiate basketball players.

**METHODS:** Participants' %fat was estimated using the SKF method at the three sites recommended by Jackson and Pollock for males (thigh, abdomen and chest) and females (thigh, suprailiac, and triceps) compared to DXA, which served as the criterion estimate. Participants were 13 female and 11 male Division 1 collegiate basketball players age 19 (1) yrs., height 1.83 (0.14) m., body mass 81.1 (13.9) kg, and BMI 24.4 (3.9) kg/m<sup>2</sup>.

**RESULTS:** The validity of the SKF %fat estimate was based on a comparison to the criterion value from the DXA by calculating the mean, SD, coefficient of determination (r<sup>2</sup>), and standard error of estimate (SEE) from linear regression analysis. To assess the average deviation of individual scores from the line of identity, total error (TE) was calculated for the SKF estimate. A paired sample t-test determined paired-wise differences between measurements using an alpha level of 0.05. The mean %fat results were as follows: SKF [17 (10) %] and DXA [20 (11) %]. Significantly different means were observed for SKF (3%fat, p<0.001) when compared to DXA. The r<sup>2</sup>



value was .918; the SEE was 3.4 %fat; and total error (TE) value was 4.4 %fat. The results were similar when separated by sex.

**CONCLUSIONS:** In this study, the SKF estimate did not provide a valid estimate of body composition and underestimated %fat compared to the DXA estimate. Thus, the results suggest that SKF may not provide a valid estimate of %fat in Division 1 collegiate basketball players.

### **37. THE EFFECTS OF ULTRA MARATHON TRAIL RUNNING ON SALIVARY BIOMARKERS**

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Numerous people are affected by performance challenges brought on by race induced psychological and physiological stress. Understanding how 50 Kilometer ultra-marathon trail running (UMT) alters endocrine and inflammatory biomarkers is currently unknown. **PURPOSE:** The purpose of this study was to investigate changes in salivary  $\alpha$ -amylase, cortisol, and interleukin-1 $\beta$  (IL-1 $\beta$ ) concentrations following participation in UMT.

**METHODS:** Eighteen ultra-marathon racers (25-52 yr, average longest run 73.2 Km) participated in this study. Two-minute oral swabs were taken 10min prior to race start and again within 1min of race finish. Samples were analyzed using ELISA kits. **RESULTS:** Twelve racers completed the event (average finish time 6:57:26). Salivary cortisol increased by (73%) and  $\alpha$ -amylase by (148%), both exhibited significantly increased concentrations at the end of the event relative to baseline values. No significant differences were observed for IL-1 $\beta$ . **CONCLUSION:** Participation in UMT is associated with activation of the sympathoadrenal and hypothalamic-pituitary-adrenal (HPA) axes. IL-1 $\beta$ , an inflammatory maker, does not appear to increase but could be a result of the collection timing. Future research should investigate the time course for inflammatory markers following UMT. Understanding stress and improved interpretation of biomarkers could lead to improvements in training and performance of participants involved in UMT as well as occupational specialties within the military that commonly undertake physical tasks of this nature.

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### **38. A NOVEL METHOD FOR THE QUANTIFICATION OF PRESSURE FORCES DURING ADMINISTRATION OF INSTRUMENT-ASSISTED SOFT TISSUE MOBILIZATION**

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Instrument Assisted Soft Tissue Mobilization (IASTM) is a popular treatment technique to reduce pain, help improve functional range of motion and corresponding functional task completion. IASTM is widely used not only in sports medicine and physical therapy contexts but also in occupational therapy in an effort to expedite return to work. Irrespective of IASTM's popularity there are few controlled, clinical research studies that have demonstrated its efficacy and even fewer that have demonstrated the underlying mechanism of improvement. **PURPOSE** The purpose of this project was to develop novel tooling that will allow our laboratory to quantify and potentially control pressure administered during IASTM treatment. The other purpose of this project was to develop tooling and methodology to calibrate our tooling and test its validity. **METHODS** In order to capture the full range of pressure administered during an IASTM treatment a two-dimensional load cell with a dynamic range of 0-100 lbs was utilized (Omegadyne Inc, Ohio, USA). The load cell was attached to a steal handlebar that was machined at the University of Kansas by a bolt that was also machined in-house. Once the load cell was reversibly mounted to the handlebar the other end of the load cell was reversibly mounted to the IASTM tool using a custom machined instrument vice (Figure 1). Once our final product was built we calibrated and tested the reliability by mounting the handlebar in a vice and loading the leading edge of the IASTM tool with standardized brass weights (Figure 2). Voltage data were collected using a National Instruments Data Acquisition Unit (Texas, USA). **RESULTS** The three point calibration used to calibrate the tooling and convert voltage readings into Newton's of force yielded an  $R^2$  of (0.999). **CONCLUSION** Our results indicate that the tooling designed during this project is valid for quantifying pressure administered during an IASTM treatment. The development of this tooling will allow our laboratory and others to quantify pressure during future controlled research of IASTM.

### 39. EXERCISE-INDUCED MUSCLE DAMAGE AND THE REPEATED-BOUT EFFECT: ROLE OF THE RELATIONSHIP BETWEEN MOTOR-UNIT FIRING RATE AND RECRUITMENT THRESHOLD

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Unaccustomed eccentric exercise results in exercise-induced muscle damage. Following an acute bout of damaging exercise, an adaptation occurs which significantly attenuates the magnitude of muscle damage induced by future bouts of eccentric exercise. This phenomenon is termed the "repeated-bout effect (RBE)." There is evidence neural adaptations may underlie the RBE, however, the specific changes in motor-unit recruitment strategies remain unclear. **PURPOSE:** The primary aim of this study was to examine changes in motor-unit activation (mean firing rate, recruitment threshold, and their inter-relationship) of the biceps brachii 3 weeks following a bout of eccentric exercise. **METHODS:** Nine participants performed 5 sub-maximal isometric trapezoid (ramp-up, hold, ramp-down) contractions at force levels corresponding to 50, 80, and 100% maximal isometric strength (MVC). Surface EMG signals of the biceps brachii were collected and decomposed into individual motor-unit action potential trains. The relationship between mean firing rate (MFR) of each motor-unit and the percent of MVC at which it began firing (recruitment threshold; RT) was examined using linear regression. Participants then performed an exercise protocol consisting of eccentric dumbbell curls with a weight corresponding to 120% of concentric 1-RM until MVC had decreased by ~40%. Indirect markers of muscle damage [MVC, range-of-motion (ROM), and delayed onset muscle soreness (DOMS)] were measured 24-hours, 72-hours, and 1-week following eccentric exercise. Three weeks later all procedures were repeated. **RESULTS:** A RBE was observed with a second bout of eccentric exercise resulting in smaller reductions in MVC ( $-32\pm 14\%$  vs  $-25\pm 10\%$ ;  $p=0.034$ ) and ROM ( $-11\%$  vs  $6\%$ ;  $p=0.01$ ), and reduced soreness ( $31.0\pm 19\text{mm}$  vs  $19\pm 12\text{mm}$ ;  $p=0.015$ ) compared to the initial bout of eccentric exercise. When compared to the initial assessment, a decrease in the slope ( $-0.60\pm 0.13$  vs  $-0.70\pm 0.18$ ;  $p=0.029$ ) and increase in the  $y$ -intercept ( $46.5\pm 8.3$  vs  $53.3\pm 8.8$ ;  $p=0.020$ ) of the MFR vs. RT relationship during contractions at 80% of MVC prior to the second bout of eccentric exercise. No changes were observed at 50% or 100% of MVC. **CONCLUSION:** These findings indicate a long lasting shift in the relationship between MFR and RT of motor-units after the induction of muscle damage occurs concomitant with the RBE. The observed shift is consistent with preferential activation of slow-twitch motor-units which have been shown to be less susceptible to damage than fast-twitch fibers. These findings support the hypothesis that neural adaptations, at least partially, underlie the RBE.

### 40. THE RELATIONSHIP AMONG PHYSICAL ACTIVITY LEVEL, ACTIVITY TYPE, AND THERMAL PAIN SENSITIVITY

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Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Previous research has demonstrated a potential relationship between pain sensitivity and total daily physical activity. However, no study has examined whether the type of physical activity may also influence pain sensitivity. **PURPOSE:** The purpose of this study was to examine differences in thermal pain sensitivity among college-aged females who engage in different amounts and types of physically activity. **METHODS:** Participants ( $n=27$ ) were tested on two occasions. For the first visit participants went through informed consent, completed a menstrual history questionnaire, and were then familiarized with the protocol for pain sensitivity testing. Participants then wore an accelerometer at the waist for 7 days during waking hours (excluding water activity). The second visit was timed to occur during luteal phase of their menstrual cycle. Pain sensitivity was determined by having participants provide ratings of pain intensity (PI; 0-20) and ratings of pain unpleasantness (PU; 0-20) in response to brief (15-sec) applications of temperatures ranging from 43-49° C. Based upon their self-reported and measured activity levels and activity types participants were placed into the following groups: aerobically trained (AERO), resistance trained (RES), aerobic and resistance trained (A+R), and sedentary (SED). **RESULTS:** Total activity differed among the groups with the AERO ( $203\pm 83$  min) and A+R ( $183\pm 28$  min) groups accumulating more physical activity compared to the RES ( $39\pm 39$  min;  $p<0.05$ ) and SED ( $62\pm 32$  min;  $p<0.05$ ) groups. AERO ( $32\pm 13$  min) and A+R ( $34\pm 7$  min) also accumulated greater "vigorous" intensity activity than the RES ( $10\pm 4$  min;  $p<0.05$ ) and SED ( $12\pm 5$  min) groups. Mean ratings of PI across all temperatures did not differ among activity groups for ( $6.0\pm 3.2$ ,  $7.4\pm 2.9$ ,  $6.6\pm 3.5$ , and  $5.3\pm 3.3$  for AERO, RES, A+R, and SED, respectively;  $p=0.652$ ) nor did ratings of PU across all temperatures

(4.1±2.3, 4.6±2.5, 4.5±3.0, and 3.5±2.4 for AERO, RES, A+R, and SED, respectively; p=0.78). **CONCLUSIONS:** Unlike previous results in middle-aged and older women where higher activity was associated with lower pain sensitivity, our results suggest pain sensitivity does not differ among individuals with differing activity levels in college-aged females. Additionally, we demonstrated pain sensitivity also did not differ among differing types of physical activity.

