Day-to-Day Precision Error and Least Significant Change for Two Commonly Used Bioelectrical Impedance Analysis Devices

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Category: Doctoral

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ABSTRACT

Bioelectrical impedance analysis (BIA) devices administer electrical currents through surface electrodes to estimate overall body fluids from the measured resistance and reactance of bodily tissues. The proportion of fat versus fat-free mass can be further estimated by these devices using algorithms developed from reference data. BIA devices are commonly used in field as well as laboratory settings due to their convenience, ease of use, and relatively low cost. **PURPOSE**: The purpose of this study was to determine the day-to-day precision error (PE) and least significant change (LSC) of the percent body fat (PBF), fat mass (FM), and fat-free mass (FFM) estimated by two commonly used BIA devices, the InBody 770 and the Omron HBF-306. **METHODS**: Seventeen healthy participants (7 males, 10 females) were included in this analysis. Participants visited the laboratory on two separate occasions no more than 48 hours apart and abstained from all food, fluid, caffeine, and alcohol for at least 8 hours prior to each visit. Height and weight were measured using a Seca 769 stadiometer and digital scale. PE was calculated as $\sqrt{\sum SD^2/n}$, where SD is the within-subject standard deviation. LSC was calculated as 2.77 * PE to reflect a 95% confidence level. **RESULTS**: Participants had a mean ±SD age of 27.1 ±8.3 years, height of 171.6 ±8.5 cm, and weight of 68.0 ±10.6 kg. PE for the InBody was 1.0%, 0.7 kg, and 0.9 kg for PBF, FM, and FFM, respectively; PE for the Omron was 0.6%, 0.4 kg, and 0.6 kg for the same variables. The LSC values of each variable for the InBody were 2.8%, 1.9 kg, and 2.4 kg for PBF, FM, and FFM, respectively; the LSC values for these variables were 1.5%, 1.0 kg, and 1.6 kg for the Omron device. **CONCLUSION:** Individuals looking to use BIA as a method of detecting true changes in body composition over time should be aware that day-to-day measurement error between estimates were as as high as 1.0% for body fat, 0.7 kg for fat mass, and 0.9 kg for fat-free mass in the current study; therefore, changes within these parameters likely reflect error of measurement and not true physiological differences. Additionally, changes over time between estimates from an InBody 770 device should meet or exceed a difference of at least 2.8% body fat, 1.9 kg FM, or 2.4 kg FFM to increase confidence that the differences are a reflection of physiological changes rather than between-day measurement error; differences between readings from an Omron should meet or exceed 1.5% body fat, 1.0 kg FM, or 1.6 kg FFM for this purpose. The InBody 770 demonstrated higher precision error and thus may entail a higher least significant change to meaningfully detect true physiological changes between time points. However, the observed differences in these values between the InBody 770 and Omron HBF-306 may also indicate that the InBody 770 is more sensitive to small but real changes in bioelectrical impedance values between days. Longitudinal studies are needed to elucidate the comparative tracking validity of these commonly used BIA devices in healthy populations.