

Assessment of Youth Athlete Body Composition using Bioimpedance Techniques as Compared to a Three-Compartment Model

JACOB J. GREEN¹, ABBY AMBROSIUS², CHRISTOPHER DODGE², BRANDON MERFELD², CHINGUUN KHURELBAATAR², MAKENNA CARPENTER², PATRICK HARTY¹, CHRISTIAN RODRIGUEZ¹, MADELIN SIEDLER¹, MATTHEW STRATTON¹, DALE KEITH¹, JAKE BOYKIN¹, ANDREW R. JAGIM^{2,3}, GRANT M. TINSLEY¹

¹Energy Balance & Body Composition Laboratory; Department of Kinesiology & Sport Management; Texas Tech University, Lubbock, TX. ²University of Wisconsin - La Crosse, La Crosse, WI. ³Mayo Clinic Health System, Onalaska, WI.

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Advisor / Mentor: Tinsley, Grant (grant.tinsley@ttu.edu)

ABSTRACT

Body composition is believed to contribute to success in many sports. For this reason, assessment of body composition with various devices is commonly performed. The agreement between devices warrants exploration, particularly in groups with limited data, such as youth athletes. **PURPOSE:** To determine the agreement between a 3-compartment model (3C) and bioelectrical impedance analysis (BIA) devices for assessing body composition in youth athletes. **METHODS:** The body composition of 90 youth athletes was evaluated (51 F, 39 M; age: 18.2±2.4 y; body mass: 69.0±12.5 kg; height: 172.0±9.9 cm; BMI: 23.2±3.2 kg/m², BF%: 19.7±6.9%). 3C values were produced using body volume from an underwater weighing system, body water from bioimpedance spectroscopy (ImpediMed SFB7), and body mass from a calibrated scale. Additionally, three BIA techniques were performed: a consumer-grade standing hand-to-foot analyzer (InBody H2ON; BIA_{INBODY}), a consumer-grade standing foot-to-foot analyzer (Tanita BF-680W; BIA_{TANITA}), and a laboratory-grade supine hand-to-foot analyzer (RJL Quantum IV; BIA_{RJL}). Bioimpedance from BIA_{RJL} was inserted into the Matias FFM equation for athletes. BIA BF% and FFM values were compared to 3C values using paired t-tests, Pearson correlations, and the standard error of the estimate (SEE). **RESULTS:** 3C BF% estimates did not differ from BIA_{INBODY} (-0.9%, 95% CI: -2.1, 0.2) or BIA_{RJL} (0.2%, 95% CI: -0.8, 1.2%). However, BF% was underestimated by BIA_{TANITA} relative to 3C (-2.7%, 95% CI: -4.1, -1.2). All BIA BF% estimates were significantly correlated with 3C (*r*: 0.59 to 0.73; *R*²: 0.35 to 0.53, *p*<0.0001 for all). SEE values for BF% ranged from 4.7 to 5.6%. 3C FFM estimates did not differ from BIA_{INBODY} (0.8 kg, 95% CI: -0.1, 1.6) or BIA_{RJL} (0.1 kg, 95% CI: -0.6, 0.9). However, FFM was overestimated by BIA_{TANITA} relative to 3C (1.8 kg, 95% CI: 0.7, 2.8). All BIA FFM estimates were significantly correlated with 3C (*r*: 0.92 to 0.97; *R*²: 0.85 to 0.93, *p*<0.0001 for all). SEE values for FFM ranged from 3.2 to 4.8 kg. **CONCLUSION:** This study demonstrated potentially acceptable agreement between 3C BF% and FFM estimates and those from BIA_{INBODY} and BIA_{RJL}, with the athlete-specific equation used with BIA_{RJL} demonstrating the best performance. In contrast, the consumer-grade foot-to-foot analyzer underestimated BF% and overestimated FFM. These findings may help inform practical and accurate body composition estimation in youth athletes.