#### **41. THE EFFECTS OF COACHING ON HEALTH BEHAVIORS POST COMPETITIVE ATHLETICS: PILOT STUDY**

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Athletic coaches have the ability to impact their players' lives beyond the time they spend mentoring them during training and competition. Of particular interest is the influence of the coach/athlete relationship on the health goals and motivation of the athlete after the completion of their athletic career. Goal contagion is the process by which individuals adopt and pursue goals implied by another person's behavior (Aarts, Gollwitzer, & Hassin, 2004). It has been studied most frequently in business settings related to money making and entrepreneurship and found to be most effective when individuals belong to the same collective group. Athletics teams are an ideal system for the evaluation of the transition of goal setting from leader (coach) to the subordinate (athlete) (Loersch, Aarts, Keith Payne, & Jefferis, 2008). To what extent do these interactions and lessons solidify over time and impact the athletes post competitive health practices? **PURPOSE:** To examine how the experiences of former competitive athletes with their coaches has influenced their current health behaviors, goals, and motivations. **METHODS:** Qualitative, semi-structured focus groups were conducted with former athletes. Responses were transcribed and coded for common themes. **RESULTS:** Through an initial analysis of data provided through focus groups, several themes have been found. The current analysis reveals themes including: life lessons, practice what you preach, and a focus on person over player. The most prevalent theme in our data of practice what you preach has become almost universal. Many participants have alluded to this concept as being a major focus in the facilitation of health behaviors and overall strength in coaching. **CONCLUSION:** Those identified as being "Good" coaches have many traits in common, as do those identified as "Bad" coaches. These commonalities can help to solidify the notion that coaches have the ability to facilitate lasting impacts on their player's health and health behaviors well after the athletes are finished competing. The idea of Goal Contagion has manifested as both motivating factors for health behaviors, as individuals have identified that some of the health related teachings, as well as the health behaviors modeled by coaches have stuck with them after competition.

#### **42. EFFECTS OF CARBOHYDRATE MOUTH RINSING ON DEPLETED-STATE WRESTLERS USING A YO-YO IR LEVEL 2 INTERMITTENT TEST**

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Recent literature has suggested that carbohydrate mouth rinsing may benefit endurance performances but produces less ergogenic effects in power sports such as hockey and sprinting. It has been suggested that the nutritional state and hydration status may affect the ergogenic ability of carbohydrate mouth rinsing on improving performance. A commonality among wrestlers in competition is reduced performance due to the glycogen and fluid depleted state resulting from the rigors of dietary restriction and dehydration required to make weight. **PURPOSE:** The purpose of this study was to compare the effects of carbohydrate mouth rinsing in wrestlers in a depleted-state performing YO-YO IR testing compared to an indistinguishable placebo condition. **METHODS:** Twelve male wrestlers (age 18-22) volunteered for this study which took place over four weeks with each collection period approximately 1 week apart. Participants initially completed a familiarization trial of the YO-YO IR test and one week later completed a self-selected, repeated weight cut within 2 lbs. of their weight category and baseline YO-YO IR test. Participants then completed two trials of mouth rinse or placebo using a randomized, double-blinded, counterbalanced design. After weigh-in, wrestlers mouth rinsed with an artificially sweetened 6.4% maltodextrin carbohydrate solution or indistinguishable placebo for 10 seconds (expectorating solution). After a standardized warm up, another mouth rinse was provided and YO-YO IR testing commenced. Final distances were recorded once test subjects were no longer able to complete the pacer run in the given time. **RESULTS:** There was no significant difference in distance covered between treatments (Placebo 1261.8 ± 424 / CHO 1221.8 ± 285 meters). There appears to be a learning/training effect as baseline distance (1127.3 ± 370) was significantly different from visit 4 (1276.4 ± 326)

independent of treatment condition ( $p < 0.05$ ). **CONCLUSION:** Carbohydrate mouth rinsing was not ergogenic compared to placebo in wrestlers making weight for a YOYO IR-2 test. However, there was a learning effect between baseline shuttle run verses last trial run. The YOYO IR in the depleted state might require more familiarization to see if distance covered balances out and has no effect.

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#### **43. EFFECTS OF UNILATERAL LOW-VELOCITY RESISTANCE TRAINING WITH BALLISTIC-INTENT ON MAXIMAL AND RAPID TORQUE DEVELOPMENT OF THE TRAINED AND UNTRAINED KNEE EXTENSORS**

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It has been suggested that regardless of contraction velocity, the intent to contract in a ballistic manner during resistance training (RT) is responsible for the training-related increase in rate of torque development (RTD). However, little evidence exists regarding the effects of low-velocity RT involving a ballistic-intent on RTD. Furthermore, it is unknown whether or not low-velocity RT performed with a ballistic-intent increases RTD of the contralateral limb during the early-phase (i.e.,  $\leq 4$  weeks) of training. **PURPOSE:** To examine the short-term maximal and rapid-strength adaptations of the trained and untrained knee extensors during 4 weeks of unilateral isokinetic RT performed with a ballistic intent. **METHODS:** Twenty-three healthy, college-aged males who had not performed RT within the past 6 months volunteered to participate in this study. A training group (TG;  $n = 14$ , age =  $22 \pm 1.89$  yrs., body mass =  $80.42 \pm 14.21$  kg) performed 3 sessions per week of unilateral isokinetic RT of the dominant leg for 4 weeks and 3 testing sessions. The control group (CG;  $n = 9$ , age =  $23 \pm 4.30$  yrs., body mass =  $88.71 \pm 17.61$  kg) only participated in the testing. RT sessions consisted of maximal concentric contractions of the knee extensors at  $45^\circ \cdot s^{-1}$  for 4 sets of 10 repetitions with 2-3 s of rest between repetitions and a 2 min rest between sets. During each RT session, subjects were instructed to "kick out as hard and fast as possible". Subjects performed two maximal voluntary isometric contractions (MVCs) of the knee extensors for the trained (TL) and untrained (UL) leg before (pre), at week 2 (mid), and after week 4 (post) of RT. Maximal strength (peak torque; PT) as well as RTD at its peak ( $RTD_{PK}$ ), at 30 ms ( $RTD_{0.30}$ ), and at 200 ms ( $RTD_{0.200}$ ) after the onset of contraction were recorded for subsequent analysis. Independent-samples t-tests were used to compare all dependent variables at pre for the TG and CG. One-way repeated measures ANOVAs were used to compare all dependent variables at pre, mid, and post for the TL and UL in the TG and CG. **RESULTS:** There were no differences between the TG and CG at pre ( $p > 0.05$ ). All dependent variables remained unchanged at mid and post for both legs in the CG ( $p > 0.05$ ). For the TG, there was a significant increase in PT from pre to post ( $p = 0.001$ ) and mid to post ( $p = 0.021$ ) for the TL, while no differences were found for the UL across time ( $p = 0.070$ ). All RTD measures remained unchanged for the TL and UL ( $p > 0.05$ ). **CONCLUSION:** The results of the present study revealed that short-term, low-velocity RT performed with a ballistic intent led to an increase in PT of the TL but not the UL. In addition, all RTD measures for the TL and UL remained unchanged during the 4 week training protocol.

#### **44. ACUTE TIME COURSE RECOVERY OF PEAK POWER AFTER A HYPERTROPHIC BOUT OF BACK SQUATS IN ANAEROBICALLY TRAINED FEMALES**

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Recovery is an important aspect of functional ability and athletic performance, specifically when activities require high levels of strength and/or power shortly after completing an acute resistance training protocol. Subsequently, previous authors have assessed prolonged (i.e.,  $>1 - 24$ hrs) recovery of vertical jump (VJ) height performance. However, examining the time-course response of peak power ( $P_{max}$ ) during a countermovement vertical jump (CVJ) assessment may provide a more valuable insight into acute post exercise recovery through functional movements. **PURPOSE:** The purpose of this study is to evaluate the effects of a hypertrophic bout of back squats on recovery of  $P_{max}$  measured by VJ performance. **METHODS:** Fourteen anaerobically trained ( $> 3$  days  $\cdot$  wk $^{-1}$  of free-weight

training  $5.8 \pm 3.8$  years) college-aged females (mean  $\pm$  SD: age =  $21.5 \pm 1.0$  years; height =  $166.2 \pm 7.8$  cm; mass =  $71.6 \pm 11.6$  kg) volunteered for participation. Participants reported on two occasions separated by  $7 \pm 4$  days. The first visit consisted of familiarization of testing procedures, and a one-repetition maximum (1-RM) of the back squat was determined. The second visit consisted of two CMJ before (Pre) a hypertrophic bout (5 x 8 at 80% 1RM) of free-weight back squats. Recovery was measured with two CMJs immediately after (Post0), 5 (Post5), 10 (Post10), 15 (Post15), and 20 (Post20) minutes following completion of the back squat exercise. To determine Pmax, a linear transducer was attached to the posterior portion of a belt secured around the participant's waistline. Participants began in an upright position with feet shoulder width apart and hands positioned on the hips. Upon verbal command, participants initiated a downward countermovement followed by a vertical movement as explosively as possible for all VJs. A one-way repeated measures ANOVA was used to analyze Pmax at all time intervals. **RESULTS:** Pmax was significantly lower at Post0 ( $P = 0.001$ ), Post5 ( $P = 0.028$ ), and Post20 ( $P = 0.006$ ) compared to Pre. However, no differences were observed for all other time points ( $P = .443-1.000$ ) (i.e., Post 10 and Post 15). **CONCLUSION:** The ability to produce maximal power after a hypertrophic squat protocol may be reduced  $\leq 10$  minutes following exercise with differential recovery patterns up to 20 minutes. These findings may be the result of muscular fatigue experienced from repeated high level contractions produced during the squat protocol. These findings may have important performance implications to the execution of explosive movements after completing fatiguing tasks. Therefore, future studies involving recovery in female populations are needed.

