TACSM Abstract

Impact of Fluid Consumption on Estimates of Intracellular, Extracellular, and Total Body Water from Multi-Frequency Bioelectrical Impedance Analysis

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ABSTRACT

Multi-frequency bioelectrical impedance analysis (MFBIA) is able to distinguish between total body water (TBW), extracellular water (ECW) and intracellular water (ICW). Low-frequency currents are thought to primarily pass through ECW, while high-frequency currents pass through all body fluids (i.e., TBW). ICW can then be estimated by subtracting ECW from TBW. As such, MFBIA may have utility for monitoring health conditions resulting in water retention within specific fluid compartments. However, the sensitivity of fluid estimates from MFBIA is not fully established. **PURPOSE**: To evaluate the effects of acute fluid ingestion on body water estimates produced by a MFBIA analyzer. **METHODS**: Sixteen adults (8 F, 8 M; age: 22.0 ± 2.9 y; height: 173.6 ± 9.9 cm; weight: 74.3 ± 21.6 kg; body fat %: 16.7 ± 8.1%) participated in a randomized crossover study consisting of two conditions: 1) no fluid ingestion (control; C); and 2) acute ingestion of 11 mL/kg of bottled water (W). In both conditions, participants reported to the laboratory after an overnight food and fluid fast for serial assessments using 8-point standing MFBIA. An initial MFBIA assessment was performed at baseline, followed by a 5-minute period during which water was ingested (W condition) or the participant continued to rest in the lab (C condition). Beginning 10 minutes after this time period, participants were assessed by MFBIA every 10 minutes for one hour. Participants stood upright for the entirety of each research visit. Analysis of variance with repeated measures was used to examine differences in MFBIA estimates of body mass (BM), TBW, ECW, and ICW between conditions and across time. Follow-up pairwise comparisons were performed and partial eta-squared (η_p^2) effect sizes were calculated. **RESULTS**: A group-by-time interaction was present for BM ($p<0.0001$; η_p^2: 0.89) but not TBW ($p=0.74$; η_p^2: 0.03), ECW ($p=0.85$; η_p^2: 0.02), or ICW ($p=0.87$; η_p^2: 0.05). Follow-up indicated that BM did not differ between conditions at baseline but was ~0.6 ± 0.2 kg higher in the W condition as compared to C at all post-baseline time points ($p<0.01$ for all). Additionally, time main effects indicated that TBW and ICW estimates decreased by 0.2 to 0.4 kg relative to baseline beginning at 30 minutes after the fluid ingestion timepoint, regardless of condition ($p\leq0.02$ for 30, 40, 50, and 60 minute time points; η_p^2: 0.29 to 0.38). No significant effects were observed for ECW. **CONCLUSION**: The lack of change in body fluids with acute water ingestion likely indicates that: 1) within one hour, ingested water has not been assimilated into body fluids to the extent that it is detectable by MFBIA; or 2) the quantity of fluid ingestion is below the detection limits of the MFBIA analyzer. In support of the first point, it is likely that bioelectrical currents do not penetrate the gastrointestinal tract, meaning fluids contained therein are unlikely to be detected by MFBIA as fluids.