Acute Water Ingestion Does Not Influence Percent Body Fat Using Bioelectrical Impedance Analysis

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Introduction

The rising rates of overweight and obesity among military personnel is a concern, especially since Soldiers are required to be physically fit to ensure that they can perform their occupational duties and meet mission requirements. The Army has authorized the use of multi-frequency bioelectrical impedance analysis (MF-BIA) as a supplemental body fat assessment for Soldiers who do not meet height and weight standards and fail the circumference-based tape test. While MF-BIA can provide valuable information, including lean body mass (LBM), fat mass (FM), body fat percentage (%BF), and total body water (TBW), external factors such as fluid intake may influence body composition parameters. For military personnel, the accuracy of supplemental body fat assessments is especially important, as failing body composition standards could negatively impact or end a service member's career. Despite this, standardization of water ingestion prior to MF-BIA has yet to be established.

Purpose:

1. To determine the change in body composition estimates (BCE) following water intake.
2. To explore the relationship between relative acute water ingestion (ml·kg^{-1}) and BCE.

Methods

Eleven healthy, active-duty military personnel (n = 5 male, n = 6 female; age 32.5 ± 8.3 years; bodyweight [BW] 75.3 ± 11.8 kg; LBM 31.0 ± 8.3 kg; FM 17.3 ± 6.5 kg; %BF 23.2 ± 8.4%; TBW 42.4 ± 8.4 kg) were randomized to a water intake group (250 mL, 500 mL, or 1000 mL). Figure 1 shows the schematic of the study design.

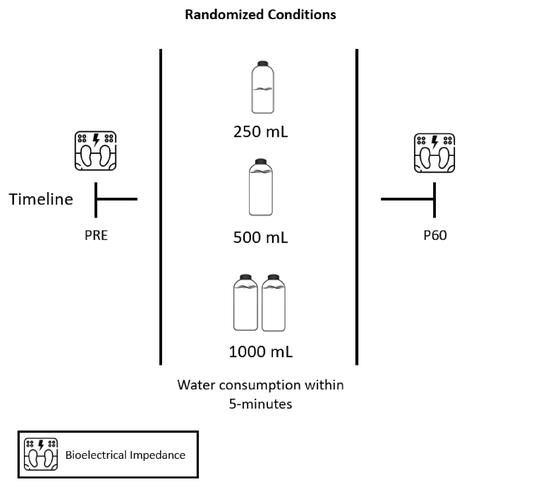

Figure 1. Schematic representation of the experimental sessions.

- Participants arrived at the lab in physical fitness uniform after an overnight fast (>8 hours, to include no water).
- Hydration status was confirmed via urine specific gravity (USG) using a digital refractometer (euhydration: USG ≤1.025) prior to taking baseline MF-BIA measurements. If USG was >1.025, participants were asked to reschedule.
- Body composition assessments using MF-BIA were collected at baseline (PRE) and 60-minutes after water consumption (P60).
- Intervention: Participants were given five minutes to consume 250 mL, 500 mL, or 1000 mL of water before starting the 60-minute timer.

Acute water ingestion (~8.0 ml·kg^{-1}) significantly increased BW, which was **detected as FM** via MF-BIA after 60 minutes.

Any water intake will negatively influence BCE, **regardless of dose.**

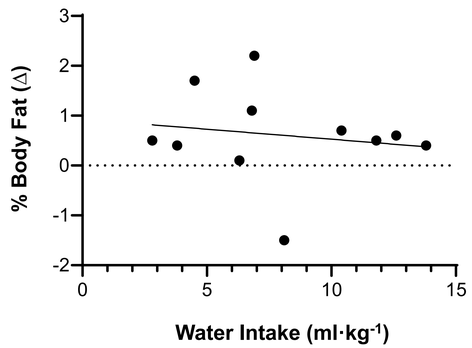

Figure 2. Correlation between the change in %BF based on water intake (ml·kg^{-1}), r = -0.16

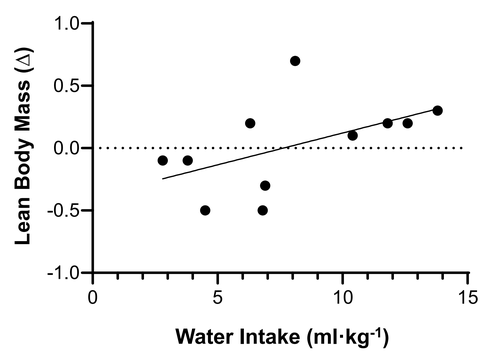

Figure 3. Correlation between the change in LBM based on water intake (ml·kg^{-1}), r = 0.52

Methods (cont)

Water consumption was normalized to body weight (ml·kg^{-1}) for all analyses. The change in body composition parameters (PRE to P60) were determined via paired-samples *t*-test. A linear regression analysis examined the relationship between acute water ingestion, normalized to body weight (ml·kg^{-1}), on BCE. An alpha level of ≤ .05 was used to determine statistical significance.

Results

Table 1. Group characteristics (n = 11)

Age (years)	32.5 ± 8.3
USG	1.017 ± 0.003
BW (kg)	75.3 ± 11.89
LBM (kg)	31.0 ± 8.3
FM (kg)	17.3 ± 6.5
%BF (%)	23.2 ± 8.4
TBW (kg)	42.4 ± 8.4

USG, urine specific gravity; BW, bodyweight; LBM, lean body mass; FM, fat mass; %BF, percent body fat; TBW, total body water

On average, participants ingested approximately 8.0 ml·kg^{-1} of water.

- Between PRE and P60:
  - There was a significant increase in:
    - BW (+0.4 ± 0.4 kg; p = .002)
    - FM (+0.6 ± 0.6 kg; p = .009)
  - There was a non-significant increase in:
    - %BF (+0.6 ± 0.9%; p = .057)
  - There were no significant differences in:
    - LBM (+0.2 ± 0.4 kg; p = .871)
    - TBW (-0.1 ± 0.5 kg; p = .599)
- Based on the linear regression model, relative acute water intake did not significantly predict changes in %BF (F[1,9] = .229, p = .664) or LBM (F[1,9] = 3.342, p = .101).

Conclusion

Acute water ingestion significantly increases BW and FM; however, no significant changes in %BF, LBM, or TBW were detected. Furthermore, relative acute water ingestion was not a significant predictor of changes in LBM or %BF in healthy, active-duty service members.

Practical Applications

Consuming 8.0 ml·kg^{-1} of water does not seem to negatively impact body composition in our sample of healthy, active-duty military personnel. For military personnel near the %BF cut-offs, any increase, from water intake or standard device error, can be concerning, since %BF is the only body composition parameter that the military uses for retention. Future research, especially with an adequate sample size, is needed to determine if ingesting an amount greater than 8.0 ml·kg^{-1} may negatively influence BCE.

References

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