#### 45. EXAMINING MOTOR UNIT POTENTIATION OF THE VASTUS LATERALIS DURING AN ISOMETRIC TRAPEZOID MUSCLE ACTION AT 50% OF MAXIMAL VOLUNTARY CONTRACTION

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Analysis of motor unit action potential trains (MUAPT) during submaximal isometric trapezoid muscle actions in the first dorsal interosseous (FDI) and tibialis anterior (TA) muscles have indicated that motor unit (MU) firing rates are typically lower at derecruitment (DEREC) than at recruitment (REC). In addition, the MUs of these muscles tended to DEREC at higher forces than REC. This phenomenon is a result of increased MU twitch forces (potentiation). **PURPOSE:** The purpose of this study was to investigate potentiation in the VL. **METHODS:** Twenty-three healthy subjects (mean  $\pm$  SD: age =  $21 \pm 3$  yrs; height =  $174 \pm 10$  cm; mass =  $75 \pm 20$  kg) participated in this study. Each subject completed a 22-s isometric trapezoid contraction of the leg extensors at 50% maximal voluntary contraction with electromyographic (EMG) signals recorded from the VL. The EMG signals were decomposed into individual MUAPTs. For each MU, 4 parameters were extracted from the firing rate data: (1) the REC threshold (expressed as a percentage of MVC [%MVC]), (2) the DEREC threshold (%MVC), (3) firing rate at REC ( $FR_{REC}$ , pulses per second [pps]), and (4) firing rate at DEREC ( $FR_{DEREC}$ , pps). Linear regressions were performed on the DEREC vs. REC relationships and the difference between  $FR_{REC}$  and  $FR_{DEREC}$  ( $FR_{DEREC} - FR_{REC}$ , [ $\Delta FR$ ]) vs.  $FR_{REC}$  relationships for each subject. Slope, y-intercept, and  $r$  values were calculated for both relationships and each subject. **RESULTS:** For the DEREC vs. REC relationships, all relationships were significant ( $P < 0.05$ ,  $r = 0.57 - 0.99$ ) and the mean ( $\pm$  SD) slope and y-intercept were  $1.18 \pm 0.43$  DEREC/REC and  $-3.11 \pm 10.9$  DEREC, respectively. Thus, the lower threshold MUs were DEREC at lower forces than REC with the inverse being true for the highest threshold MUs. For the  $\Delta FR$  vs.  $FR_{REC}$  relationships, 15 of the 23 relationships were significant ( $R = 0.00 - -0.94$ ) and the mean ( $\pm$  SD) slope and y-intercept were  $-0.80 \pm 0.59$   $\Delta FR/FR_{REC}$  and  $7.67 \pm 6.11$   $\Delta FR$ , respectively. The majority of MUs decomposed in the present study had a positive  $\Delta FR$  with this effect being more pronounced in higher threshold MUs. **CONCLUSIONS:** In the present study, MUs were reported to have lower forces at DEREC than at REC and have slightly higher firing rates at DEREC than REC. Thus, potentiation was limited at DEREC for the VL unlike for the FDI and TA muscles.

#### 46. EFFECTS OF REST PERIOD DURATION ON MUSCLE ECHOGENICITY AND CROSS SECTIONAL AREA

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Numerous studies have shown that resistance training can improve muscle size and quality over time; yet, it remains unknown how these muscle variables are influenced by the manipulation of training variables, such as rest period duration (i.e. time interval allotted between sets). **PURPOSE:** To determine the effects of rest period duration on muscle echogenicity and muscle cross-sectional area (CSA) following an 8 week (3 session/wk) resistance training program. **METHODS:** Twenty-one, college-aged males volunteered for, and completed, this IRB-approved research study. The participants were randomly assigned to 1 of 2 groups [SHORT ( $n=11$ ); LONG ( $n=10$ )], before participating in 8 weeks of supervised, full-body, dynamic resistance training. All training variables were identical between groups (7 exercises, 3 sets, 10 reps, 10 RM load) with the only exception being rest period duration (SHORT = 1 min; LONG = 3 min). Before, and following, the resistance training program, ultrasound images were obtained from each participant's dominant rectus femoris (RF) and vastus lateralis (VL) muscles. Using NIH Image-J software, CSA ( $\text{cm}^2$ ) and echogenicity (mean gray-scale value; 0 – 255) were calculated by carefully selecting as much of the muscle as possible, while avoiding any outer fascia. **RESULTS:** Following training, no significant differences were observed between groups ( $p>.05$ ). However, with both groups collapsed ( $n=21$ ), significant improvements were seen for 3 of the 4 variables: CSA of the RF (+6.62%;  $p<.05$ ), CSA of the VL (+13.61%;  $p<.05$ ), and echogenicity of the VL (-7.73%;  $p<.05$ ). Echogenicity of the RF, however, was not significantly affected following training (-3.23%;  $p>.05$ ). **CONCLUSION:** Resistance training can increase muscle size and may positively affect echogenicity of the quadriceps muscles in college-aged males. However, our findings indicate that these adaptations were not specific to the rest period duration utilized. Therefore, it was concluded that the resistance training program described in this investigation can elicit positive muscular adaptations (size and quality) using either 1 or 3 minute rest periods.

#### **47. THE EFFECTS OF SMELLING SALTS ON BROAD JUMP AND VERTICAL LEAP**

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Stimulants, such as ammonia inhalants (smelling salts) are commonly used by athletes prior to competition, however their effectiveness is still in question. The purpose of this project was to determine if the use of smelling salts would impact vertical leap or broad jump performance. Twelve participants (age = 20.9 +/- 1.8yrs, height = 180.8 +/- 5.7cm, weight = 81.1 +/- 8.3kg) met on two different days. The first day consisted of anthropometric assessments and the 1-repetition max estimation for both bench press and back squat. Participants were expected to bench press at least their body weight (mean = 1.1 +/- 0.2) and back squat 1.5 times their body weight (1.5 +/- 0.3). At least 48hrs later individuals completed the jump/leap exercise testing. Prior to each jump the participant had to inhale 1 of 3 randomly chosen vials containing either smelling salts/ammonia inhalant (AI), Vick's® VapoRub® (VVR), or a control/no scent (CON). After a brief inhalation, they performed a maximal effort on both broad jump and vertical leap. The results showed no significant differences in vertical leap height or broad jump distances after inhaling the various substances. These results support previous research showing that smelling salts/ammonia inhalants have no impact on muscular power performance.

#### **48. EFFECTIVENESS OF A VENTILATORY TRAINING MASK ON AEROBIC CAPACITY IN RESERVE OFFICERS' TRAINING CORPS CADETS**

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Exercise training at altitude is a well-established and commonly used method for increasing aerobic performance with endurance athletes. Currently, the military requires personal to be deployed into high altitude situations without sufficient time to acclimatize. This can result in altitude sickness and a decrease in performance, which in turn increases the risk of injury during an assignment. To reduce the detriments in performance due to altitude, hypoxic training during physical training (PT) may be an option. An economical solution could be to implement a commercially available ventilatory training mask during their PT sessions. Such a mask essentially causes breathing to become more difficult while creating slightly hypoxic conditions, thus roughly simulating altitude. **PURPOSE:** The purpose of this study was to observe the effects on aerobic performance after using the ventilatory

training mask during PT for a 6 week period. **METHODS:** Nineteen ROTC cadets (age  $19.47 \pm 1.22$  y, weight  $73.2 \pm 9.94$  kg, height  $174.79 \pm 6.5$  cm, body fat  $7.85 \pm 2.9\%$ ) from a Midwest university completed pre- and post-assessments consisting of anthropometry and a maximal aerobic capacity treadmill ergometer test. Participants underwent a six week intervention training program consisting of their ROTC mandatory PT sessions. The experimental (MASK;  $n = 9$ ) and control (CON;  $n = 8$ ) groups were randomly divided based on  $VO_{2max}$  to create two groups of similar fitness. Ventilatory training masks were set to simulate an altitude of 2750 m. **RESULTS** There was no significant difference main effect between groups after the intervention period on  $VO_{2max}$  nor Time to Exhaustion (TE),  $VO_{2max}$  scores,  $F(1,15) = .598, p = .451$ , TE,  $F(1,15) = .327, p = .576$  based on a repeated measures ANOVA. Although statistical significance was not reached for either group, mean  $VO_{2max}$  for the MASK group displayed a slight increase of 1.81% and the mean  $VO_{2max}$  CON group exhibited a marginally greater increase of 5.57%. **CONCLUSION:** The results of the current study demonstrated that the ventilatory training masks did not yield any greater aerobic performances in ROTC cadets. We recommend further research to be conducted using other more established forms of altitude training to benefit future military operations.

#### 49. Acute Effects of Vibration on Recruitment Threshold versus Peak Firing Rate Relationship during an Isometric Contraction

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**PURPOSE:** This study examined the acute effects of vibration (VIB) on motor unit (MU) behavior of the vastus lateralis (VL) during 40% maximal voluntary contraction (MVC). **METHODS:** Five males (age =  $22.0 \pm 2.4$  yrs) and three women (age =  $20.7 \pm 3.1$  yrs) volunteered for this study. An electromyographic (EMG) sensor was placed over the VL. Participants performed 3 isometric MVCs followed by isometric trapezoid muscle actions at 40% MVC (CON). Procedures were performed twice separated by 3-5 days. VIB was then applied at 55 Hz. to the patella tendon for 10 min. prior to testing and continued throughout the remainder of testing, including a 40% MVC (VIB) at the same absolute force as the 40% CON. Decomposition techniques were applied to the EMG signals to extract action potentials and firing events of single MU. Only MUs decomposed with accuracies >92% were included for analysis. Linear regressions were performed on the MU recruitment threshold (REC) vs. peak firing rate (PFR) relationships during the first, middle, and final sec of the steady force segment for each subject. Slopes and y-intercepts were calculated for each subject and time point. Two separate 2-way repeated measures ANOVAs (treatment [CON vs. VIB] x time [first vs. middle vs. final sec]) were used to examine possible differences among y-intercepts and slopes. When appropriate, follow-up analyses for the ANOVA models were performed using paired samples *t*-test with Bonferroni corrections. The level of significance was set at  $P \leq 0.05$ . **RESULTS:** The analyses for the y-intercepts indicated that there was no 2-way interaction ( $P = 0.681$ ) and no main effect for time ( $P = 0.803$ ), however, there was a main effect for treatment ( $P = 0.047$ ). The y-intercepts were greater for the VIB ( $29.49 \pm 1.74$  pps) than CON ( $26.49 \pm 1.83$  pps). The analyses for the slopes indicated no 2-way interaction ( $P = 0.684$ ) or main effects for time ( $P = 0.729$ ) and treatment ( $P = 0.055$ ). **CONCLUSION:** The firing rates of the motoneuron pool were greater during VIB than the CON at the same absolute force. Thus, supporting the hypothesis that muscle spindles provide inhibitory effects on MU firing rates. When Ia afferent feedback from muscle spindles is removed the firing rates of the motoneuron pool increase. In addition, there was no time-dependent alterations in the REC vs. PFR relationships as function of VIB.

