

Comparison of Laboratory-Grade and Consumer-Grade Hand-to-Foot Bioelectrical Impedance Analyzers for Body Composition Estimation

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ABSTRACT

Bioelectrical impedance analysis (BIA) is a simple and effective technique to estimate body composition, including body fat percentage (BFP). While these analyzers are a popular method of describing a person's body composition, laboratory-grade devices are expensive and inaccessible to most people. As a result, they may be an unrealistic method for consumers to use. However, consumer-grade devices are increasingly available. **PURPOSE:** The purpose of this study was to compare laboratory-grade and consumer-grade bioelectrical impedance analyzers. **METHODS:** Seventy-five adults (40 F, 35 M) were evaluated using a laboratory-grade, hand-to-foot, multifrequency bioelectrical impedance analyzer (BIA_{LAB}; Seca mBCA 515) and a consumer-grade, hand-to-foot, single frequency bioelectrical impedance analyzer (BIA_{CON}; Omron HBF-516). Both devices administer undetectable electrical pulses through one extremity that are measured at another extremity, where the voltage drop (impedance) is determined. This information is used to estimate body fluids and composition. **RESULTS:** A strong, statistically significant correlation between devices was observed for BFP ($r: 0.93, R^2: 0.87, p < 0.001$). However, BIA_{CON} overestimated BFP by $3.5 \pm 3.4\%$ (mean \pm SD) relative to BIA_{LAB} (BIA_{CON}: $28.3 \pm 9.6\%$; BIA_{LAB}: $24.8 \pm 9.3\%$; $p < 0.001$). The standard error of the estimate (SEE) between devices was 3.3%, and the 95% limits of agreement from Bland-Altman analysis were $\pm 6.7\%$. **CONCLUSION:** These results collectively suggest that while the laboratory-grade and consumer-grade analyzers in our study exhibit strong correlations when assessing a group of individuals, the consumer-grade device overestimates BFP. Additionally, the SEE indicates that 3.4% error can be expected with the consumer-grade device. Overall, the Omron HBF-516 consumer-grade device may be an adequate and affordable option to estimate body composition in some contexts, but results should be interpreted cautiously when used in individuals.