TACSM Abstract

Validity of Body Volume Estimates from a Smartphone 3-Dimensional Scanning Application

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Body volume (BV) indicates the total 3-dimensional (3D) space an individual occupies. BV is either used alongside body mass in density-based two-compartment models or in conjunction with other body components in multi-compartment models to estimate body composition (BC). BV estimates are typically produced by costly laboratory methods, such as hydrostatic weighing or air-displacement plethysmography (ADP). However, more accessible options are emerging. Smartphone-based 3D scanning uses the phone's built-in camera to provide a BV estimate in a time-efficient and cost-effective manner. However, few investigations have validated this method against an accepted laboratory technique. **PURPOSE:** To determine the validity of BV from a 3D scanning smartphone application. **METHODS:** ADP and a 3D scanning smartphone application were used to estimate BV in 60 adults (28 F, 32 M; [mean ± SD] age 24.4 ± 6.5 y, body mass index 24.7 ± 4.3 kg/m^2). The 3D scanning application required participants to rotate in place in front of the smartphone camera while serial images were collected, and avatars were produced from approximately 30 images using non-rigid avatar reconstruction. BV was estimated from the avatars, then corrected for estimated thoracic gas volume through published equations using basic demographic and anthropometric variables. ADP was conducted using standard practices recommended by the manufacturer. The relationship between ADP and 3D scanning BV was quantified by Deming regression, the concordance correlation coefficient (CCC), equivalence testing, and Bland-Altman analysis. **RESULTS:** Mean ± SD BV was 67.1 ± 10.9 L for ADP and 66.8 ± 9.9 L for 3D scanning. The Deming regression line for ADP vs. 3D scanning BV (3D=1.1×ADP - 6.5) did not significantly differ from the line of identity (i.e., y=1x + 0). The CCC between BV estimates was 0.96, and statistical equivalence was demonstrated using 2.5% equivalence regions (p<0.01). Bland-Altman analysis indicated slight negative proportional bias (slope = -0.1). **CONCLUSION:** The present study indicates BV estimated by a 3D scanning smartphone application may be a potential alternative to BV measured by ADP. This could increase the accessibility of BV values for BC estimation in two-compartment models and incorporation into field-based multi compartment models.