#### 50. RESTING MAPK EXPRESSION REMAINS STABLE AFTER 1-WEEK CESSATION OF RESISTANCE EXERCISE TRAINING.

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Mitogen-activated protein kinases (MAPK) modulate the hypertrophic, apoptotic, and metabolic resistance exercise (RE) adaptations of muscle tissue. Several studies have described the acute MAPK response to RE, yet few have reported their expression following RE used during maintenance training. Furthermore, there is a paucity of research concerning MAPK following the cessation of RE training. **PURPOSE:** The purpose of this study was to describe MAPK expression after short-term "maintenance" RE, and after the complete cessation of training. **METHODS:**

Male subjects (n=6; age: 24.2±4.6yrs; body mass: 76.6±8.4kg, bodyfat: 10.1±6.7%) performed three weeks of RE training. Subjects participated in preparatory training the first two weeks (wk 1+2) and performed 3 sets of 5 repetitions of barbell back squats at 70% 1-RM load for all training sessions two times per week. After two weeks, subjects performed two sessions of “maintenance training” during week 3, which utilized the same training load and scheme as the preparatory period. Following the maintenance period, subjects ceased all training for one week (wk 4). Resting muscle biopsies were collected at the end of preparatory training (T1), the end of maintenance training (T2), and one week after the complete cessation of training (T3). Biopsy samples were analyzed for total and ratio (pMAPK/totalMAPK) of extracellular signal-regulated kinase (ERK), c-Jun NH<sub>2</sub>-terminal kinase (JNK), and p38 via western blotting. Non-parametric Freidman’s test determined differences in MAPK expression between T1, T2, and T3. Cohen’s *d* effect sizes were calculated anchoring on T1. Significance was set at  $p \leq 0.05$ . **RESULTS:** There were no significant differences in total- or pMAPK/totalMAPK for ERK1/2, JNK, or p38 among any timepoint ( $p \geq 0.05$ ). There were large and moderate effect sizes for total- and pJNK/totalJNK respectively. Resting total JNK displayed a large effect size at T2 (68% increase;  $d=0.8$ ). Resting pJNK/totalJNK displayed a moderate effect size at T3 (27% decrease;  $d=0.5$ ). **CONCLUSION:** Expression of most MAPK (i.e. ERK and p38) remain stable following short-term maintenance RE. Furthermore, total and pJNK/totalJNK may differentially alter their resting expression depending on the phase and training stresses (or lack thereof) placed on muscle tissue. Funding provided by Nutricia.

#### **51. THE EFFECTS OF A HIGH-FAT DIET AND EXERCISE ON THE PGC-1 $\alpha$ -FNDC5/IRISIN PATHWAY IN C57BL/6 MICE**

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Recent research has identified irisin as a novel protein that stimulates the “browning” of white adipose by inducing thermogenesis in white adipose via increased uncoupling protein 1 (UCP1) levels. Exercise, in a peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1 $\alpha$ ) dependent manner, increases the release of the irisin precursor, fibronectin type III domain-containing protein 5 (FNDC5), from muscle. Irisin holds potential as a novel pharmacotherapeutic that could be used in the treatment of obesity. Prior studies have assessed the effects of exercise on irisin and proteins upstream and downstream of its activation, but the effects of diet on irisin have not been investigated. **PURPOSE:** The aim of this study was to evaluate the effects of diet and exercise on FNDC5 and associated proteins. **METHODS:** C57BL/6 mice were randomized into three groups for the 4 week intervention: Mice were fed a standard diet (Std), a high-fat diet (HF), or fed a high-fat diet and housed individually with free access to a running wheel (HFEX). At the end of the 4 week intervention, mice were sacrificed, tissues were harvested, and protein levels were measured in the gastrocnemius muscle using western blots. **RESULTS:** Body weight, fasting glucose and insulin, and homeostatic model of insulin resistance (HOMA-IR) were significantly higher in HF compared to Std and HFEX after the 4 week intervention. There was a trend ( $p = 0.09$ ) toward increased FNDC5 levels in HF compared to HFEX. UCP-1 levels were significantly lower in the HFEX compared to both Std and HF. There were no significant differences among groups in PGC-1 $\alpha$ . **CONCLUSION:** Although there were no statistically significant differences in FNDC5 levels, the trend toward increased FNDC5 in HF compared to HFEX suggests increased FNDC5 may be a compensatory mechanism to offset HF diet-induced weight gain by increasing energy expenditure. Exercise prevented excess weight gain and metabolic derangements in HF fed mice, but these effects do not appear to be mediated by increased FNDC5 levels. Further investigation, including assessment of FNDC5, PGC1- $\alpha$ , and UCP1 levels in adipose from these mice is needed to confirm the effects of HF feeding on the FNDC5/irisin pathway.

Funding provided by Southern Illinois University Edwardsville Seed Grants for Transitional and Exploratory Projects.

#### **52. A SOY-PROTEIN-BASED DIET DOES NOT ALTER SERUM MARKERS OF BONE FORMATION AND RESORPTION IN OVARECTOMIZED, LOW-FIT RATS**

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Osteoporosis and the associated increased risk of fracture are serious health concerns for postmenopausal women. In addition to a significant decline in estrogen post-menopause, decreased physical activity may further predispose women to osteoporosis. The soy isoflavones genistein and daidzein are phytoestrogens, and, therefore, might reduce the negative effects of estrogen loss on bone. Low-capacity runner (LCR) rats are selectively bred for intrinsically low aerobic fitness and might serve as an effective model of menopause, following ovariectomy. **Purpose:** Therefore, the purpose of this study was to examine the effects of a soy-protein-based diet or a corn-based-diet on serum bone markers of formation and resorption in ovariectomized, low-capacity runner (LCR) rats. **Methods:** LCR rats were either ovariectomized or sham operated and fed a soy-protein-based diet (600 ppm genistein+daidzein; SOY) or a corn-gluten-meal-based protein diet (<15 ppm genistein+daidzein; CORN) for 23 weeks. Bone formation (osteocalcin, OC; propeptide type I procollagen, PINP) and resorption (tartrate-resistant acid phosphatase, TRAP5b; C-terminal telopeptide of type I collagen, CTx) serum markers in LCR rats were measured following ovariectomy (OVX) or sham (SHAM) surgery at 28 weeks of age. **Results:** Final body weight was significantly increased by OVX vs. SHAM ( $p=0.002$ ), but not by diet. PINP, OC, TRAP5b, and CTx were measured in plasma using ELISAs. A two-factor (OVX, diet) ANOVA was used to test for significant main and interactive effects. There was a trend for OC and CTx to be higher and TRAP5b lower in OVX vs. SHAM (main effects:  $p=0.098$ ,  $p=0.083$ , and  $p=0.099$ , respectively). In OVX, PINP/CTx was significantly less than SHAM ( $p=0.003$ ). **Conclusion:** There were no effects of diet on serum bone markers. In conclusion, serum markers of bone formation and resorption are affected by OVX, but not by a soy-protein-based diet, in LCR rats.

### 53. EFFECTS OF AN EXPLOSIVE BACK SQUAT EXERCISE ON MAXIMAL POWER OUTPUT DURING VERTICAL JUMP ASSESSMENTS

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Previous researchers have examined the time-course effects of explosive resistance training protocols on maximal and rapid strength characteristics in anaerobically trained individuals. However, sport-related measures, such as the vertical jump (VJ), may be more practical and functionally-relevant in order to track performance recovery after an explosive exercise. **PURPOSE:** The purpose of this study was to investigate the effects of an explosive free-weight back squat protocol on maximal power ( $P_{max}$ ) in resistance-trained females using a commercially-designed linear transducer during VJs. **METHODS:** Thirteen resistance-trained ( $> 3$  days  $\cdot$   $wk^{-1}$  of free-weight training  $6.3 \pm 3.4$  years) college-aged females (mean  $\pm$  SD: age =  $21.6 \pm 0.9$  years, height =  $165.6 \pm 7.6$  cm, weight =  $72.0 \pm 12.1$  kg) volunteered to participate in this investigation. Participants visited the laboratory on two occasions separated by  $7 \pm 4$  days. The first visit consisted of familiarization to testing procedures, and a one-repetition maximum (1-RM) of the free-weight back squat exercise was determined. The second visit consisted of two countermovement VJs (CMJ) before (Pre), immediately after (Post0), five (Post5), ten (Post10), fifteen (Post15), and twenty (Post20) minutes following the completion of the explosive back squat protocol ( $5 \times 16$  at 40% 1-RM). To determine  $P_{max}$ , a linear transducer was attached to the posterior portion of a belt fastened around the participant's waistline. Participants were asked to perform a rapid downward countermovement and then jump up as explosively as possible for all CMJs, with feet shoulder width apart and hands positioned on the hips. A one-way repeated measures ANOVA was used to analyze  $P_{max}$  at all time points. **RESULTS:**  $P_{max}$  was significantly decreased at Post0 ( $P = 0.006$ ) and Post15 ( $P = 0.009$ ) compared to Pre. No significant differences ( $P = 0.061 - 0.071$ ) were observed at all other time points (i.e., Post 5, Post 10, and Post 20) compared to Pre. **CONCLUSION:** These findings suggest  $P_{max}$  may be significantly affected by explosive bouts of exercise for up to five minutes. The ability to produce maximal vertical power after an explosive squat protocol may be reduced for brief periods of time, with possible differential recovery up to 20 minutes. Although CMJs may be a functional measure for performance, inconsistent recovery patterns may be observed. The acute decrease in maximal power after explosive back squats may have important recovery implications for practitioners when developing and implementing resistance-training programs.

