

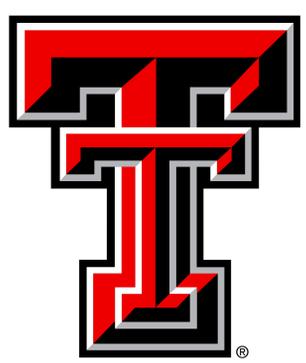


Tracking Resistance Training-Induced Changes in Body Composition via 3-Dimensional Optical Scanning

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Introduction

- Tracking changes in body composition is potentially useful for monitoring health status, disease risk, and results of lifestyle interventions.
- In active individuals, evaluating body composition changes over time may provide useful information regarding the effectiveness of nutrition and exercise programs.

Purpose

- The purpose of this study was to compare changes in body composition estimates obtained from a 4-compartment (4C) model and a 3-dimensional optical (3DO) scanner in resistance-trained males.



Figure 1. Devices utilized in the creation of a 4-compartment model. Air displacement plethysmography for “Body Volume,” bioelectrical impedance spectroscopy for “Water,” and dual-energy x-ray absorptiometry for “Bone.”

Methods

- Twenty resistance-trained males underwent assessments via 4C and 3DO before and after 6 weeks of supervised resistance training plus overfeeding with a high-calorie protein/carbohydrate supplement.
- To generate the 4C model, tests were performed using dual-energy x-ray absorptiometry, air displacement plethysmography, and bioimpedance spectroscopy.
- Changes in fat mass (ΔFM) and fat-free mass (ΔFFM) detected by 3DO were compared with the reference 4C model using paired-samples t-tests, Bland-Altman analysis, equivalence testing, and evaluation of validity metrics.

Results

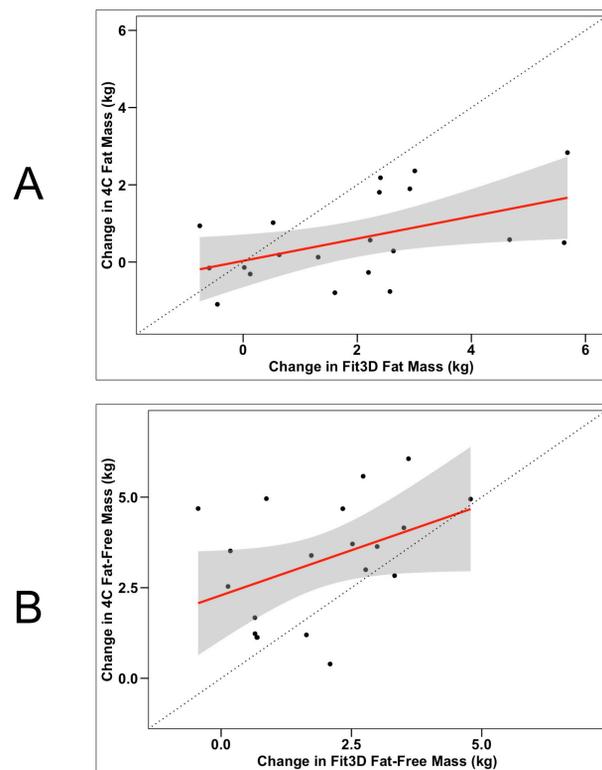


Figure 2. Proportional Bias in Fat Mass (A) and Fat-Free Mass (B).

- Both ΔFM (mean \pm SD: 4C: 0.6 ± 1.1 kg; 3DO: 1.9 ± 1.9 kg) and ΔFFM (4C: 3.2 ± 1.7 kg; 3DO: 1.9 ± 1.4 kg) differed between methods ($p < 0.002$). The correlation (r) for ΔFM was 0.49 (95% confidence interval [CI]: 0.06 to 0.77) and was 0.42 (95% CI: -0.03 to 0.73) for ΔFFM .
- The total error for ΔFM and ΔFFM estimates was 2.1 kg.



Figure 3. Fit 3D Proscanner. Infrared 3-dimensional scanners utilize structured light technologies to acquire data through pattern deformations caused by the projected light over a 3D object. Those interested in these scanning technologies are encouraged to review the recent summary provided by Heymsfield et al. [1].

- ΔFFM demonstrated equivalence between methods based on a ± 2 kg ($\sim 62\%$ of 4C change) equivalence interval, whereas ΔFM failed to exhibit equivalence even with a 100% equivalence interval.
- Proportional bias was observed for ΔFM but not ΔFFM .



Summary

- Our data indicate that changes in FM and FFM detected by a 3D scanner did not exhibit strong agreement with changes detected by a 4C model.
- However, within the context of our study, agreement in FFM changes was superior to agreement in FM changes based on the results of equivalence testing and lack of proportional bias in FFM changes.
- Therefore, depending on the level of accuracy needed, the error in FFM changes observed for the 3D scanner may be potentially acceptable for some applications.

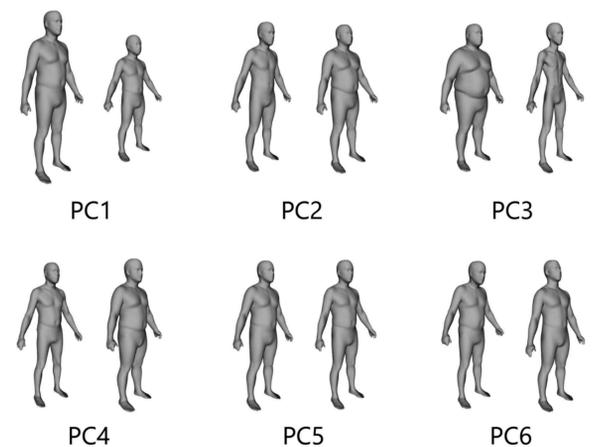


Figure 4. Body Phenotypes. Ng, Bennett K, et al [2] found significant correlation between 3DO principal components (PCs) and serum, HDL cholesterol, triglycerides, glucose, insulin, and HOMA-IR, independent of simple anthropometrics

- Future research should investigate the utility of 3D scanners for monitoring changes in body composition and anthropometric variables in healthy and clinical populations, as well as investigate novel body phenotypes that may be associated with disease risk or health status.

References

- Heymsfield SB, Bourgeois B, Ng BK et al. (2018) Digital anthropometry: a critical review. *Eur J Clin Nutr* 72, 680-687.
- Ng, Bennett K, et al. “Detailed 3-Dimensional Body Shape Features Predict Body Composition, Blood Metabolites, and Functional Strength: the Shape Up! Studies.” *The American Journal of Clinical Nutrition*, vol. 110, no. 6, 2019, pp. 1316-1326., doi:10.1093/ajcn/nqz218.

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