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

KASSANDRA A. JARAMILLO1, ALEXANDRA LOREDO1, GRANT M. TINSLEY2, and BRETT S. NICKERSON1

1Exercise Physiology Laboratory; Department of Professional Programs; Texas A&M International University; Laredo, TX
2Department of Kinesiology and Sport Management; Texas Tech University; Lubbock, TX

Category: Undergraduate

Advisor / Mentor: Nickerson, Brett (brett.nickerson@tamiu.edu)

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\textsubscript{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\textsubscript{BMC}) and TBW (4C\textsubscript{TBW}) or in combination (4C\textsubscript{BMC+TBW}). **METHODS:** Seventy-one men and seventy women (n=141) participated in this study (age=23±5 years). 4C\textsubscript{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\textsubscript{BMC} = UWW for BV, BIS for TBW, and SF-BIA for BMC; 4C\textsubscript{TBW} = UWW for BV, DXA for BMC, and SF-BIA for TBW; 4C\textsubscript{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\textsubscript{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\textsubscript{TBW} and 4C\textsubscript{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\textsubscript{BMC} produced the smallest individual error of all the 4C prediction models when using SF-BIA. However, 4C\textsubscript{TBW} and 4C\textsubscript{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).