### 54. EFFICACY OF A VENTILATORY TRAINING MASK TO IMPROVE ANAEROBIC CAPACITY IN RESERVE OFFICERS' TRAINING CORPS CADETS

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Present day military operations often require personnel to be deployed into high altitude locations without a sufficient acclimatization period, which may require 1-3 weeks for sufficient physiological changes to occur. Any decrement to performance as a result of environmental factors such as altitude increases the risk of the mission. Therefore seeking both cost effective and time efficient methods for providing adequate physiological altitude adaptations is of great importance. Intermittent hypoxic training (IHT), follows the "live low-train high" philosophy. One potential method is performing physical training (PT) while wearing a commercially available ventilatory training mask, which increases the energy costs of breathing and provides a small level of hypoxia in an attempt to simulate training at altitude. **PURPOSE:** The purpose of this study was to examine the efficacy of a ventilatory training mask to improve anaerobic fitness in ROTC cadets. **METHODS:** Nineteen ROTC cadets (age  $19.47 \pm 1.22$  y, weight  $73.2 \pm 9.94$  kg, height  $174.79 \pm 6.5$  cm, body fat  $7.85 \pm 2.9\%$ ) from a Midwest university completed pre- and post-assessments consisting of anthropometry and a 30-sec Wingate Anaerobic Test (WAnT). A six week intervention training period was utilized during which time participants completed their mandatory physical training (PT) sessions. Participants were randomly assigned to either the experimental group (MASK;  $n = 9$ ), or the control group (CON;  $n = 8$ ). The ventilatory training masks were adjusted to simulate an altitude of 2750 m. **RESULTS:** There was no significant effect ( $p < .05$ ) between groups on fatigue index (FI), anaerobic capacity (AC), or peak power (PP). Based on the results from the paired samples *t*-test, there was a significant improvement in AC for the combined groups ( $p < .001$ ), while no significant difference was found for the combined group's FI ( $p = .724$ ) nor PP ( $p = .154$ ). **CONCLUSION:** These results suggest that the use of the ventilatory training mask during mandatory PT did not elicit superior anaerobic adaptations in ROTC cadets. Therefore, it is recommended that more established simulated altitude training methods be utilized when incorporating intermittent hypoxic training.

#### 55. THE ROLE OF RACE/ETHNICITY, DIETARY INTAKE AND MOVEMENT ON OBESITY IN CHILDREN ATTENDING OKLAHOMA CHILD-CARE CENTERS

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There are racial/ethnic differences in prevalence of overweight and obesity in 2-5 year old children. An important factor in early obesity development for all children includes unhealthy dietary patterns and movement behaviors. Child-care centers can be an intervention target for developing healthy patterns since 60% of young children spend substantial time in these facilities. **PURPOSE:** The purpose of this study is to examine the relationship of race/ethnicity, dietary intake and movement by Body Mass Index (BMI) percentile in children attending child-care centers. **METHODS:** An observational study at child-care centers was conducted between 2011-2014. BMI was calculated from measured height and weight and BMI percentile was calculated based on age and sex. Parental report of race included American Indian/Alaska Native (AI/AN), white and black. Dietary intake was determined from observed lunch food consumption and analyzed using dietary analysis software. Independent dietary variables used included sugars (g), total kcal and total fruits-and-vegetables consumed. Physical activity intensity and duration was measured for the entire school day using waist-worn accelerometers. Data was recorded in 15 second epochs and analyzed with age-specific cut points to determine intensity. Independent movement variables included minutes of sedentary, light and moderate-to-vigorous physical activity. **RESULTS:** Participants included 174 children, age  $3.8 \pm 0.7$ , 51% male, AI/AN 32%, white 46% and black 20%. AI/AN had the highest mean BMI percentile ( $72.2 \pm 25.8$ ) compared to white ( $62.9 \pm 27.8$ ,  $p = 0.02$ ) and black ( $65.2 \pm 27.8$ ,  $p = 0.05$ ). When a second race was included for AI/AN children of mixed heritage, AI/AN-only children ( $79.8 \pm 21.8$ ) had a higher BMI percentile compared to AI/AN-mixed children ( $61.8 \pm 27.3$ ,  $p < 0.05$ ). There were no significant differences found between race/ethnicities in movement behaviors. After adjusting for race, only higher kcal consumption ( $\beta = 0.039$ ,  $SE = 0.01$ ,  $p = 0.004$ ) was associated with higher BMI percentile. **CONCLUSION:** In support of previous research, AI/AN children had a higher mean BMI percentile than other races. This difference was further amplified when AI/AN-only children were examined; AI/AN-mixed BMI percentile was not different than white. Race/ethnicity may not be the driver of lunch dietary patterns at child-care centers since after adjusting for race, total kcal was still associated with BMI Percentile. Health and child-care providers should be aware of the differences in dietary intake and maximize the opportunity for health promotion in this sensitive environment with higher-risk populations.

## 56. EFFECTS OF A PHASE CHANGE COOLING DEVICE ON PERCEPTUAL MEASURES AND WORK PRODUCTIVITY WHILE WORKING IN THE HEAT

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Performing industrial work in a hot environment increases thermal discomfort and could decrease work productivity (WP). There is limited research on the effect of external phase change cooling (PCC) modalities in an industrial work setting. **PURPOSE:** Examine the effect of a PCC garment on perceptual responses and WP while performing industrial work in a hot environment. **METHODS:** Twenty male participants ( $24 \pm 3$  y,  $75.0 \pm 10.7$  kg,  $13.6 \pm 5.2\%$  body fat,  $1.93 \pm 0.17$  m<sup>2</sup> body surface area) completed two randomized trials in an environmental chamber ( $34.2 \pm 0.06^\circ\text{C}$ ,  $54.6 \pm 0.5\%$  relative humidity) wearing a compression shirt and shorts, a fire rated coverall suit, a hard hat, and gloves. PCC packs (8 total; solid to a liquid at  $10^\circ\text{C}$ ) were inserted in the front and back of the compression garments for our PCC trial, and no cooling packs for a control (CON) trial. Each trial included two identical 20min. periods of industrial work ( $W_1$ ,  $W_2$ ): five min. each of treadmill walking (3.0mph, 2% grade), lifting/carrying 11.3kg boxes, loosening and tightening nuts to bolts, and carrying 3.6kg dumbbells over steps followed by a five min. break. Participants then completed a 15 min. WP assessment (as many repetitions as possible in 15 min. of lifting and transporting five 11.3 kg. boxes, loosening and tightening six nuts to bolts, and carrying 3.6 kg. dumbbells over steps and back 5 times), three min. of standing recovery ( $R_3$ ), and seven min. of seated recovery ( $R_{10}$ ). Thermal sensation (0-8 scale; TS), thirst (1-9 scale; Th), and rating of perceived exertion (6-20 scale; RPE) were assessed pre and post  $W_1$ ,  $W_2$ , WP, and at  $R_3$  and  $R_{10}$ . Fatigue (1-7 scale; FS), and muscle pain (0-10 scale) were assessed post  $W_1$ ,  $W_2$ , and WP. Perceptual strain index (PS) was calculated post  $W_1$ ,  $W_2$ , and WP. **RESULTS:** TS was lower in PCC compared to CON pre WP ( $P=0.007$ ). Th was lower in PCC compared to CON post  $W_1$  ( $P=0.034$ ). Overall, Th was lower in PCC compared to CON WP and recovery ( $P=0.008$ ). RPE was lower in PCC compared to CON throughout ( $P \leq 0.05$ ). FS was lower in PCC compared to CON throughout trials ( $P=0.023$ ). PS was lower in PCC compared to CON throughout trials ( $P=0.002$ ). Participants completed  $5.59 \pm 1.07$  repetitions in CON and  $5.84 \pm 1.05$  repetitions in PCC ( $P=0.097$ ). **CONCLUSION:** Perceptual benefits for Th, RPE, FS, and PS were shown when using the cooling garment while WP was not increased. Wearing PCC garments improves subjective feelings and may enhance job satisfaction while working in a hot environment.

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## 57. The Relationship Between Performance Decrements and Peak EMG Amplitude Following Resistance Exercise Overreaching

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Training and sport specific performance decrements are the hallmark of overtraining and overreaching, however the physiological cause of these decrements are unclear. Fatigue studies have demonstrated the effects of resistance exercise on neuromuscular activity; however, few studies have examined the effects of overtraining or overreaching on neuromuscular parameters. **PURPOSE:** To analyze the relationship between overreaching induced changes in performance and neuromuscular activity. **METHODS:** Eight resistance-trained men ( $n = 8$ ;  $X \pm SD$ ; age =  $22.6 \pm 2.1$  yrs) were assigned to the overreaching group as part of a larger study evaluating the effects of a nutritional supplement on overreaching. Following two weeks of resistance training twice per week, subjects trained twice per day for 7.5 days, performing ten sets of five repetitions using 70% 1RM. Performance and neuromuscular measures were collected before (PRE) and after (POST) the 7.5 day overreaching period. Performance measured included peak and average force during a back squat performed at the training load, as well as back squat one-repetition maximum. Neuromuscular activity was assessed via peak sEMG amplitude in the vastus lateralis during a seated leg extension isometric contraction performed with the knee positioned at a  $90^\circ$  angle. Pearson product-moment correlation coefficients ( $r$ ) were calculated to evaluate the relationship between performance and neuromuscular changes induced by the overreaching period. **RESULTS:** The relationship between PRE to POST changes in sEMG peak amplitude and peak force were significant at the  $p = .05$  level ( $r = .804$ ). Analysis of the relationship between changes in sEMG peak amplitude and average force yielded an  $r$  value of .661, significant at the  $p = .10$  level. Similarly, the relationship between changes in the sEMG peak amplitude and 1RM was significant at the  $p = .10$  level ( $r = .627$ ). **CONCLUSION:** The results of this investigation suggest that overreaching induced performance

changes may, in part, be due to changes in neuromuscular activity. The observed changes in sEMG peak amplitude may be due to changes in motor unit recruitment or motor unit firing rates. Future investigations employing decomposition EMG (dEMG) may be able to further elucidate the effects of overreaching and overtraining on neuromuscular activity.

