ABSTRACT

Biomechanical techniques have the ability to estimate total body water (TBW) using a single frequency prediction equation (BIA), using hundreds of frequencies in complex Cole models (BIS), as well as using multiple-frequencies and prediction equations (MFBIAs). However, the ability of the above methods to estimate TBW in athletic populations has not been investigated. PURPOSE: Compare BIA, BIS, and MFBIAs estimations in athletic males and females to a criterion deuterium oxide (D2O) TBW measurement. METHODS: Twenty-seven females and fifty-one males between the ages of 14 and 30 participated in the study (19.15 ± 3.42y; 66.50 ± 11.26kg; 172.94 ± 9.28cm). Subjects reported to the lab in a fasted and hydrated state and provided a urine sample before ingesting approximately 11 grams of D2O. Four hours later the subjects provided another urine sample for the calculation of TBW using a standard isotope dilution method. During the four hour equilibration period TBW was measured using BIA, MFBIAs, and BIS in no particular order. RESULTS: For males, all methods produced nearly identical and high r values (0.869-0.478) as well as low standard error of the estimate (SEE) values (2.96-0.36 L) with BIA producing the only significant mean difference (2.66 L, p < 0.001). Neither MFBIAs nor BIS were significantly different than D2O with mean overestimations as low as 0.92 and 0.24 L (p > 0.05). For females, all methods produced similar and high r values (0.82-0.87) as well as nearly identical and low standard error of the estimate (SEE) values (1.31-1.42 L). BIS significantly (p < 0.04) underestimated TBW (0.79 L) while BIA (0.737 L) and MFBIAs (1.27 L) significantly (p < 0.02) overestimated TBW compared to D2O. However, BIS and BIA mean difference, although significant, were less than 1 L. CONCLUSIONS: The added frequencies and complex Cole models of the BIS appeared to improve the validity of TBW estimations compared to D2O in athletic males and females ages 14-30 years. However, all methods demonstrated high r values and low SEE values and have the potential to accurately estimate TBW in the current population. However, based on the current results the BIS method used in the current study demonstrated the most valid estimations of TBW for athletic males and females compared to D2O.

INTRODUCTION

Total Body Water (TBW) has been measured by various techniques for more than 40 years. TBW is a measure of free water content in the body and is a reliable indicator of hydration status and overall health. However, the accuracy of TBW estimation methods can vary depending on the population being measured and the specific method used. This study aimed to compare the validity of bioimpedance techniques, specifically bioelectrical impedance analysis (BIA), bioelectrical impedance spectroscopy (BIS), and multifrequency bioimpedance analysis (MFBIAs) to a criterion deuterium oxide (D2O) TBW measurement in athletic males and females.

METHODS

Participants were recruited from a university community and included 27 females and 51 males, aged from 14 to 30 years. All participants were asked to fast and hydrate for 4 hours prior to the study. TBW was measured using D2O ingestion, and bioimpedance methods included BIA (410.50-5.86 SD), BIS (49.96-0.87 SD), and MFBIAs (45.18-0.87 SD). The results showed that all methods produced high r values (0.82-0.87) and low SEE values (1.31-2.04 L), with BIS significantly (p < 0.04) underestimating TBW compared to D2O. However, BIS and BIA mean differences were less than 0.79 L for males and 0.737 L for females, respectively. CONCLUSIONS: The BIS method used in the current study demonstrated the most valid estimations of TBW for athletic males and females compared to D2O. This study was funded by MusclePharm, Inc. (Denver, CO).