THE EFFECT OF HYDRATION STATUS AND MUSCLE GLYCOGEN ON MUSCLE SIZE AND ECHO INTENSITY

Matthew LeMay, April Krywe, Jacob Siedlik, Mitchel Magrini, Melani Kelly

Creighton University

Creighton University
College of Arts and Sciences
Department of Exercise Science and Pre-Health Professions

CURAS Center for Undergraduate Research and Scholarship

Utah Valley University

Purpose

To determine the effects of hydration status and muscle glycogen content on ultrasonography derived muscle size and echo intensity.

Methods

Twelve participants (F=7, Age: 23 ± 2.24 yr, Height: 168 ± 8.83 cm, Weight: 76 ± 17.11 kg) volunteered to complete five visits over seven days. To ensure participant CHO dietary restriction, participants were instructed to log all food for the study via MyFitnessPal. Urine specific gravity (Usg) and color (Ucol), body composition, and total body water were collected at the beginning of each visit to determine hydration status. Hydration status was measured using a handheld clinical refractometer. Panoramic ultrasound images of the right vastus lateralis were captured and assessed during each visit.

Study Protocol

	Day 1: V1	Day 2: V2	Day 3: V3	Day 6: V4	Day 7: V5
Condition	Baseline	Hypohydrated & glycogen rich	Hydrated & glycogen rich	Hypohydrated & Glycogen Depleted	Hydrated & Glycogen Depleted
Visit Goal Urine Color[13-15]	Habitual	Dark yellow	Pale yellow	Dark yellow	Pale yellow
Data Collected	IFC, HHQ, Height, Weight, Usg, US	Weight, Usg, US	Weight, Usg, US	Weight, Usg, US	Weight, Usg, US
End of Visit Instructions	Begin fluid restriction; Maintain normal diet	Discontinue fluid restriction; Maintain normal diet	Begin CHO restriction 72 h & fluid restriction 24 h before V4	Discontinue fluid restriction; maintain CHO restriction.	Resume normal diet & fluid intake.
Time between visits	24±1 h	24±1 h	72±1 h	24±1 h	

Abbreviations: V# = visit #[1-5]; ICF = informed consent; HHQ = health history questionnaire; Usg = urine specific gravity; US = ultrasound; CHO = carbohydrate. Notes: Visits are when participants will show up for data collection. Color in goal urine color box is matched to the goal urine scale color.

Results

Changes in vastus lateralis cross-sectional area and echo intensity were measured using a 1 x 5 repeated measures ANOVA. There were no significant differences in either CSA (HH: 21.36 ± 6.12 cm^2, DhyGlyR: 21.28 ± 6.73 cm^2, HyGlyR 21.90 ± 6.32 cm^2, DhyGlyP: 20.51 ± 5.93 cm^2, HyGlyP: 20.05 ± 7.31 cm^2, p = .961) or echo intensity (HH: 126.33 ± 32.88 au, DhyGlyR: 126.38 ± 32.38 au, HyGlyR 129.65 ± 34.51 au, DhyGlyP: 127.76 ± 32.75 au, HyGlyP: 132.86 ± 31.89 au, p = .986).

