Department of Kinesiology
Graduate Student Symposium

The University of Toledo
April 26, 2013
College of Health Sciences
About the Graduate Research Symposium

The Department of Kinesiology at The University of Toledo proudly presents the Annual Graduate Student Research Symposium. The objectives of this symposium are to facilitate the dissemination of current research activities within the discipline of Kinesiology, while acknowledging the efforts of our students, and future professionals within the field.

About the Department of Kinesiology

The Department of Kinesiology, within the University’s newly formed College of Health Sciences, currently offers the Master of Science in Exercise Science (Athletic Training, Biomechanics, Clinical Kinesiology, and Exercise Physiology concentrations) and the Doctor of Philosophy in Exercise Science degrees. For more information, visit www.utoledo.edu/~kinesiology.

About Our Keynote Speaker

Dr. Tim Butterfield, ATC, is an Assistant Professor at The University of Kentucky in the Department of Rehabilitation Sciences, Division of Athletic Training. Dr. Butterfield completed his doctoral work at the University of Calgary, and post-doctoral training at the Ohio State University. He earned his M.S. degree at Old Dominion University and B.S. and B.A. degrees from the Messiah College and the State University of New York at Potsdam, respectively. His area of research is muscle mechanics, specifically strain-induced muscle injury and the plasticity of skeletal muscle. Dr. Butterfield’s research interests focus on skeletal muscle function. Dr. Butterfield is exploring the potential role of directly measured fiber dynamics and force production during eccentric and concentric exercise on muscle damage and functional adaptation. His models include in-vivo ambulation and exercise models that allow the direct, real time measurements of mechanical properties and performance of skeletal muscle during modified use. Dr. Butterfield resides in Lexington, KY and spends his free time outdoors in a variety of activities, his favorite of which is back-country camping in the Canadian Rockies.
Schedule of Events

8:55  Welcome and Introduction

ORAL PRESENTATION SESSION

9:00  Ed Nyman (abstract 1)
Effects of Visual Binocularity on Knee Biomechanics During Drop Landing Task in Healthy Young Females

9:15  Maria J. Torres-Palsa (abstract 2)
Skeletal Muscle Fibers in Dystrophin-deficient Mice Express Intercellular Adhesion Molecule-1

9:30  Heather Boley (abstract 3)
A Comparison of Self-Reported Disability and Dynamic Postural Control Between Patients with Chronic Ankle Instability, Ankle Copers, and Healthy Controls

10:00 Sam McMullen (abstract 4)
Injury Prediction in Division-I Collegiate Cross-Country Runners using Functional Movement Tests

10:15 Lindsay Baic (abstract 5)
The Effects of Chronic Ankle Instability and Changes in Visual Focus on Sensorimotor Control in the Lower Extremity During a Drop Landing

10:30 Elizabeth Rullestad (abstract 6)
A Comparison of Strength, ROM, Laxity, and Dynamic and Static Postural Control Between Those At-Risk and Healthy

10:45 Qing Goh (abstract 7)
ICAM-1 Expression by Skeletal Muscle Cells Augments Stages of Myogenesis

**15 Minute Break**
POSTER PRESENTATION SESSION

11:00  Hayley Ericksen (abstract 8)
Immediate Effects of Real-time and Traditional Feedback on Knee and Hip Biomechanics During Landing

11:05  Rachael Potter (abstract 9)
The Negative Impact of FoxO1 on Skeletal Muscle Protein Synthesis

11:10  Evan Schick (abstract 10)
The Effect of FoxO1 on Triglyceride Storage in Skeletal Muscle and Liver

11:15  Samantha Boland (abstract 11)
Reliability and Validity of Hand-Held Dynamometry Assessment of Hip Abduction Strength in Healthy, Young Adults

11:20  Brittnney Luc (abstract 12)
Reliability of Corticocellular Excitability in Leg and Thigh Musculature at 14 and 28 Days

11:25  Aaron Shaw (abstract 13)
The Effect of a Pre-exercise Nutritional Supplement on Muscle Fatigue during Handgrip Exercise

11:30  Megan Quinlevan (abstract 14)
Measuring Hip External Rotation Strength with a Hand-Held Dynamometer: Is it a Reliable and Valid Measurement?

11:35  Matt Harkey (abstract 15)
Soleus Corticospinal Excitability Predicts Self-Reported Disability in Patients with Chronic Ankle Instability

11:40  Michelle McLeod (abstract 16)
Relationship Between Ankle Swelling and Dynamic Stability Following Acute Lateral Ankle Sprains

LUNCH AND KEYNOTE ADDRESS

11:45  Lunch and Awards (posters available for viewing)

1:00  Keynote Address
Dr. Tim Butterfield, ATC
Title: "From hare to allometry: can massage accelerate recovery of function in strain-damaged muscle?"
1. Effects of Visual Binocularity on Knee Biomechanics During Drop Landing Task in Healthy Young Females

Edward Nyman and Charles A. Armstrong

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Since relationships have been established between ACL injury and neuromuscular control, and between vision and neuromuscular control, exploration of the relationship between vision and ACL injury may be helpful to clinicians.

