TACSM Abstract

Validity of Four-Compartment Models when Estimating Bone Mineral Content and Total Body Water with Single-Frequency Bioimpedance

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ABSTRACT

Bone mineral content (BMC) and total body water (TBW) are commonly assessed via dual energy X-ray absorptiometry (DXA) and bioimpedance spectroscopy (BIS), respectively, for a criterion 4-compartment body composition model ($4C_{CRITERION}$). However, single-frequency bioelectrical impedance analysis (SF-BIA) has been proposed as an alternative for calculating BMC and TBW. **PURPOSE:** The purpose of this study was to compare 4C models for body fat percent (BF%), fat-free mass (FFM), and fat mass (FM) when using SF-BIA individually for the estimation of BMC ($4C_{BMC}$) and TBW ($4C_{TBW}$) or in combination ($4C_{BMC+TBW}$). **METHODS:** Seventy-one men and seventy women (n=141) participated in this study (age=23±5 years). $4C_{CRITERION}$ was derived using underwater weighing (UWW) for body volume (BV), BIS for TBW, and DXA for BMC. 4C prediction models were as follows: $4C_{BMC}$ = UWW for BV, BIS for TBW, and SF-BIA for BMC; $4C_{TBW}$ = UWW for BV, DXA for BMC, and SF-BIA for TBW; $4C_{BMC+TBW}$ = UWW for BV and SF-BIA for BMC and TBW. **RESULTS:** The standard error of estimate (SEE) and total error (TE) was smallest for $4C_{BMC}$ in men (BF% = 0.53 and 0.60%; FFM = 0.42 and 0.48kg; FM = 0.43 and 0.48kg, respectively) and women (BF% = 0.48 and 0.50%; FFM = 0.27 and 0.28kg; FM = 0.27 and 0.29kg, respectively). However, $4C_{TBW}$ and $4C_{BMC+TBW}$ also produced acceptable individual error in both sexes (SEEs = 1.19-1.37% and TEs = 1.44-1.83% for BF%; SEEs = 0.73-0.96kg and TEs = 1.09-1.36kg for FFM; SEEs = 0.79-1.00kg and TEs = 1.10-1.36kg for FM). **CONCLUSIONS:** $4C_{BMC}$ produced the smallest individual error of all the 4C prediction models when using SF-BIA. However, $4C_{TBW}$ and $4C_{BMC+TBW}$ also produced acceptable SEEs and TEs. This indicates that a 4C model could potentially be utilized with only 2 methods (UWW and SF-BIA).