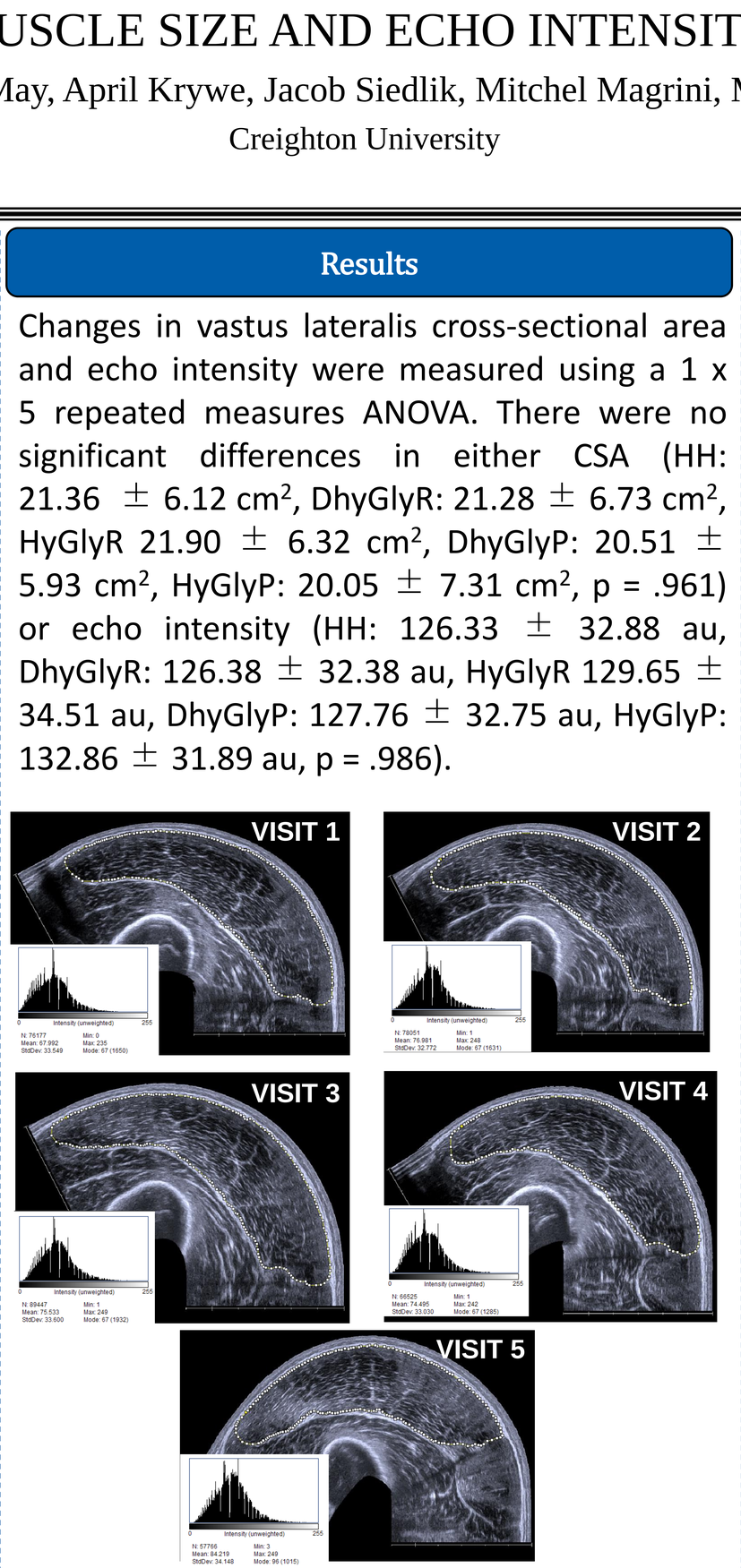

Figure 1. Ultrasounds with histograms show no significant change over the course of the 7 days with each taken at every visit. Visit 1 (top-left), Visit 2 (top-right), Visit 3 (middle-left), Visit 4 (middle-right), and Visit 5 (bottom).

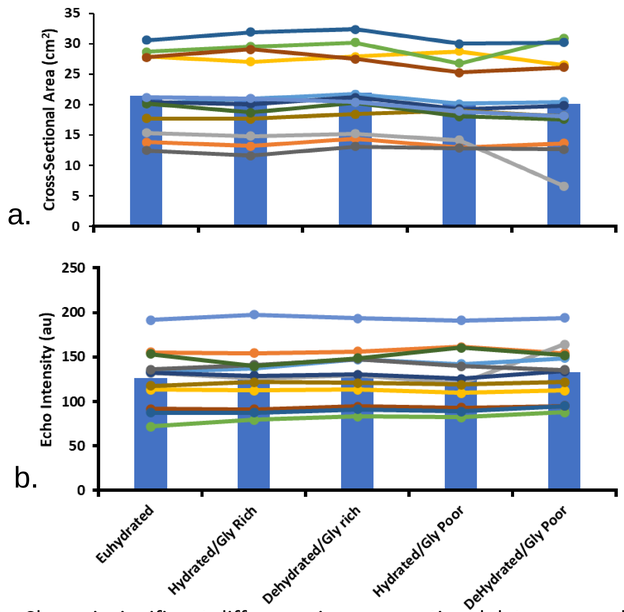

Figure 2a. Shows insignificant difference in cross-sectional data over each visit of hydration and glycogen (Gly) state going left (visit 1, Euhydrated) to right (visit 5, Dehydrated/Gly Poor).
Figure 2b. Shows insignificant difference in Echo Intensity over each visit.

Conclusions

These data suggest that muscle glycogen content and/or general hydration levels do not significantly impact ultrasonographic derived muscle cross-sectional area or echo intensity. However, the impact of muscle glycogen on skeletal muscle size and echo intensity should be examined by a more direct measure of muscle glycogen (i.e., skeletal muscle biopsy) to confirm these results.

Practical Applications

This data suggest that hydration status or muscle glycogen levels do not influence muscle size and EI in younger adults. This study contributes valuable information for clinicians and practitioners who utilize ultrasonography in assessing muscle architecture.