PURPOSE: The purpose of this study was to determine whether biomechanics consistent with increased risk of ACL injury (Peak GRF (Fz) upon landing for each leg, peak knee valgus angle, peak knee valgus moment, and knee flexion angle, for the initial 30ms after initial surface contact) were significantly altered under dynamic perturbative conditions of regular stereo-optic vision, dominant eye occluded monovision, and non-dominant eye monovision.

METHODS: Fourteen healthy female volunteer subjects, ages 18 – 28 years, were recruited from the university student body and instrumented with thirty-six 20mm retro-reflective markers, enabling 3D kinematic data to be captured at 200 Hz. Two force plates (AMTI, MA, USA) sampling at 2000 Hz captured kinetics. Participants completed three 30cm drop vertical jump trials for each of the randomly assigned conditions of: stereo, dominant eye non-occluded vision, dominant eye occlusion, and non-dominant eye monovision. Monocular occlusion was achieved via application of clinical-grade eye patch. All trials were exported to Visual 3D software where data was low-pass filtered at 16 Hz.

RESULTS: Monocular vision conditions yielded a higher peak knee abduction (valgus) angle (stereo= 5.20°, monocular= 5.60°). On the left side, for NDEO specifically, this difference was significant (p=.026). A higher left side peak knee abduction (valgus) moment was found for monocular conditions as compared with stereo-optic control trials (stereo= 0.315 Nm, monocular = 0.387 Nm). Peak knee flexion was increased during monocular trial conditions (stereo-optic= 91.4°, monocular= 93.9°). There was no difference in vertical ground reaction force for monocular vision as compared with binocular vision conditions.

CONCLUSION: This study found that while visual binocularity may play a role in dynamic force attenuation during the initial contact phase of a drop vertical jump task, further research is needed to more completely explore the effects of visual perturbations and to explore the effects of training interventions.

2. Skeletal Muscle Fibers in Dystrophin-deficient Mice Express Intercellular Adhesion Molecule-1

Maria J. Torres-Palsa, Matthew V. Koziol, Qingnian Goh, Francis X. Pizza

Exercise Biology Laboratory, Department of Kinesiology, The University of Toledo, Toledo, OH

Duchenne muscular dystrophy (DMD) is an inherited disease caused by the absence of the cytoskeletal protein dystrophin from skeletal and cardiac muscle cells. In healthy muscle, dystrophin maintains the skeletal muscle cell integrity by linking the extracellular matrix and the cytoskeleton. Without dystrophin, skeletal muscle cells are structurally and functionally weak. In patients with DMD, activities of daily living can result in extensive muscle cell damage. In response to the muscle damage, the body initiates an inflammatory response which in turn, exacerbates the pathology of DMD. This leads to repeated cycles of skeletal muscle damage and regeneration, which is a hallmark of the pathology. In a murine model of DMD (i.e. mdx mice), cells of the inflammatory response (neutrophils and macrophages) are known to contribute to the onset and progression of the muscle damage. Previous studies have demonstrated an increase in the expression of intercellular adhesion molecule-1 (ICAM-1) in endothelial and skeletal muscle cells in patients with DMD. We hypothesize that the expression of ICAM-1 by skeletal muscle fibers in dystrophin-deficient muscle serves as a mechanism by which neutrophils and macrophages exacerbate the muscle pathology of DMD. The purpose of this investigation was to determine if ICAM-1 is expressed by skeletal muscle fibers in mdx mice. The expression of ICAM-1 in wild type and mdx muscle samples from three weeks to six months of age was revealed via immunoblotting and western blotting. We found ICAM-1 expressed on the membrane of necrotic, injured, and regenerating muscle fibers of the mdx mice. The majority of ICAM-1 positive fibers were injured and necrotic muscle fibers. Skeletal muscle fibers of control wild-type mice showed no expression of ICAM-1. These observations may indicate that skeletal muscle fiber expression of ICAM-1 serves as a mechanism by which neutrophils and macrophages attach to skeletal muscle and exacerbate the myopathy in the mdx mouse. This preliminary finding can be used to develop future experiments to investigate the specific role of ICAM-1 in the pathophysiology in Duchenne muscular dystrophy.
3. A Comparison of Self-Reported Disability and Dynamic Postural Control Between Patients with Chronic Ankle Instability, Ankle Copers, and Healthy Controls

