Agreement Between 4-Compartment Model and 7-Site Ultrasonography for Tracking Weight Training-Induced Changes in Body Composition

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ABSTRACT

Tracking body composition changes provides valuable information in a variety of contexts, including aging, disease, and lifestyle interventions. The 4-Compartment (4C) model is widely accepted as a criterion molecular-level method for evaluating body composition by integrating data from dual-energy x-ray absorptiometry (DXA), air displacement plethysmography (ADP), and bioimpedance spectroscopy (BIS). Ultrasonography (US) is another method of body composition estimation that evaluates subcutaneous adipose tissue at various body sites. **PURPOSE**: To evaluate the agreement between body composition changes detected by a molecular-level 4C model and a 7-site skinfold thickness-based US method in response to weight training and a hypercaloric diet. **METHODS**: Seventeen adult males (age: 22.5 ± 2.4 y, body mass: 72.8 ± 11.6 kg, body fat % [BF%]: 14.0 ± 4.8%) who were moderately resistance-trained completed a 6-week period of supervised resistance training in conjunction with overfeeding via provision of a high-calorie, carbohydrate/protein dietary supplement. At the beginning and end of this period, body composition was evaluated via 4C model, necessitating assessments via DXA, ADP, and BIS. Additionally, body composition was estimated via US by utilizing subcutaneous adipose tissue thicknesses at seven sites on the body as described by Jackson and Pollock. Changes in fat mass (ΔFM) and fat-free mass (ΔFFM) detected by the 4C model and US were compared using paired-samples t-tests, Bland-Altman analysis, equivalence testing, and evaluation of validity metrics. **RESULTS**: ΔFM and ΔFFM were significantly correlated between methods (ΔFM: r=0.48 [95% confidence interval {CI}: 0.002 to 0.78]; ΔFFM: r=0.87 [95% CI: 0.66 to 0.95]. However, both ΔFM (4C: 0.6 ± 1.2 kg; US: 2.8 ± 2.5 kg) and ΔFFM (4C: 3.3 ± 1.6 kg; US: 1.0 ± 3.4 kg) significantly differed between methods ($p < 0.001$). The total error for ΔFM and ΔFFM estimates was 3.1 kg (95% CI: 3.0 to 3.2 kg). 4C and US predicted the same direction of change in ΔFFM but not ΔFM, based on equivalence testing with an equivalence interval equal to 4C change. Proportional bias was observed for both ΔFM and ΔFFM. **CONCLUSION**: Although changes in body composition were correlated between methods, ΔFM and ΔFFM significantly differed between 4C and US. As compared to the 4C, US detected a greater proportion of increased body mass as FM rather than FFM. Overall, the magnitude of differences in body composition changes do not support the interchangeability of 4C and US. Although tracking body composition changes provides valuable information, it is important to take into account that different assessment methods may produce varying results in response to a given intervention.