The Effect of Dehydration and High-Volume Resistance Exercise on Intracellular and Local Muscular Fluid Shifts - A Pilot Study

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ABSTRACT

Hypertonic hypovolemia (dehydration) could disrupt the balance between extracellular water (ECW) and intracellular water (ICW). Notably, high-volume resistance exercise (RE) accumulates metabolites resulting in acute muscle swelling (increased ICF). However, the impact of hypertonic hypovolemia state on ECW and ICW distribution after RE is not known. **PURPOSE**: To determine the effect of acute dehydration on fluid balance after RE. **METHODS:** 7 resistance-trained males completed two identical high-volume RE, separated by two weeks (bilateral leg press and knee extensions exercises [5 sets of 10 repetitions at 80% of 1 repetition maximum]) either in a euhydrated (EH; urine specific gravity [USG] < 1.020) or dehydrated state (DH; USG ≥ 1.020; 24hr fluid fast). Total body water (TBW) and the ratio of ICW to ECW (ICW/ECW) were measured using bioelectrical impedance spectroscopy before (PRE), 1h, and 3h after RE. The rectus femoris thickness (RFT) was imaged using ultrasound at PRE, immediately (IP), 10m, 15m, and 30m after RE. Vastus lateralis samples were collected at PRE, 1h, and 3h and were immediately weighed (Wt) before and after heating at 80°C for 55 minutes. Repeated measures ANOVAs were used to identify the differences, and effect sizes were calculated if *p* values were trending. **RESULTS:** A significant ($p < 0.05$) condition effect was observed for TBW, while a time effect was observed for ICW/ECW and RFT. For TBW, EH (1.00±0.06L) was greater than DH (0.95±0.05L). For ICW/ECW, PRE (1.00±0.00L) was lower than 1h (1.05±0.10L) and 3h (1.03±0.05L), while 1h was greater than PRE and 3h. For RFT, PRE (17.1±0.9mm) was less thick than IP (23.7±0.9mm), 10m (22.3±1.0mm), 15m (22.0±0.9mm), and 30m (21.5±1.0mm) while IP was thicker than all time points. Furthermore, EH (22.8±1.4mm) trended to have thicker RFT than DH (19.9±0.8mm; $p=0.082$; Cohen's $f = 0.85$; large effect size). Additionally, a significant condition x time effect was observed for Wt. For Wt, EH (1.07±0.04mg) had a greater change in muscle weight than DH (1.01±0.06mg) at 1h. **CONCLUSION:** These results suggest that high volume RE can cause fluid shift from the extracellular to the intracellular compartment (i.e., increase ICW/ECF and RFT) regardless of the hydration status. Intriguingly, at the intramuscular level, it appears that the intramuscular water content after RE is less in dehydrated than euhydrated state (i.e., less changes in Wt).