Boyle HA, Carey S, Rulstedt E, Terada M, Quinlivan ME, Gribble PA

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**Context:** Diminished postural control assessed by the star excursion balance test (SEBT) and decreased self-reported function assessed by the Foot and Ankle Ability Measure (FAAM) and FAAM-Sport have been demonstrated in individuals with chronic ankle instability (CAI) compared to controls. There are limited comparisons between CAI patients and ankle copers, who have sprained their ankles without developing CAI. It is unclear if there is a correlation between SEBT and FAAM measures. **Objective:** Compare SEBT performance, and self-reported disability among individuals with CAI, copers, and healthy controls; and to determine if there is a correlation between the selected outcome measures. **Design:** Case-control. **Participants:** Fourteen coper participants (7M, 7F), 9 CAI participants (4M, 5F), and 8 control participants (8F) volunteered. **Interventions:** Participants completed the FAAM and FAAM-Sport, and performed the anterior reach of the SEBT (A-SEBT). **Main Outcomes:** Three trials of the A-SEBT (cm) were reported as a percentage of limb length (cm) of the participant (%MAXD). Scores on the FAAM and FAAM-Sport are reported as percentages. Group means and standard deviations of the A-SEBT trials, FAAM, and FAAM-Sport were used for analysis. Separate one-way ANOVA’s were used to compare the group means and standard deviations of the A-SEBT, FAAM, and FAAM-Sport. **Results:** Significant group differences were observed for %MAXD (F2,29=11.03, P<.01), FAAM (F2,29=25.18, P<.01), and FAAM-Sport (F2,29=6.22, P<.01). For %MAXD, CAI patients (58.80%±6.05) performed worse than copers (67.79%±4.73, P<.001) and controls (72.22%±2.47, P=.03). For the FAAM, CAI scores (87.16%±5.61) were lower than copers (97.77%±2.39, P<.001) and controls (98.66%±3.78, P<.001). For the FAAM-Sport, CAI scores (74.63%±8.17) were lower than copers (93.08%±7.27, P<.001) and controls (97.65%±6.62, P<.001). %MAXD was significantly and moderately correlated with the FAAM (r=0.50, P<.01) and FAAM-sport (r=0.44, P<.01). **Conclusion:** Participants with CAI demonstrated decreased dynamic postural control on the A-SEBT and increased self-reported disability compared to copers and controls. These measures appear to differentiate CAI patients and copers. We observed a moderate correlation between self-reported disability measures and A-SEBT, suggesting those with lower perceived ankle function may exhibit less dynamic postural control. Future research should identify the mechanism by which copers retain these higher levels of function. This project was supported by a NATAREF Osternig Masters Grant.


Samuel McMullen, ATC, Phillip A. Gribble, ATC, PhD

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**Objective:** (1) Examine FMS, mFMS, and SEBT-AR performance during pre and post-workout states between collegiate cross-country runners that do and do not suffer a chronic injury to the lower extremity, and subsequently establish cut-off scores that can predict an increase in risk of musculoskeletal injury in cross-country athletes. (2) Examine FMS, mFMS, and SEBT-AR performance during pre- and post-workout states between cross-country runners that do and do not have a previous acute or chronic injury history, and subsequently establish a cut-off scores that can identify athletes that may have performance deficits with previous injuries. (3) Determine if performance of the mFMS and SEBT-AR are different post-workout compared to a pre-workout state in cross-country athletes. **Design, Setting, and Data Source:** A prospective cohort design was utilized. Separate independent T-tests were used to determine if there was a difference in scores between those that sustained an in-season chronic RRI and those who did not. For the FMS, mFMS, and SEBT-AR during pre/post-workout conditions. A Receiver Operator Characteristic Curve (ROC) was used to determine cut-off scores for those screening scenarios to maximize sensitivity and specificity. A Chi-Squared analysis was used to determine if there was a relationship between previous injuries and in-season injuries. Significance was set to p<.05. **Results:** A total of 28 athletes met the inclusion criteria and completed the study and the 2012 cross-country season. When the pre-workout FMS and SEBT-AR were combined these tests produced a DOR of 8.7 for in-season injuries. The pre-workout FMS and SEBT-AR had DOR of 4.0 and 5.0 for previous injuries. The mFMS was significantly worse post workout (p=.05). The SEBT-AR was significantly better post-workout (p<.001). There was no significant interaction between previous injury and in-season injury status. **Conclusion:** A combination of the pre-workout SEBT-AR and full FMS should be used to optimize the injury prediction model. Athletes falling below both the pre-workout SEBT-AR cut-off of 79.32 and FMS of 16.25 are 8.7 times more likely to sustain an in-season injury. The pre-workout SEBT-AR and pre-workout FMS were the most effective at identifying deficits in athletes with a previous injury. This study supports the use of functional movement testing as a method of identifying lingering functional deficits and creating an individualized prevention protocols in an attempt to prevent future injury.
5. **The Effects of Chronic Ankle Instability and Changes in Visual Focus on Sensorimotor Control in the Lower Extremity During a Drop Landing**

Lindsay Baic, ATC, Masafumi Terada, MS, ATC, Brian Pietrosimone, PhD, ATC, Charles Armstrong, PhD, ATC, Phillip Gribble, PhD, ATC

