TACSM Abstract

Assessing the Qualitative Validity of a Non-Invasive Ultrasound Technique for Estimating Muscle Glycogen Change

JAKOB R. ALLEN

Human Performance Laboratory; Kinesiology and Health Education; University of Texas at Austin; Austin, TX

Category: Masters

Advisor / Mentor: Coyle, Edward (coyle@austin.utexas.edu)

ABSTRACT

Intramuscular glycogen is a primary fuel source for intense exercise and the use of an invasive muscle biopsy is still the gold-standard of measurement. **PURPOSE:** To assess the qualitative validity of a proprietary algorithm from ultrasound images (MuscleSound®)(MS) for determination of intramuscular glycogen concentration compared to the body of literature reporting muscle glycogen depletion from exercise and subsequent recovery. **METHODS:** 12 healthy recreational students (n=1 female) (25.5 ± 1.2y, 74.0 ± 2.6kg, 174 ± 4.48cm) were recruited from campus for participation in this study. Subjects performed six bouts of six-minute efforts on a stationary cycle ergometer at 84% of their VO_{2peak}; an exercise protocol designed to elicit substantial muscle glycogen depletion. Care was taken to maintain body hydration status. Each interval was followed by a six-minute rest period, during which time ultrasound images were taken of the vastus lateralis (VL), rectus femoris (RF) and gastrocnemius/soleus (GS) muscles. Images were processed using the MS algorithm which assigns a MS score (0-100) based on the opacity of the image. Following the exercise protocol, subjects remained in the laboratory for a six-hour recovery phase, wherein images were taken at the same three sites at two-hour intervals. A high carbohydrate (CHO) and protein (PRO) beverage was consumed immediately following exercise, and after two and four hours in order to assess the MS algorithm's ability to capture the qualitative pattern of glycogen resynthesis established in the literature. It was hypothesized that the VL and RF muscles would decrease in a curvilinear fashion during the intervals to a greater extent than the GS and that during the recovery phase these muscles would show an increase in MS units every two hours for six hours. **RESULTS:** In support of our hypothesis, we found that during exercise, MS values decreased in a curvilinear pattern in the VL with significantly lower values after bouts 3 through 6 versus baseline. The RF showed a similar pattern with bouts 4 through 6 being significantly lower than baseline, while the GS remained constant throughout. After 120 minutes of recovery the MS values of the VL and RF had returned to pre-exercise baseline levels. **CONCLUSIONS:** It is established in the literature that a nearly glycogen depleted muscle should take approximately 20 hours to return to full-capacity yet the MS technology estimated recovery in 2h. Therefore it is unclear whether the MS technology is truly capturing muscle glycogen concentration in its images. While effective in detecting expected directional qualitative changes, it is not clear if MS is valid for quantitative measurement of muscle glycogen concentration.