Muscle volume is a critical determinant of rowing performance in Olympic rowers

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Published in:
Supplement 1 5S

DOI:
10.1249/01.mss.0000519047.24644.bc

Citation for published version (APA):

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Download date: 02 01 2019
METHODS: 23 C57BL/6 (WT) and 24 Transgenic (A1) mice were used for this study, with A1 mice overexpressing the protein PGC-1α. Mice were injected with either PBS or Bupivacaine (MAR) at 12 weeks of age. Tibialis anterior (TA) muscle and tibia were excised 3 days post injection. Tissue was immediately frozen for gene expression analysis using RT-qPCR.

RESULTS: There was no difference between TAMass/Tibia length ratio in any mice 3 days post injection. PGC-1α gene expression was 13-fold greater in the A1-PBS group compared to the WT-PBS group (p<0.05). The A1-MAR group however, expressed approximately 4-fold less PGC-1α compared to the A1-PBS group 3 days post injection (p<0.05). In WT mice, Myogenin gene expression was 1.5 fold greater in the MAR group compared to the PBS group (p<0.05), with no difference between A1 mice. There was a main effect of MAR to increase Myogenin gene expression in both WT and A1 mice. There was a main effect of genotype to decrease LDH-A expression ~50% in both A1 groups (p<0.05). There was a 4-fold increase in LDH-B expression in the A1-PBS group compared to the WT-PBS group (p<0.05). In WT mice, there was no effect of MAR on LDH-B gene expression. However, in A1 mice there was a 50% decrease in the A1-MAR group compared to the A1-PBS group (p<0.05). TNF-α increased approximately 2-fold as a response in both A1 groups (p<0.05).

CONCLUSION: A surplus of mitochondria may result in more ROS production and higher levels of TNF-α, resulting in altered expression of MyoD. With TNF-α possibly activating NF-κB, a nuclear factor shown to negatively regulate myogenin. The differential response in LDH-B expression suggests PGC-1α is involved in altering glycolytic energy metabolism at the onset of muscle regeneration.

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RELIABILITY AND COMPARISON OF MEASUREMENTS OF THE Tibialis POSTERIOR CROSS-SECTIONAL AREA VIA ULTRASOUND IMAGING

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(No relationships reported)

PURPOSE: The tibialis posterior is a key muscle in controlling the medial longitudinal arch. Being able to assess the strength, activity and size of the muscle is crucial in understanding its role in controlling the functions of the foot. Difficulties exist in directly imaging muscle due to the depth of its origin within the leg. This study’s purpose was to evaluate techniques used to image the TP muscle size using ultrasound.

METHODS: 10 legs of 5 healthy college students were imaged via ultrasound (12LM probe, GE Logiq P6) and the cross-sectional area and thickness of the TP was recorded. To measure the TP the probe was held at the 30% and then the 50% point from the knee joint line to the inferior tip of the lateral malleolus. Subjects inverted their foot and videos of the contraction were recorded. 2 separate still-shots of the muscle at rest were saved from the recorded videos to make size measurements. This process was performed on both anterior and posterior sides of the leg. To assess reliability intraclass correlation coefficients (ICC) were calculated. A correlation was performed to compare anterior to posterior measurements.

RESULTS: Excellent reliability was seen when comparing repeated measurements for anterior and posterior area and thickness measurements at the 30% point (ICC>0.96). There was a strong significant correlation between anterior and posterior measurements at the 30% mark (r=0.91, p<0.001). There was a non-significant weak correlation between anterior and posterior measurements at the 50% (r=0.31, p<0.19). The means and standard deviations of the cross-sectional area from the posterior view were 4.35 ± 0.49 cm² (30%) and 3.78 ± 0.47 cm² (50%). While the anterior view cross-sectional areas were 4.18 ± 0.49 cm² (30%) and 3.42 ± 0.46 cm² (50%).

CONCLUSION: Excellent measurements showed excellent reliability. At the 30% point, the anterior and posterior measurements were highly correlated, thus either position could be used to image the TP. The anterior view, at the 50% should generally not be used because portions of the TP were often hidden behind bone which decreased accuracy of the measurement.

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Thigh Muscle Architecture Changes During a Soccer Season in Previously Injured and Non-injured Female Athletes

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(No relationships reported)

Very little research has investigated muscle morphology and architectural characteristics changes on the individual thigh muscles during a competitive season in previously injured and non-injured collegiate athletes. Such research may provide important insight into sport-induced anatomical changes, which could have a significant impact on muscle performance and injury risks.

PURPOSE: To examine the influence of competitive women's college soccer participation on thigh and hamstring muscles' morphological and architectural characteristics.