#### **58. COMPARISON OF POWER OUTPUT AND FATIGUE IN RECREATIONALLY ACTIVE AND MASTER ATHLETE FEMALES**

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When researching exercise performance females, especially older females, are an understudied cohort. With age there is a loss of muscular power and muscular fatigue occurs at a quicker rate than that of younger individuals. With masters athletes (MA) becoming an ever growing group of exercisers, it is important to compare whether MA can produce rates of power and fatigue similar to those in younger athletes and examine how age affects muscular power and rates of fatigue. **PURPOSE:** The purpose of this experiment was to examine the differences in peak power output (PPWR), average power (APWR), total work (WRK), and fatigue index (FI) between recreationally active (RA) younger adults and MA females. **METHODS:** Two groups, RA ( $n = 15$ ;  $20.6 \pm 0.8$  years) and MA ( $n = 17$ ;  $50.5 \pm 8.6$  years) volunteered to be participants in this study. PPWR, APWR, WRK, and FI were measured during a maximum cycling test in which the subjects completed the Wingate protocol. Subjects completed the 30 second protocol at a predetermined resistance of 7.5% body mass. **RESULTS:** PPWR ( $p = 0.92$ ; RA:  $654.1 \pm 114.5$  watts; MA:  $658.6 \pm 147.6$  W), APWR ( $p = .09$ ; RA:  $429.8 \pm 73.3$  W; MA:  $384 \pm 73.8$  watts), WRK ( $p = .09$ ; RA:  $12894.3 \pm 2198.3$  J; MA:  $18044.3 \pm 27184.9$  joules), and FI ( $p = 0.30$ ; RA:  $11.8 \pm 4.1$  W/s; MA:  $14 \pm 5.2$  W/s) were not significantly different when comparing the RA to the MA groups. **CONCLUSION:** By observing no significant differences between the RA and MA groups we determined that MA can produce similar power and total work when compared to RA. MA also experienced similar rates of fatigue as RA. This conveys that MA are comparable to RA in different parameters of performance. With similar power outputs and rates of fatigue, we can theorize that MA are comparable in all aspects of exercise performance as RA, and therefore, further research within the MA population needs to be performed.

#### **59. EFFECTS OF SELF-IMPLEMENTED CARBOHYDRATE CYCLING AND MODERATE TO HIGH INTENSITY RESISTANCE EXERCISE ON BODY FAT IN BODY BUILDERS: CASE STUDY.**

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Carbohydrate resources are limited during moderate- to high-intensity resistance exercises which limit performance (Wright, 1991). Increase in intake of carbohydrates prior to exercises have shown to enhance performance (Saunders, 2004). **PURPOSE:** The main purpose of the study is to investigate the effect of self-implemented carbohydrate cycling and resistance exercise on college athlete body builders. **METHODS:** Two body builders (males, 21[S1] and 22[S2] years old) athlete at a Division I University performed a baseline Dual Energy X-ray Absorptiometry (DXA) test prior to five-week self-implemented carbohydrate cycling program (CCP) along with high-intensity (60-90mins, 75-90%MHR) resistance (HRT) performed by S1 and moderate-intensity (30-45mins, 60-75%MHR) resistance training (MRT) performed by S2. After the 5-week of CCP and HRT/MRT, post-program DXA measurement was obtained. In effort to study the effects of CCP, body %fat (BF %) and bone mineral density (BMD) were analyzed. **RESULTS:** BF % was reduced by 14.5% (7.6 to 6.5) in S1 and 24.5% (14.7 to 11.1) in S2. There was not a significant change in BMD of S1 [0.68% (1.346 to 1.341)] and S2 [0.37% (1.318 to 1.309)]. **CONCLUSION:** Decrease in BF% among both the subjects can be primarily attributed to moderate- to high-intensity exercises. Although S2 performed MRT, higher decrease in BF% was recorded (24.5%) compared to S1 (14.5%). However, the baseline BF% of S1 was 7.6 which are lower than average BF% in athletes (9-15%) whereas baseline BF% for S2 was 14.7. BMD measured after 5-week program did not report significant changes. This can be because BMD takes longer than 5 weeks to change. These data suggests that short-duration moderate-intensity

exercise can be performed to reduce BF% at the initial training i.e. when baseline BF% is between 9-15%. Moreover, longer duration high-intensity exercise is needed to further reduce BF% in collegiate body builders.

#### 60. THE INFLUENCE OF TYPE I MYOSIN HEAVY CHAIN EXPRESSION ON MOTOR UNIT FIRING RATES OF THE VASTUS LATERALIS IN VIVO

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**PURPOSE:** Differences in motor unit (MU) behavior as a result of chronic training have previously been reported. It is hypothesized that MU behavior is regulated by the physical properties of a muscle rather than the central nervous system. Thus, it has been suggested that differences in MU firing rates between training statuses were likely due to differences in the physical properties of the MU, such as, percent myosin heavy chain [%MHC] expression. No study has correlated MU control strategies during a voluntary contraction with MHC expression *in vivo*. **METHODS:** Twelve individuals (age = 20.91 ± 2.30 yrs, weight = 70.76 ± 14.47 kg) volunteered for this investigation. Participants performed 3 isometric maximal voluntary contractions of the leg extensors on an isokinetic dynamometer followed by an isometric trapezoid muscle action at 40% MVC. An electromyographic (EMG) sensor was placed over the vastus lateralis (VL). EMG signals were decomposed to extract action potentials and firing events of single MUs. Only MUs with > 90% accuracies were used for further analysis. Recruitment (REC) thresholds and mean firing rates (MFR) were calculated for each MU. MFR was calculated as the average value of the MFR trajectory during steady force. Subjects gave a muscle biopsy of the VL. Type I %MHC expression was determined by SDS-PAGE. Linear regressions were performed to determine the slopes and y-intercepts of the MFR versus REC relationships. Pearson product-moment correlations were used to determine the relationship between type I %MHC expression with the slopes and y-intercepts. Alpha was set at 0.05. **RESULTS:** Pearson's product moment correlations were significant between the type I %MHC expression and the slopes (P = 0.001, r = 0.844) from the MFR versus REC relationships, but not the y-intercepts (P = 0.826, r = -0.071). **CONCLUSION:** Individuals with a greater percentage of type I %MHC expression had greater firing rates of the higher-threshold MUs at the targeted force level than individuals with a lower percentage of type I %MHC expression. It is plausible that the firing rates of the higher-threshold MUs are lower in individuals with greater percentages of type II MHC isoform content as a result of greater twitch forces. This study supported the hypothesis that the MU control scheme is regulated by the physical properties of the muscle.

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## Doctoral Student Poster Presentations

#### 61. PHYSIOLOGICAL EFFECTS OF A COOLING GARMENT DURING INDUSTRIAL-TYPE WORK IN THE HEAT

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Work in the heat elevates core temperature and increases physiological strain, more-so when wearing attire that limits convective and evaporative heat loss. Utilization of phase change cooling garments (CG) to attenuate the rise in core temperature may reduce physiological strain and protect against heat related illnesses. **PURPOSE:** To evaluate the physiological effects of using a phase change CG while conducting industrial-simulated work in the heat. **METHODS:** Twenty males (age 24.5±3.6 y, ht 1.79±8.04 m, body mass 75.0±10.7 kg, body fat 13.6±5.2%, body surface area 1.93±0.17m<sup>2</sup>) participated in two randomly assigned trials in an environmental chamber (34.2±0.05°C, 54.7±0.3% RH). Trials consisted of two 20 minute bouts of submaximal work (treadmill walking, lifting and moving 11.3 kg boxes, loosening and tightening nuts on bolts, carrying 3.6 kg dumbbells over steps) separated by five minute seated breaks. A final maximal effort performance bout (number of repetitions in 15 minutes of previous work without treadmill walking) was conducted, followed by a 10 minute recovery. Participant attire consisted of compression undergarments, coverall suit, gloves, and a hard-hat to mimic industry clothing. Phase change cooling inserts (10°C) were added to compression undergarment during the CG trial while control (CON) trial consisted of no inserts. Rectal temperature (T<sub>re</sub>), heart rate (HR), and skin temperature (T<sub>sk</sub>) were

recorded pre and post submaximal work bouts, immediately post performance, and at three and 10 minutes of recovery. Physiological strain index (PSI) and heat storage were also calculated. **RESULTS:**  $T_{re}$  was different at baseline (CON  $37.14 \pm 0.40^\circ\text{C}$ , CG  $36.99 \pm 0.48^\circ\text{C}$ ,  $P=0.03$ ) and at 3 minutes (CON  $38.78 \pm 0.38^\circ\text{C}$ , CG  $38.55 \pm 0.39^\circ\text{C}$ ,  $P=0.003$ ) and 10 minutes (CON  $38.72 \pm 0.37^\circ\text{C}$ , CG  $38.36 \pm 0.40^\circ\text{C}$ ,  $P<0.001$ ) of recovery from performance. HR was lower in the CG trial ( $P<0.05$ ) during mid-work bout 1, from pre-work bout 2 to post-work bout 2, and during performance and recovery (CON  $133 \pm 12$ , CG  $120 \pm 13$  bpm,  $P<0.001$ ).  $T_{sk}$  was reduced with CG from post-work bout 1 (CON  $36.3 \pm 0.6^\circ\text{C}$ , CG  $31.8 \pm 1.0^\circ\text{C}$ ,  $P<0.001$ ) through 10 minutes of recovery (CON  $36.9 \pm 0.6^\circ\text{C}$ , CG  $32.9 \pm 1.2^\circ\text{C}$ ,  $P<0.001$ ). PSI was greater during work-bout 2 in CON ( $4.54 \pm 1.77$ ) than CG ( $3.30 \pm 1.49$ ,  $P<0.001$ ) trials. Heat storage was reduced with CG ( $27.04 \pm 7.56 \text{ W} \cdot \text{m}^{-2}$ ) compared to CON ( $42.69 \pm 9.90 \text{ W} \cdot \text{m}^{-2}$ ,  $P<0.001$ ).