Musculoskeletal Health and Movement Science Laboratory, Department of Kinesiology, University of Toledo, Toledo OH

**Objective:** To examine the effects of the combination of chronic ankle instability (CAI) and modified visual focus on lower extremity sagittal-plane kinematics and dynamic stability during a drop-landing task. **Design:** A case-control design. **Participants:** 15 participants with self-reported CAI and 15 healthy participants. **Methods:** Participants performed a drop-landing task in both looking-up and looking-down conditions. **Main Outcome Measures:** Pre-landing and post-landing sagittal-plane kinematics in the hip, knee, and ankle were analyzed. Time-to-stabilization (TTS) was calculated to assess dynamic stability. **Statistical Analysis:** A 2 x 2 repeated-measures analysis of variance was used for each dependent variable. Significance was set a priori at p < 0.05. Cohen’s d effect sizes using means and pooled standard deviations were calculated. **Results:** A significant group main effect existed for pre-landing hip (p = 0.01) and post-landing knee (p = 0.05) sagittal-plane kinematics. The CAI group had significantly decreased hip flexion at the point of 100 ms pre-initial contact (IC) compared to the control participants (CAI = 24.07 ± 6.78; Control = 31.36 ± 6.78; d = -1.08, 95% CI: -1.82, -0.27). The CAI group also demonstrated decreased knee flexion at IC compared to controls (CAI = 5.08 ± 6.24; Control = 9.89 ± 6.24; d = -0.77, 95% CI: -1.50, 0.00). There were no significant results for other kinematic measures or TTS. **Conclusion:** We found proximal joint alterations pre- and post-landing that indicate feed-forward supraspinal sensorimotor alterations associated with CAI. These findings reinforce previous findings of feed-forward alterations associated with CAI and suggest the need for clinicians to assess for proximal joint kinematic patterns during a functional task in individuals with CAI.

6. **A Comparison of Strength, ROM, Laxity, and Dynamic and Static Postural Control Between Those At-Risk and Healthy**

Elizabeth Rullestad, ATC, Phillip A. Gribble, ATC

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**Objective:** The purposes of this study were to compare strength, ankle joint laxity, ankle dorsiflexion range of motion (DF-ROM), and static balance between individuals with poor and good performance on the Star Excursion Balance Test in the anterior reach direction (SEBT-A), as well as to identify what combination of factors contribute the most to SEBT-A performance. **Participants:** Twenty three participants with no self-reported injury were assigned to either at-risk (M = 4, F = 9, 21.00 ± 2.61 yrs, 74.78 ± 15.94 kg, 165.99 ± 10.28 cm) or a healthy control group (M = 3, F = 7, 20.60 ± 1.51 yrs, 65.82 ± 17.27 kg, 169.36 ± 11.43 cm) based on their performance on the SEBT-A. **Interventions:** Participants completed five testing activities, including the SEBT-A, a single-lag balance task, the Weight Bearing Lunge Test (WBLT), concentric strength using the Biodex, and ankle laxity using an instrumented ankle arthrometer. **Main Outcome Measures:** The normalized reach distance of the SEBT-A was calculated and represented as a percentage score (MAXD), static postural control was examined with the center of pressure velocity (COPV, m/s²) and time-to-boundary (TTB, s), Ankle dorsiflexion from the WBLT was reported in cm. The average of five peak torque productions of the sagittal-plane was represented as average peak torque (Nm/kg). Total anterior-posterior (AP) and inversion-eversion (IE) laxities were quantified in millimeters and degrees, respectively. **Statistical Analysis:** Independent t-tests were used to compare each dependent variable between the at-risk and healthy groups. Cohen’s d effect sizes with 95% confidence intervals (CI) were calculated for each comparison between groups. A multiple linear backward regression analysis was performed to determine which dependent variables contributed to the variance of SEBT-A. Significance was set at a priori p = 0.05. **Results:** There were statistically significant differences in the SEBT-A ($t_{df} = -5.961, \ p \leq 0.001$) and the WBLT ($t_{df} = -2.632, \ p = 0.016$) between the at-risk and healthy groups. There were no significant results for other outcome measures (p = 0.05). For the at-risk group, the combination of knee extensor strength, static postural control, and the WBLT explained 75% of the variance in SEBT-A ($R^2 = 0.750, \ p = 0.004$). **Conclusion:** Participants with shorter anterior reaching distance in the SEBT had significantly less DF-ROM compared to controls. Sagittal-plane knee strength, static postural control, and weight-bearing ankle DF-ROM may represent clinically modifiable factors for a targeted prevention program when decreased functional performance is identified with the SEBT-A.
ICAM-1 Expression by Skeletal Muscle Cells Augments Stages of Myogenesis

Goh Q, Dearth CL, and FX Pizza.

