TACSM Abstract

Influence of Subject Presentation on Body Composition Estimates from Dual-Energy X-Ray Absorptiometry, Air Displacement Plethysmography, and Bioelectrical Impedance Analysis

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ABSTRACT

Body composition assessment devices are commonly employed to track changes associated with exercise or nutritional interventions. However, many individuals undergo body composition assessments with little to no pre-testing standardization of dietary intake or physical activity, potentially introducing error into their results. **PURPOSE**: To examine the validity of unstandardized body composition assessments relative to standardized assessments using three common body composition assessment devices. **METHODS**: Twenty-three resistance-trained males (Mean ± SD; 21.6 ± 2.6 years; 71.3 ± 6.8 kg; 177.4 ± 5.9 cm; 17.4 ± 4.1% DXA-derived percent body fat [%BF]) underwent paired body composition assessments via dual-energy x-ray absorptiometry (DXA), air displacement plethysmography (ADP), and single-frequency bioelectrical impedance analysis (BIA). Each participant's initial standardized body composition assessments were performed in the morning following an overnight food and fluid fast and 12 hours of exercise and caffeine abstention, and all unstandardized assessments were performed later during the same day following ad libitum daily activities. Unstandardized estimates of %BF and fat-free mass (FFM) for each device were compared with device-specific standardized values using paired-samples t-tests, line of identity analysis, evaluation of validity metrics, Bland-Altman analysis, and equivalence testing. **RESULTS**: The total error between standardized and unstandardized %BF estimates was 0.66% for DXA [95% confidence interval {CI}: 0.56-0.76%], 1.60% for ADP [95% CI: 1.50-1.70%], and 1.85% for BIA [95% CI: 1.75-1.95%]. The total error for FFM estimates was 0.75kg for DXA [95% CI: 0.65-0.85kg], 1.15kg for ADP [95% CI: 1.06-1.25kg], and 1.68 kg for BIA [95%CI: 1.58-1.78]. %BF estimates did not differ between paired measurements for DXA ($p = 0.17$) or ADP ($p = 0.10$) but differed between BIA ($p < 0.001$) assessments. Similarly, FFM estimates did not differ between paired measurements for DXA ($p = 0.40$) or ADP ($p = 0.78$) but differed between BIA assessments ($p < 0.001$). All paired assessments for each outcome produced regression line slopes which differed from the line of identity ($p < 0.001$). Only BIA %BF estimates exhibited an intercept that differed from the line of identity ($p < 0.001$). No proportional bias was detected for any outcome. Equivalence was demonstrated between %BF estimates for DXA but not ADP or BIA, based on a ±1%BF equivalence interval. Equivalence was demonstrated for all FFM estimates except BIA, based on a ±1kg equivalence interval. **CONCLUSION**: Our findings suggest that DXA body composition estimates are more robust when conducted in an unstandardized state relative to ADP or BIA. These results can inform the choice of body composition assessment methodology when pre-testing standardization is not possible.