**CONCLUSION:** By attenuating thermal strain during submaximal work in the heat, utilization of the CG reduced the physiological demand during performance and improved recovery. The reduction in heat storage during work in the heat may increase safety and reduce the risk of heat-related illnesses.

Funding provided by PreventaMed Inc.

## 62. DEEP INSPIRATIONS ATTENUATE POSTPRANDIAL AIRWAY INFLAMMATION IN NON-ASTHMATIC ADULTS: A RANDOMIZED CROSSOVER STUDY

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**PURPOSE:** Exhaled nitric oxide increases after a single high-fat meal (HFM). However previous research suggests that exercise, causing repeated airway stretch due to high ventilation rates, can modify airway inflammation. Yet the research investigating the impact of physical activity on airway inflammation is conflicting and may depend on 1) airway stretch independent of whole body exercise, and 2) initial levels of airway inflammation. The purpose of this study was to investigate whether deep inspirations (DI's: airway stretch to total lung capacity) would attenuate airway inflammation post-HFM. A secondary purpose was to determine the effect of DI's on inflammation in a subgroup of subjects with high initial airway inflammation. **METHODS:** A randomized cross-over design with eighteen college-aged subjects was used (healthy eNO: 7F/7M; high eNO 3M/1F). Following an initial assessment, all subjects completed both a control (CON) and a deep inspiration (DI) condition. In both condition, subjects performed baseline testing after a 12-hour fast in the following order; airway impedance; standard pulmonary function tests (PFTs), exhaled nitric oxide (eNO). Following these tests, baseline blood lipids and glucose were assessed. Subjects then had 20 minutes to consume the HFM. In DI, subjects performed 60 DI's to total lung capacity (1 DI every 6 seconds) after fasting baseline testing, which were immediately followed by the HFM. The same experimental measurements at baseline were collected at 2 and 4 hours post-HFM in both conditions.

**RESULTS:** Blood lipids and glucose increased significantly in both conditions (CON,  $p<0.001$ ; DI,  $p=0.046$ ) with no significant difference between the healthy and high eNO subgroups ( $p>0.05$ ). Pulmonary function and airway impedance did not significantly change in either condition or between groups (healthy versus high eNO) ( $p>0.05$ ). There was a significant increase in eNO in healthy eNO subjects (CON:  $\sim 3$ ppb at 2 hours; DI  $\sim 2.5$  ppb at 4 hours), and in high eNO (CON:  $\sim 9$  ppb at 2 hours;  $p=0.027$ ). However DI's abolished the increase in the high eNO subgroup ( $\sim 6$  ppb decrease at 2 hours;  $p=0.319$ ). **CONCLUSION:** In subjects with healthy eNO levels, DI's did attenuate the initial rise in eNO post-HFM. In high eNO, DI's abolished airway inflammation post-HFM.

## 63. EFFECT OF FLUID INTAKE ON CHANGING BLOOD VOLUME IN HEALTHY MALES

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Given that euhydration should represent an optimal total body water (TBW) level and there is a clear relationship between TBW and BV, it is important to understand how fluid intake may change BV. It is well documented that altered fluid intake changes urinary and circulatory markers of hydration status; however, the degree to which changes in traditional indices of hydration status are simultaneously reflected in measurements of blood volume (BV) remains unknown. **PURPOSE:** To investigate changes in hydration status and BV in response to 24 h of

controlled fluid intake. **METHODS:** Seventeen healthy male subjects (age  $24 \pm 3$  y, mass  $84.4 \pm 8.4$  kg) were provided food and water over 24 h that had a total water volume of 60 ml/kg fat-free mass. Plasma volume (PV) and BV (via CO rebreathing) along with serum and urine osmolality ( $S_{osm}$  and  $U_{osm}$ , respectively) were measured pre- and post-intervention. Urine was collected over the 24-h period and analyzed for volume (24- $U_{vol}$ ) and osmolality (24- $U_{osm}$ ). Based on BV responses to the intervention, subjects were *post-hoc* assigned to groups in which BV had either increased (BV<sub>Inc</sub>: n = 9,  $362 \pm 136$  ml) or decreased (BV<sub>Dec</sub>: n = 8,  $-493 \pm 247$  ml;  $p < 0.001$ ). **RESULTS:** Total fluid intake was not different between groups ( $3930 \pm 322$  vs.  $3883 \pm 468$  ml;  $p = 0.813$ , for BV<sub>Inc</sub> and BV<sub>Dec</sub>, respectively). The groups started the hydration protocol with similar  $S_{osm}$  and  $U_{osm}$  (both  $p > 0.05$ ). However, the BV<sub>Inc</sub> group started with a lower PV ( $3517 \pm 481$  ml) and BV ( $6228 \pm 653$  ml) versus the BV<sub>Dec</sub> group ( $4005 \pm 345$  ml and  $7081 \pm 644$  ml, respectively;  $p < 0.05$ ). With the fluid intervention, BV<sub>Inc</sub> had an increase in BV ( $362 \pm 136$  ml) and PV ( $268 \pm 84$  ml) while BV<sub>Dec</sub> had a decrease in BV ( $-493 \pm 247$  ml) and PV ( $-272 \pm 110$  ml). This led to similar PV ( $3875 \pm 512$  and  $3734 \pm 386$  ml, for BV<sub>Inc</sub> and BV<sub>Dec</sub>;  $p > 0.05$ ) and BV ( $6590 \pm 669$  and  $6588 \pm 661$  ml,  $p > 0.05$ ) at the end of the 24-h fluid intervention. Interestingly, with 24-h of prescribed fluid, the change in  $S_{osm}$  ( $-1 \pm 2$  vs.  $-2 \pm 2$  mOsm/kg) and  $U_{osm}$  ( $-133 \pm 190$  vs.  $-33 \pm 316$  mOsm/kg), along with 24- $U_{vol}$  ( $2819 \pm 978$  vs.  $3218 \pm 711$  ml) or 24- $U_{osm}$  ( $377 \pm 177$  vs.  $324 \pm 81$  mOsm/kg) were similar between BV<sub>Inc</sub> and BV<sub>Dec</sub> (all  $p > 0.05$ ). **CONCLUSION:** Despite no significant differences in traditional indices of hydration status prior to the intervention, two groups of subjects' blood volume responded in opposite fashion to the same volume of fluid over 24 h. Interestingly, the changes in blood volume were not reflected in changes in traditional hydration biomarkers. This may suggest that, while they appeared to begin similarly hydrated, the BV<sub>Inc</sub> group had below optimal TBW level, as evidenced by the retention of fluid (and subsequent increase in BV) during a period of prescribed fluid intake.

## Professional Member Poster Presentations

### 64. VERTICAL JUMP GROUND REACTION FORCES ARE RELATED TO NCAA D1 MEN'S BASKETBALL GAME PERFORMANCES – A PILOT STUDY

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The development of force plate software for rapidly evaluating vertical jump (VJ) ground reaction forces (GRF) permits easy monitoring of off-court measures of high velocity and power. Whether these measures are related to actual game performances is not known. **PURPOSE:** The purpose of this project was to determine if kinetic measures from VJ tests are related to actual game performances for a high level men's college basketball team. **METHODS:** Players (N=16, BW= $95.6 \pm 13.7$  kg; X $\pm$ SD) from an NCAA D1 men's basketball team were monitored during the 2014-15 competition season. Prior to games, players performed a standardized counter-movement VJ test protocol with arm swing while on a 3-D force plate (Kistler Instrumente AG, Switzerland). Resulting GRF data were analyzed using proprietary software (Sparta Science, Menlo Park, CA). Kinetic variables measured during the VJ included relative mean vertical concentric force (MVCF), eccentric rate of vertical force development (ERVF), relative concentric vertical impulse (CVI), and center of mass VJ height (COM VJ). Game variables included minutes played (MIN), free throws attempted (FTA), offensive rebounds (OFFR), defensive rebounds (DEFR), blocks (BLK), and steals (STL) for each game. A total of 87 tests were performed as players were tested multiple times throughout the season and mean scores for all variables were calculated. **RESULTS:** The following performances were observed for all test sessions; MVCF =  $23.5 \pm 2.9$  N $\cdot$ kg<sup>-1</sup>, ERVF =  $7456 \pm 3487$  N $\cdot$ s<sup>-1</sup>, CVI =  $5.83 \pm 0.37$  [N $\cdot$ s] $\cdot$ kg<sup>-1</sup>, COM VJ =  $0.57 \pm 0.07$  m, MIN =  $17.8 \pm 11.3$  min, FTA =  $2.5 \pm 2.8$ , OFFR =  $1.0 \pm 1.1$ , DEFR =  $2.1 \pm 2.0$ , BLK =  $0.5 \pm 0.8$ , and STL =  $0.5 \pm 0.6$ . A canonical correlation was performed to determine relationships between all force plate variables combined and all game variables combined ( $r = 0.634$ ; eigenvalue = 0.4022;  $p < 0.001$ ). Standardized loadings  $\geq \pm 0.3$  indicated three force plate variables (AVCF = -1.680, ERVF = 1.061, COM VJ = 0.391), and two game variables (MIN = -1.058, OFFR = 0.725) contributed significantly to the canonical

correlation. **CONCLUSIONS:** Basketball game performance measures are related to combinations of vertical jump kinetics. It may be possible to partially account for game performances using a standardized VJ kinetics test, and to monitor training and game performances across a training year.

