Comparison of Regional Body Composition Estimates Obtained from Dual-energy X-ray Absorptiometry and Single-frequency Bioelectrical Impedance Analysis

JACOB R. DELLINGER, M. LANE MOORE, MARQUI L. BENAVIDES, TYLER C. DIEROLF, BRIAN T. ADAMSON, CLAIRE P. UNDERWOOD, and GRANT M. TINSLEY

Energy Balance & Body Composition Laboratory; Department of Kinesiology & Sport Management; Texas Tech University; Lubbock, TX

Category: Undergraduate

Advisor / Mentor: Tinsley, Grant (grant.tinsley@ttu.edu)

ABSTRACT

The anatomical distribution of fat mass (FM) and lean mass (LM) is significant for health and athletic performance. Dual-energy x-ray absorptiometry (DXA) is often used for regional body composition analysis but is not portable, often inaccessible, and costly, while single-frequency bioelectrical impedance analysis (SFBIA) is a more affordable and accessible alternative. **PURPOSE**: The purpose of this analysis was to compare regional body composition estimates obtained via DXA and SFBIA. **METHODS**: After an overnight food and fluid fast, 102 adults (64 F, 38 M; age: 29.2 ± 13.4 y; BMI: 24.3 ± 3.9 kg/m^2; BF%: 24.6 ± 8.3%) underwent assessments via DXA and SBFIA, each of which provided estimates of FM and LM for the whole body, torso, legs, and arms. DXA scans were performed using custom-made foam blocks to enhance accuracy of regional body composition estimates. SFBIA was performed using an 8-lead device with a 12-channel multiplexer. Both DXA and SFBIA were performed in the supine position. DXA was designated as the criterion method, and body composition estimates were compared using paired-samples t-tests using a Bonferroni-corrected significance level of $p \leq 0.00625$. Additional evaluations were conducted using the correlation coefficient (r), constant error (CE), standard error of the estimate (SEE), and total error (TE). **RESULTS**: Correlations between DXA and SFBIA were high, and the magnitude of errors was generally small: LM_{TOTAL} (r: 0.97; CE: 1.4 kg; SEE: 2.7 kg; TE: 2.9 kg), LM_{LEGS} (r: 0.85; CE: -0.3 kg; SEE: 2.0 kg; TE: 2.1 kg), LM_{TORSO} (r: 0.92; CE: 1.0 kg; SEE: 2.2 kg; TE: 2.5 kg), LM_{ARMS} (r: 0.96; CE: 0.6 kg; SEE: 0.6 kg; TE: 0.8 kg), FM_{TOTAL} (r: 0.95; CE: -2.3 kg; SEE: 2.6 kg; TE: 3.5 kg), FM_{LEGS} (r: 0.83; CE: -1.0 kg; SEE: 1.2 kg; TE: 2.0 kg), FM_{TORSO} (r: 0.90; CE: -1.3 kg; SEE: 2.2 kg; TE: 2.6 kg), and FM_{ARMS} (r: 0.89; CE: -0.1 kg; SEE: 0.5 kg; TE: 0.5 kg). Despite the relatively small magnitude of differences in FM and LM estimates between DXA and SFBIA, results of paired-samples t-tests indicated that all differences were statistically significant ($p < 0.0001$), with the exception of LM_{LEGS} ($p=0.13$) and FM_{ARMS} ($p=0.11$). **CONCLUSION**: Despite the fact that body composition estimates for most regions exhibited statistically significant differences between DXA and SFBIA, the strong correlations (r: 0.83 to 0.97) and relatively low magnitude of error (CE: -2.3 to 1.4 kg; TE: 0.8 to 3.5 kg) indicate that SFBIA may be an acceptable alternative to DXA when regional body composition is being evaluated and DXA is unavailable. However, additional research is needed to determine the ability of SFBIA to accurately track changes in regional body composition over time. Due to its low cost, portability, and ease of use, the presently examined SFBIA device may represent a useful tool for the evaluation of regional body composition when more advanced methods are unavailable.