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We previously reported that intercellular adhesion molecule-1 (ICAM-1), an important protein of the inflammatory response, was expressed by satellite cells and myofibers of hypertrophying muscles. As skeletal muscle cell expression of ICAM-1 contributed to the formation of regenerating fibers, and hypertrophy after mechanical overload, we speculate that ICAM-1 expression facilitates regenerative and hypertrophic responses in skeletal muscle cells. Therefore, the purpose of the current study was to establish phenotypic alterations associated with skeletal muscle cell expression of ICAM-1. Through stable transfection of C2C12 myoblasts with an ICAM-1 plasmid, we found ICAM-1 expression augmented stages of myogenesis in which myotubes are forming, adding nuclei, aligning, fusing, synthesizing proteins, and hypertrophying. To reveal underlying mechanisms involved in ICAM-1 mediated myogenesis, we selectively inhibited the function of the extracellular and cytoplasmic domains of ICAM-1 with a neutralizing antibody, and a cell permeable peptide, respectively. Our results established a distinct role for the extracellular domain of ICAM-1 in facilitating the formation of nascent myotubes, whereas the cytoplasmic domain of ICAM-1 contributed to the subsequent growth and maturation of myotubes. Taken together, our findings extend knowledge of the immunobiology of skeletal muscle cells by revealing a novel mechanism through which the inflammatory response augments myogenesis.

Immediate Effects of Real-time and Traditional Feedback on Knee and Hip Biomechanics During Landing

Hayley M. Ericksen, Abbey C. Thomas, Phillip A. Gribble, Brian G. Pietrosimone.

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Introduction: Females have demonstrated altered biomechanics when landing from a jump, including increased knee abduction and decreased knee flexion angles, which may increase risk of non-contact ACL injury. Feedback has demonstrated the ability to alter biomechanics during landing; however, delivery of feedback has yet to be optimized. This study investigates the effect of a single session of real-time feedback (RTF) on lower extremity biomechanics compared to traditional feedback (TF), and two control groups. Methods: Twelve RTF, 12 TF, 11 jumping, and 8 control were included in this study. Pre- and post-intervention, participants performed 3 jump landings off a 30cm box, set to 50% of the participant’s height away from the force plate, and upon landing, immediately rebounded for maximum height. The intervention consisted of 18 jump landings (3 sets of 6 jumps) off of the same box, but sticking the landing for the RTF, TF, and jumping groups. RTF and TF received cues of correct landing technique from a single clinician after each set of 6 jumps. RTF subjects were provided real-time, visualization of their frontal plane knee angle and were instructed to align this knee angle with a vertical reference line during landing. Jumping subjects performed 18 jump landings with no feedback. The control group sat quietly for 10 minutes with no feedback. The average peak of three trials for knee and hip sagittal and frontal plane biomechanics were determined during the first 25% of stance pre- and post-intervention using standard inverse dynamic analysis. Data were analyzed using 2x4 repeated measures ANOVAs and Tukey multiple comparisons. Results: Participants in the TF group (pre: 98.8⁰±9.5; post: 107.6⁰±13.2) increased knee flexion angles compared to jumping subjects (pre: 84.2⁰±21.1; post: 82.9⁰±20.7, P=0.01). Traditional feedback did not influence hip sagittal plane or knee or hip frontal plane biomechanics (P>0.05). Real-time feedback did not influence knee or hip frontal or sagittal plane biomechanics (P>0.05). Conclusion: The TF group increased knee flexion angle compared to the jumping group. There may be no immediate benefit of adding RTF in altering lower limb biomechanics. Multiple sessions may be needed to realize the full benefit of feedback.
9. The Negative Impact of FoxO1 on Skeletal Muscle Protein Synthesis

Rachael A. Potter, Tara Lohr, Monica Hajjar, Thomas J. McLoughlin

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The regulation of skeletal muscle is dependent upon the balance between protein synthesis and protein degradation. The canonical Akt/mTOR signaling pathway plays a strong role in promoting skeletal muscle hypertrophy through upregulation of protein synthesis and downregulation of protein degradation. The transcription factor, FoxO1, may play a role in negatively affecting protein synthesis thus leading to suppression of skeletal muscle hypertrophy.

PURPOSE: To study the role FoxO1 plays in regulating skeletal muscle size.

METHODS: An in vitro model was used in which FoxO1 estrogen receptor fusion proteins were transfected into skeletal muscle myoblasts and grown into myotubes. The 4 day differentiated myotubes were treated with 4-hydroxytamoxifen (4-OHT) to activate the FoxO1 estrogen receptor fusion proteins for 30 minutes, 2 hours, 4 hours and 24 hours of treatment. The myotubes were also treated with insulin in order to stimulate protein synthesis for 30 minutes, 2 hours, 4 hours, and 24 hours. The cells were treated with [3H]phenylalanine to measure the total protein synthesis upon FoxO1 overexpression and total protein content was analyzed by using a DC protein assay.