#### 65. GAIT TRANSITION AND KNOWLEDGE OF PERFORMANCE FEEDBACK

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The speed at which transitions occur between gait patterns has previously been shown to depend on multiple factors such as leg length, energy usage, state of fitness, and cognitive load. This suggests that gait transition is a complex phenomenon that warrants the investigation of other potential factors. One potential factor influencing gait transition could be having knowledge of one's current gait speed. **PURPOSE:** The purpose of this study was to investigate the effect of knowledge of performance, in this case treadmill speed, on the speed at which gait transition occurs. **METHODS:** Healthy, college-aged participants (6 men and 6 women) were tested on a treadmill on two separate occasions. In one session, participants had access to visual feedback regarding their gait speed. In the other session, this feedback was blocked. In both sessions, treadmill speed was randomly adjusted to between 40%- 110% of the participants' Froude number during thirty-second intervals for a total of fifteen minutes. Gait was classified as walking or running for each interval. Gait transition was quantified as the lowest speed at which a transition from walking to running was observed. **RESULTS:** Paired t-tests found no significant differences between feedback conditions for absolute speed of gait transition ( $4.36 \pm 0.31$  mi/h vs.  $4.49 \pm 0.26$  mi/h,  $t = 1.574$ ,  $p = 0.144$ ) or percentage of Froude number at which gait transition occurred ( $64.67 \pm 4.21\%$  vs.  $66.51 \pm 3.95\%$ ,  $t = 1.558$ ,  $p = 0.148$ ). In addition, we found no differences in preferred walking speed ( $2.50 \pm 0.39$  mi/h vs.  $2.53 \pm 0.54$  mi/h,  $t = 0.225$ ,  $p = 0.827$ ). **CONCLUSION:** Contrary to our hypothesis, there were no significant differences in gait transition speed as a result of the presence or absence of knowledge of performance, in this case treadmill speed. This was true for absolute speed, speed normalized to the participant's leg length and preferred walking speed. Interestingly, in roughly a third of participants, gait transition did not appear to be a discrete event but occurred within a range of speeds. This could have been as a result of the randomized speed protocol and warrants further study.

#### 66. POSSIBLE GENDER EFFECT IN BESS-LIKE BALANCE ASSESSMENTS

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The Balance Error Scoring System (BESS) is a common field assessment used by athletic trainers to determine the severity of a concussion sustained during participation in sports. BESS is facilitated by a trained practitioner and, as such, is subjective. As with many subjective measures, BESS has been shown to suffer from inter-and intra-rater reliability issues, as well as exhibiting a learning effect. Data taken for a related study indicates that results from balance assessments similar to BESS may also exhibit a gender effect. **PURPOSE:** The purpose of this study was to investigate the effect of gender on balance tasks similar to those performed during BESS. **METHODS:** 36 participants (27 females and 9 males) were recruited for a related study investigating balance deficits in concussed participants (6 females, 6 males) compared to controls (21 females, 3 males). Participants attempted to maintain balance in quiet stance for twenty seconds in five of the six BESS conditions, excluding the single-leg stance on foam. Outcome measures included the number of times a participant did not maintain stability while performing a trial of a particular task ("trial failures"). Additionally, if a participant failed to maintain stability during three trials under the same task conditions, the instability for that particular task ("task failures") was recorded. **RESULTS:** A two-way ANOVA showed no significant interaction effect between gender and concussion status, nor was there any main effect for concussion status for either outcome measure. There was a statistically significant main effect for gender in both the total number of trial failures per participant (Female:  $3.512 \pm 0.468$  vs. Male:  $1.667 \pm 0.715$ ,  $F_{3,32} = 4.667$ ,  $p = 0.038$ ) as well as the number of BESS-task failures per participant (Female:  $0.821 \pm 0.158$  vs. Male:  $0.083 \pm 0.241$ ,  $F_{3,32} = 6.550$ ,  $p = 0.015$ ). **CONCLUSION:** Care must be taken when using BESS in determining the severity of concussion symptoms or



when returning an athlete to competition. Due to a possible gender effect, females could present with a higher score and therefore be misdiagnosed with a more severe concussion or held out of competition longer than their male counterparts.

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## **67. COMPARISON OF ABSOLUTE AND ALLOMETRIC STRENGTH NORMALIZATION BETWEEN ELITE RESISTANCE TRAINED ATHLETES AND NOVICE STRENGTH TRAINEES.**

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Body size is a confounding variable when comparing muscular strength among individuals. Allometric normalization for strength among athletes seems to be appropriate, but little information is available to suggest that this method is suitable for untrained individuals. **Purpose:** To compare allometric normalization of strength between trained athletes and untrained novices. **Methods:** Subjects consisted of students ( $n=45$ ) in a beginning weight training class and Division I football players ( $n=81$ ). Students were instructed in lifting techniques and after 2 weeks were tested on the 1-RM bench press (BP). Technique for the BP was strictly monitored. For the football players, data from the most recent testing day was accessed. Participants' body masses (BMs) were stratified into three 10 kg categories in order to facilitate the comparison of strength in different BM among players and novices. These categories were: 75 – 85 kg.; 85.1 – 95 kg; 95.1 – 105 kg. Allometric normalization involved the product of 1-RM and  $BM^{2/3}$ . **Results:** For absolute 1-RM BP strength the athletes were significantly ( $p<0.01$ ) stronger than the novice group (means =136.37 kg vs. 78.76 kg). Comparison by allometric scaling yielded significant differences ( $p<0.01$ ) between the two groups. In the untrained group comparisons, the lightest group had significantly smaller absolute 1-RM bench press weight than the two heavier groups (55.69 kg vs. 93.89 kg and 92.91 kg respectively) and the two heavier groups were essentially similar. For allometrically scaled data the lightest group was significantly different from the two heavier groups (3.75 vs. 4.45 and 4.43 respectively) while the two heavier groups did not differ significantly. Absolute 1-RM for the athletes differed significantly ( $p<0.01$ ) among all three weight groups with the heavier BM individuals exhibiting significantly greater 1-RMs. Following allometric scaling no significant differences among the weight groups were found. **Conclusion:** Normalizing data by allometric scaling has been utilized in several athletic venues and has been shown to be appropriate and useful when comparing athletes' strength. Based on the current results it is inappropriate to compare by allometric normalization the strength of untrained individuals potentially due to the confounding variable of variance of body composition.

## **68. ASSESSMENT OF ELECTROMYOGRAPHIC ACTIVITY DURING A TRX AND TRADITIONAL SPLIT-SQUAT**

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To date, traditional resistance training (TRT) programs incorporate a minute amount of instability training (IT). Over several decades TRT has transformed and taken on new and unusual concepts, such as TRX (total body resistance exercise). However, very little research has been completed investigating the effects of the TRX. **PURPOSE:** Therefore, the purpose of the study was to determine if muscle electrical activity (EMG) will differ while performing a bodyweight split-squat while using an instability device, the TRX, as compared to performing a bodyweight split-squat in a stable environment, without an external load present. **METHODS:** Twenty non-athlete (10 male; 10 female) experienced resistance and/or aerobically trained individuals participated in the investigation. The study consisted of three sessions including two variations of bodyweight split-squats and a training session to acclimatize the participants. The TRX split-squat was performed by placing the rear foot within the foot cradle of the TRX strap, while the traditional split-squat required the participant to place their rear foot on a stable bench, both 16 inches in height. Each session was separated by one minute of rest and each split-squat required the participant to perform three correct repetitions. EMG analysis was performed to assess the muscle activity of the gluteus maximus (GMa) and rectus femoris (RF). Paired samples t-tests using IBM SPSS version 23 were performed to compare the EMG data of the GMa and RF of males and females for both the TRX and traditional split-squat. **RESULTS:** Paired

samples t-tests revealed significantly higher EMG activity occurred in the GMa during the TRX split-squat compared to the traditional split-squat. No other significant differences in the muscle activity of the GMa or RF occurred. **CONCLUSIONS:** The study purpose was to determine if a TRX split-squat would increase muscle activity in the GMa or RF compared to the traditional split-squat because of the higher degree of instability involved. Significant results were found for the EMG of the GMa during the TRX® split-squat. The TRX® trainer has not been incorporated in many studies, thus should be an increased focus in the future.

#### **69. MUSCULAR STRENGTH AS A PREDICTOR OF BONE MINERAL DENSITY IN COLLEGIATE FEMALE ATHLETES**

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It has been well established that the frequency and duration of impact loading, age, body weight, and body composition are independently correlated with bone mineral density (BMD) in female athletes. However, very little is known about the relationship of strength, in addition to other anthropometric measures, and BMD. **PURPOSE:** The purpose of this study was to examine the relationship between muscular strength, muscular endurance, sport specific impact loading, age, body composition and body weight simultaneously in regards to BMD in collegiate female athletes. **METHODS:** Participants included apparently healthy collegiate female athletes from a variety of sports; tennis (n=7), basketball (n=8), soccer (n=7), cross country (n=2), cheer (n=2), and volleyball (n=4). Each subject reported twice during a seven day span to complete the assessments. During the first session, descriptive statistics such as height, weight, BMD and body composition were recorded. Additionally, objective assessments for muscular strength (hand-grip strength, one-repetition max bench press and squat strength), muscular endurance (push-ups and curl-ups) were performed. The second session included the evaluation of maximal oxygen consumption, obtained from a graded exercise test and open circuit spirometry. **RESULTS:** Using a Pearson correlation, bench press strength displayed the greatest relationship with BMD ( $r = 0.826$ ). Significant relationships also existed between BMD and fat-free mass ( $r = 0.739$ ), maximal squat strength ( $r = 0.666$ ) and hand-grip strength ( $r = 0.597$ ). A stepwise regression model revealed maximal bench press strength as the most significant variable for predicting total BMD in respect to the variables being measured. In addition, a negative relationship was displayed between BMD and partial curl-ups ( $r = -0.387$ ) and maximal oxygen uptake ( $r = -0.360$ ). **CONCLUSIONS:** These results indicate that the relationship between BMD and muscular strength, particularly maximal bench press strength, may be greater than previously indicated.

