Comparison of Air Displacement Plethysmography and Whole Body Bioelectrical Impedance in Middle-Aged Women

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Hydrostatic weighing is the gold standard of body composition measurement. However, it is difficult to use due to a high participant burden. Air displacement plethysmography (ADP) provides an alternative that agrees within 1% body fat with hydrostatic weighing for both lean and obese adults. Although participant burden is decreased, use of ADP in the field remains problematic due to portability issues. A portable body composition measure is needed for field work that is both accurate and does not overly burden participants. Multifrequency whole body bioelectrical impedance (BIA) is both portable and involves minimal burden, but its accuracy in different populations has yet to be determined.

PURPOSE:
To compare the accuracy of multifrequency whole body BIA (Bodystat QuadScan 4000) with ADP for measurement of body composition in middle-aged women.

METHODS:
Twenty-four healthy women between the ages of 40 – 55 (46.5 ± 1.0 years) with height 161.6 ± 1.4 cm, weight 68.7 ± 2.2 kg, and mean body mass index (BMI) 26.3 ± 0.9 kg/m² were assessed in a laboratory setting by ADP followed immediately by multifrequency whole body BIA. BIA measurements were standardized so that participants remained supine for five minutes in order to allow fluid levels to stabilize prior to testing.

RESULTS:
Absolute lean mass was 42.7 ± 0.8 kg and 44.4 ± 0.9 kg with ADP and BIA respectively (p <0.01), while absolute fat mass was 26.1 ± 1.9 kg for ADP and 24.4 ± 1.5 kg for BIA (p <0.01). Percent lean mass was 63.1 ± 1.8 % and 65.3 ± 1.3 % with ADP and BIA respectively (p= 0.01), while percent fat mass was 36.9 ± 1.8 % for ADP and 34.7 ± 1.3 % for BIA (p= 0.01). BIA consistently overestimated lean mass and underestimated fat mass compared with ADP. However, Pearson’s correlation analysis identified a strong positive linear relationship (p= 0.01) between ADP and BIA in absolute lean mass (r= 0.798), absolute fat mass (r= 0.969), percent lean mass (r= 0.909) and percent fat mass (r= 0.910).

CONCLUSION:
There is strong agreement between multifrequency whole body BIA and ADP in middle-aged women. Based on this agreement multifrequency whole body BIA provides an accurate alternative to ADP that is portable and can be used in field settings with middle-aged women.