RESULTS: Our findings show that i) FoxO1 overexpression significantly suppresses protein synthesis in skeletal muscle myotubes, ii) despite treatment with insulin; FoxO1 overexpression blunts protein synthesis compared to control myotubes.

CONCLUSIONS: FoxO1 overexpression promotes for muscle atrophy through increased protein degradation. Until now, it was unknown if protein synthesis is suppressed or blunted upon FoxO1 overexpression. In this study, it is demonstrated that FoxO1 overexpression suppresses total protein synthesis despite treatment with insulin in an in vitro skeletal muscle model. Therefore, decreased skeletal muscle size is attributed to both increased protein degradation and suppression of protein synthesis. Future direction will focus on ribosomal biogenesis and protein synthesis machinery to elucidate the mechanism to which FoxO1 activity suppresses protein synthesis.

10. The Effect of FoxO1 on Triglyceride Storage in Skeletal Muscle and Liver

Evan E. Schick, Maggie M. Ray, Rachael A. Potter, Thomas J. McLoughlin

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Forkhead Box protein 1 (FoxO1), a member of the Forkhead Box family of transcription factors has been shown to induce insulin resistance in various types of tissues. Lipid molecules likely play a role in the development of insulin resistance as they secrete factors known to interfere with insulin signaling. Activated FoxO1 has been shown to amplify lipid uptake and oxidation in cultured skeletal muscle cells. The purpose of the present study was to determine the effect that FoxO1 has on intracellular triglyceride (ITG) accumulation and insulin signaling in vivo. Three wild-type (WT) and three transgenic mice with skeletal muscle-specific overexpression of FoxO1 were used to examine ITG storage. Frozen section of the plantaris (PLN), soleus (SOL) and liver from FoxO1 and WT mice were stained with Oil Red O for ITG droplet visualization. Protein expression of key insulin signaling intermediates in the Insulin/Akt/PI3K pathway was analyzed by western blot. PLN and SOL from WT mice exhibited greater ITG accumulation compared to FoxO1 mice while the liver from FoxO1 mice showed greater ITG accumulation compared to WT. There was no difference in protein expression levels of Insulin Receptor Substrate (IRS-1), Protein Kinase B (PKB/Akt) and PI3K between WT and FoxO1 mice.

FoxO1 may cause enhanced ITG oxidation that outweighs the increase in ITG uptake. Thus, FoxO1 may induce insulin resistance in skeletal muscle through accumulation of lipid metabolites produced from increased ITG oxidation, which were not captured by Oil Red O. Under control conditions, FoxO1 overexpression may not affect insulin signaling.
11. Reliability and Validity of Hand-Held Dynamometry Assessment of Hip Abduction Strength in Healthy, Young Adults

Boland SA, Quinelevan ME, Dodge EB, Gribble PA: University of Toledo, Toledo, OH.

Musculoskeletal Health and Movement Science Laboratory, Department of Kinesiology, University of Toledo, Toledo OH

Context: Hip musculature weakness, specifically of the hip abductors (HABD), has been associated with numerous musculoskeletal pathologies. Screening of hip strength during pre-participation examination may be important in the prevention of lower extremity injury. Hand-held dynamometers (HHD) are a convenient and relatively inexpensive clinical tool that can estimate muscle strength. In addition, a strap to stabilize the HHD and address bias associated with tester strength has been utilized in recent investigations. Limited data exists on the accuracy of HHD assessment compared to the gold standard of isokinetic dynamometry (ID). Objective: To determine the intersession and intrarater reliability, as well as the validity of the HHD in measuring HABD strength in sidelying (SL) and supine (S) positions, both with (SLW, SW) and without a stability strap (SLWO, SWO).

Design: Controlled laboratory. Setting: Research laboratory. Participants: Twenty healthy, young adults (10M, 10F; 21.6±3.1 yrs; 178.1±4.2 cm; 76.3±9.5 kg; 10F, 23.6±2.0 yrs; 166.9±5.6 cm, 65.9±11.1 kg).

