TACSM Abstract

Differential Effects of Oral vs. Intravenous Fluid Administration on Bioelectrical Impedance During Dehydration Induced by Exercise and Heat

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ABSTRACT

There is continued debate regarding optimal evaluation of hydration. Bioimpedance analysis has been utilized to evaluate hydration status, but there is limited information regarding the ability of this technology to detect physiological changes occurring during acute dehydration. **PURPOSE**: To evaluate whether bioimpedance spectroscopy (BIS) detects changes in bioelectrical resistance (R) in response to dehydration induced by exercising in the heat, assess whether these changes are related to body mass changes, and determine if the route of fluid administration during the dehydration protocol influences these observations. **METHODS**: Twelve males (mean ± SD; age: 28.6 ± 12.4 y; body mass: 74.7 ± 7.9 kg; height: 179.4 ± 7.0 cm; VO2max: 49.8 ± 6.6 mL/kg/min) completed two randomized experimental trials, each consisting of 90 minutes of continuous cycling exercise at 55% VO2max followed by a 12 km time trial in the heat (ambient temperature: 34.9 ± 0.6 °C; relative humidity: 30.3 ± 0.9 %; wind speed: 3.4 mile·h^{-1}). During each trial, fluid was administered either orally (DRINK) or intravenously (IV). During the DRINK trial, participants drank 25 mL of water every 5 minutes. During the IV trial, participants received 25 mL of isotonic saline solution through their IV catheter every 5 minutes. Nude body mass and BIS data were collected before and after trials to assess hydration status. Data were analyzed using Pearson's correlations and paired t-tests with p-values corrected via false discovery rate. **RESULTS**: Body mass decreased, without differences between conditions (IV: -2.3 ± 0.5%; DRINK: -2.4 ± 0.9%; p=0.85). However, significant differences were observed for changes in predicted R at zero frequency (R0; IV: -3.6 ± 4.6%; DRINK: 1.3 ± 5.6%; p=0.02) and R at 50 kHz (R50; IV: -3.2 ± 4.1%; DRINK: -0.2 ± 4.1%; p=0.04), without differences in predicted R at infinite frequency (R∞; IV: -2.4 ± 6.1%; DRINK: -1.1 ± 3.7%; p=0.45). In the IV condition, significant correlations between body mass changes and R changes were observed for R0 (r=-0.80; p=0.002), R50 (r=-0.85; p<0.001), and R∞ (r=-0.84; p<0.001); however, no correlations were observed in the DRINK condition (r=-0.06 to 0.13; p≥0.69 for each). **CONCLUSION**: Differences between oral and intravenous fluid administration were seemingly detected by bioelectrical resistance at low-to-moderate, but not high, frequencies. With intravenous administration, negative correlations between changes in body mass and changes in R at all frequencies were observed, unlike with oral fluid administration. These findings suggest a potential sensitivity of bioimpedance technologies for monitoring intravenous fluid administration in the context of acute dehydration. However, additional investigation is needed to confirm their utility during distinct fluid loss scenarios and to confirm if these technologies are useful in the context of oral intake of fluids varying in composition.