METHODS: Eighteen soccer players (Previously injured n=8, age=20.43±0.90 yrs; Non-injured n=10: age= 20.31±1.38 yrs) volunteered to participate in the study. Participants reported a total of 4 times separated by 4 weeks during the season and underwent ultrasound testing to assess changes in muscle thickness (MT; cm), subcutaneous tissue thickness (ST; cm), pannier angle (PA;°), and echo intensity (EI) of the rectus femoris (RF), vastus medialis (VM), vastus medialis oblique (VMO), vastus lateralis (VL), vastus intermedius (VI), and biceps femoris (BF) muscles and high circumference measures using a tape measure. A 3-way (dominant side of the leg x injury history x time) ANOVA with repeated measure was used to analyze each variable. When interactions were present, Tukey-Kramer multiple comparison post-hoc tests were used.

RESULTS: MT of the RF, VI, VM, and VMO muscles increased between 4.4 and 14.5% at week 4 and 8 during the season (P<0.02) regardless of the dominant side of the leg or injury history. EI of RF, VL, and VM muscles decreased between 3.1 and 8.1% at week 4 and 8 during the season (P<0.01).

CONCLUSION: These results indicated that, muscle size and quality had improved in non-injured athletes but had diminished in those who were previously injured. Because no time-related differences in thigh circumference measures were observed it is possible that these measures may not be sensitive enough for detecting morphological changes. Given the relationship between muscle size and quality, it is possible that these unique morphological and architectural adaptations over time may influence athletic performance and/or potential risks of musculoskeletal injuries; however, future studies are needed to test these hypotheses.

Supported by NRI Grant 15-060

2690 Board #210
June 2 11:00 AM - 12:30 PM

MUSCLE VOLUME IS A CRITICAL DETERMINANT OF ROWING PERFORMANCE IN OLYMPIC ROWERS

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(No relationships reported)

BACKGROUND: Rowing races challenge rowers to combine high sprint and endurance capacity. Muscle morphology is an important determinant of sprint and endurance capacities and as such may also be a critical determinant of rowing performance.

PURPOSE: To determine how much of the rowing performance of Olympic rowers is explained by sprint and endurance capacity and by muscle morphology.

METHODS: 18 elite rowers (12 male, 6 female and 17 competed in different disciplines at the 2016 Olympics) performed a maximal incremental rowing test to obtain VO2max reflecting the endurance capacity. Sprint capacity was assessed by a 30-second Wingate cycling test and maximal isometric knee extension torque. Morphology of m. vastus
For the purpose of this discussion, it is important to understand the benefits and challenges associated with disuse atrophy and spaceflight. Disuse atrophy, often observed in the absence of activity, can lead to significant reductions in muscle mass and strength. In contrast, spaceflight, characterized by extended periods of disuse, presents a unique environment to study these effects. During spaceflight, muscles experience a lack of gravity, leading to atrophy. This is further complicated by the disuse associated with the sedentary lifestyle required for space missions.

Partial or Complete Unloading of Skeletal Muscle Leads to Specific Alterations of Anabolic Signal Transduction

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Consequences of disuse atrophy of skeletal muscle observed during spaceflight on astronaut health and performance are a focal point of space research. Decrements of both muscle mass and protein synthesis have been observed with exposure to varying muscle loading environments (1G = partial loading > 0G), and most of the reduced muscle mass can be attributed to diminished rates of synthesis. However, specific mechanisms behind unloading-dependent reductions of protein synthesis are not well defined.

**PURPOSE:** To determine whether or not alterations of anabolic signal transduction was responsible for the changes previously observed in fractional synthesis rates with specific gravitational loading paradigms.

**METHODS:** Female BALB/cByJ mice were normalized by bodyweight and assigned to normal cage ambulation (1G), partial weight bearing suspension tilted to approximately 33% bodyweight (G/3), partial weight bearing tilted to 16% bodyweight (G/6) and full unloading of hind limbs (0G) in specially designed cages. All mice were subjected to that loading environment for 21d prior to tissue harvest, and monitored daily. Immunoblotting of the gastrocnemius (n=23) was performed an acute RT by climbing. FDP muscle samples were obtained 2, 6 and 24 hours after RT.

**RESULTS:** Consecutive atrophy of skeletal muscle observed during spaceflight on astronaut health and performance are a focal point of space research. Decrements of both muscle mass and protein synthesis have been observed with exposure to varying muscle loading environments (1G = partial loading > 0G), and most of the reduced muscle mass can be attributed to diminished rates of synthesis. However, specific mechanisms behind unloading-dependent reductions of protein synthesis are not well defined.

**CONCLUSION:** In combination with previous data (unpublished observations), ambulation at G/3 is sufficient to maintain anabolic signaling capacity when compared to G/6 or 0G, suggesting that a threshold level of stimulus is necessary to maintain anabolic capacity in muscle. These results may have important implications towards the development of strategies designed to counter the effects of partial/complete unloading on skeletal muscle based on how the anabolic capacity of muscle is affected.