Intervention: Participants volunteered and reported for two sessions one week apart. At each session, two raters, both certified athletic trainers, performed assessments in SL and S positions. During the no strap condition the raters performed a manual muscle test holding the HHD. During the strap condition, the volunteer pushed against the HHD secured with a strap. Four, 5-second trials were performed during each condition, with appropriate rest between trials, conditions, and raters. Additionally, at the first session, HABD strength was also measured using the ID, utilizing the same protocol as the HHD for trials and rest. Main Outcome Measures: Raw force values were converted to torque values using the appropriate moment arms and reported in Nm. ICC2,1 models were calculated for intrarater and intersession reliability for each condition. Pearson Correlation coefficients were calculated for validity between each HHD condition and the ID measure. Results: There was strong intrarater reliability for the SW (ICC2,1=0.906; 95%CI:0.964-0.994), SWO (ICC2,1=0.951; 95%CI:0.877-0.981), SLW (ICC2,1=0.966; 95%CI:0.965-0.994), SLWO conditions (ICC2,1=0.962; 95%CI:0.949-0.985). Additionally, there was strong intersession reliability for the SW (ICC2,2=0.966; 95%CI:0.914-0.987), SWO (ICC2,2=0.977; 95%CI:0.941-0.991), SLW (ICC2,2=0.983; 95%CI:0.958-0.993), and SLWO conditions (ICC2,2=0.984; 95%CI:0.939-0.986). There were strong, positive correlations between the HHD and SW (r=0.905, p<0.001), SWO (r=0.853, p<0.001), SLW (r=0.879, p<0.001), and SLWO conditions (r=0.843, p<0.001). Conclusion: The HHD had strong intrarater and intersession reliability for HABD strength assessment in two testing positions, both with and without a strap. Additionally, there was a strong correlation between the ID and HHD for HABD strength. The HHD appears to be a valid and reliable tool for clinicians in assessing HABD strength.

12. Reliability of Corticomotor Excitability in Leg and Thigh Musculature at 14 and 28 Days

Brittney A. Luc, Adam S. Lepley, Michael A. Tevald, Phillip A. Gribble, Donald B. White, Brian G. Pietrosimone

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Objective: Determine the intersession reliability of active motor threshold (AMT) and amplitudes of motor evoked potentials (MEPs) over 14 and 28 days in the quadriceps and fibularis longus muscles. Methods: Twenty healthy volunteers attended a baseline session and two additional testing sessions at 14 and 28 days following the baseline testing session. AMT and MEP amplitudes were evaluated at 95, 100, 105, 110, 120, 130, and 140% of AMT in the dominant and non-dominant quadriceps and fibularis longus muscles. Interclass Correlation Coefficients (ICCs) were used to assess reliability for absolute agreement and internal consistency between baseline and both follow-up sessions (day 14 and 28). Each ICC was fit with the best-fit straight-line or parabola in order to smooth out the noise in the observations and best determine if a pattern existed in determining the most reliable MEP value. Results: All muscles yielded strong ICCs between baseline and both time points for AMT. MEPs at 130% of AMT in the dominant quadriceps on day 28 produced the strongest ICC, while MEPs elicited at 140% of AMT on Day 28 produced the strongest ICC in the non-dominant quadriceps. MEPs elicited at 130% of AMT between baseline and both follow-up sessions in the fibularis longus muscles produced the strongest ICCs. MEP ICCs for both absolute agreement and internal consistency for the dominant fibularis longus demonstrated significant lines of best fit (Absolute Agreement p=0.001; Internal Consistency p=0.01). Conclusion: AMT and MEPs have varying degrees of reliability over time in both quadriceps and fibularis longus muscles. The dominant fibularis longus muscle showed a significant pattern as TMS intensity increased MEP reliability increased. Significance: TMS can be used to identify corticomotor alterations following therapeutic interventions as well as monitor disease progression.
The use of pre workout stimulating supplements has been on the rise and continues to increase with athletes and recreationally active humans endlessly seeking methods to improve their performance. This study used a pharmaceutical grade nutritional supplement termed ARK-16, containing L-arginine which is a precursor to nitric oxide (NO). NO is released from endothelial cells and is important in the regulation of vascular function and muscle blood flow in humans. PURPOSE: To examine the effects of L-arginine on vascular function and muscle blood flow during isometric handgrip to fatigue and to determine if the L-arginine supplement would lead to an increase in exercise tolerance as determined by the time to task failure during a handgrip fatigue test. For comparison purposes, the efficacy of the NO precursor L-arginine was determined relative to the maximal vasodilatory response of the brachial artery following sublingual administration of 0.4 mg nitroglycerin (GTN) tablet. The shear stress induced, endothelial dependent vascular response was determined using the flow-mediated dilation (FMD) technique. METHODS: Thirteen healthy men (23 ± 3 yrs.; 88.6 ± 17.5 kg; 183.0 ± 7.3 cm; 16.7 ± 7.7 Kg·m⁻²; means ± SD) completed an 8 day regimen of L-arginine loading (10g/day). Pre to Post measurements of the vascular response (i.e. FMD and GTN) were obtained using B-Mode ultrasonography. Mean blood velocity (MBV) was measured using 2-D Doppler velocimetry in the left brachial artery during baseline, exercise and recovery. RESULTS: Pre/Post L- arginine baseline artery diameter FMD and GTN was not different, however the change in arterial diameter Pre/Post L- arginine was different (p<0.05). Time to task failure was longer (p<0.05) following L-arginine supplement compared to Pre. CONCLUSION: These results indicate that eight days of L- arginine supplementation significantly improves the vascular response (both endothelial-dependent and endothelial-independent mechanisms). In addition, it appears that FMD response is independent of the shear stress stimulus since there was no difference in shear stress stimulus following L-arginine supplementation. The longer time to task failure following L- arginine supplementation is consistent with an improvement in performance reported in previous studies and may be related to an improvement in muscle blood perfusion and/or oxygen utilization.
15. **Soleus Corticospinal Excitability Predicts Self-Reported Disability in Patients with Chronic Ankle Instability**

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Neuromuscular dysfunction contributes to the functional impairments associated with chronic ankle instability (CAI). Corticospinal excitability pathways generate coordinated muscle activation patterns and may be a target for novel treatments used to improve dynamic ankle stability. However, the extent to which corticospinal excitability of the lower leg is associated with self-reported function is unknown. **PURPOSE:** Determine the relationship between self-reported disability and corticospinal excitability of the soleus in patients with CAI. **METHODS:** Twenty-one patients with CAI (9M/12F, 21.4±3.0 yrs, 171.1±8.3 cm, 69.8±11.9 kg) completed the Foot and Ankle Disability Index (FADI) and FADI-Sport (FADIs) questionnaires (FADI: 79.8±14.0%, FADI-S: 62.9±17.0%). Scores were reported as percentages with lower values indicating greater disability. Transcranial magnetic stimulation (TMS) was applied over the contralateral motor cortex to elicit motor evoked potentials (MEP) in the soleus of the injured limb. AMT was determined as the lowest intensity required to elicit measureable MEPs (>100µv) in 5 of 10 consecutive stimuli. Five peak-to-peak MEP amplitudes at a TMS intensity of 120% of active motor threshold (AMT) were normalized to muscle responses obtained from peripheral nerve stimulation over the tibial nerve and averaged. Pearson product-moment correlations were used to establish the relationship between soleus corticospinal excitability and self-reported disability (FADI and FADIs). Alpha levels were set a priori as P<0.05. **RESULTS:** A significant, strong, negative correlation was found between self-reported ankle disability and corticospinal excitability of the soleus (FADI: r=-0.716, P<0.001; FADIs: r=-0.627, P<0.001). This correlation indicates that CAI patients with greater perceived disability have higher corticospinal excitability of the soleus. **CONCLUSIONS:** Increased corticospinal excitability in patients with more ankle disability may be a mechanism to incorporate more voluntary control of muscles around the ankle and improve stability. Further studies should evaluate if the magnitude of soleus corticospinal excitability affects physical function in people with CAI. **Supported by the National Athletic Trainers’ Association Research and Education Foundation Osternig Master’s Research Grant**

16. **Relationship Between Ankle Swelling and Dynamic Stability Following Acute Lateral Ankle Sprains**

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The anterior reach (AR) of the Star Excursion Balance Test (SEBT), a measure of dynamic stability, has previously shown to be a predictor of lower extremity injury. Acute lateral ankle sprain (LAS) is the most prevalent lower extremity injury in sport, and a risk factor for the development of chronic ankle instability (CAI). It has been hypothesized that regaining AR following LAS may reduce the risk of future sprain. However, it is unknown what factors contribute to changes in AR following LAS as patients recover. **PURPOSE:** Determine the relationship between changes in pain, ankle range of motion, and ankle swelling, and changes in AR of the SEBT at 5 days (d) and 14d post-LAS. **METHODS:** Eight individuals with LAS (6F, 2M, 20.78±1.86yrs, 170.46±10.19cm, 69.01±18.11kg) participated. Measurements were conducted within the first 36 hours (h), 5d and 14d post-injury. Pain was quantified using a 10 cm Visual Analog Scale (VAS) where 0 indicates no pain and 10 indicates the worst pain possible. Ankle dorsiflexion (DF) was quantified in degrees; and swelling assessed using a figure of eight (FIG8) girth measurement in centimeters. The AR was performed with the patient standing on the injured limb while making a maximal reach anteriorly with the uninjured toe. AR distances were normalized as a percentage of leg length. Standardized change scores [(post-pre)/pre*100] were calculated between 36h-5d, and 36h-14d. Spearman Rank order correlations were used to determine the relationship between DF, VAS and FIG8 with AR. Alpha level was set a-priori as P<0.05. **RESULTS:** Between 36h-5d, there was a significant, strong, negative correlation between change scores of FIG8 (-0.53±1.57%) and AR (2.01±12.81%) (r=-0.905, P<.002). At 36h-14d, there was a significant, strong, negative correlation between FIG8 (-1.79±2.25%) and AR (9.28±15.89%; r=-.738, P=.037). VAS and DF did not significantly correlate at 5 or at 14 days (P>.05). **CONCLUSION:** The strong, negative correlations observed between FIG8 and AR indicates that as swelling decreases, dynamic stability increases. While pain and range of motion are commonly targeted following LAS, the change in the amount of swelling may have a greater influence on increasing dynamic stability. It is possible that joint effusion may play a role in stability of the joint independent of range of motion and pain.