

Title: Measurement of Fat Mass: Concordance between Field Research Measures and Dual-Energy X-ray Absorptiometry.

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Background: There are several approaches to measure total fat mass (FM). Some measures are suitable to field research, such as skinfolds, circumferences and resistance from Bioelectrical Impedance Analysis (BIA), while others, including underwater weighing, MRI, and Dual-Energy X-ray Absorptiometry (DXA), require specialized equipment.

Objective: Test the concordance of field measures to estimate FM against the index measure of Dual-Energy X-ray Absorptiometry (DXA) in girls 7 to 12 years of age.

Methods: Equations developed by Slaughter et al., Goran et al., and Dezenberg et al. were used to calculate FM from skinfold measures and equations developed by Goran et al and Houtkooper et al. were used to calculate fat free mass from resistance. DXA scans and anthropometric measures were collected on 108 peripubertal female participants. Bland-Altman analysis was used to compare the FM as estimated from the field measures with the index measure from DXA. Sensitivity analysis was done to examine the effect of overweight status on the estimates.

Results: Age of the participants was 9.37 +/- 0.91 years (range, 7-12); 43.5% African American and the remainder white. The Slaughter, Goran and Dezenberg estimates of FM were all correlated to the DXA measurement at $r > 0.97$. The Goran skinfold equation showed the largest mean underestimation of FM at 2.62 kg +/- 1.66. The Dezenberg equation overestimated FM by 0.70 kg +/- 1.45. The difference between the Dezenberg estimate and the index measure was correlated to the mean of the measures at $r = -0.24$ $p = 0.01$.

The Goran and Houtkooper equation estimates of FM from BIA were both correlated with the DXA measure at $r > 0.94$. The Bland Altman plot for Houtkooper showed that the equation underestimated FM by 3.28 kg +/- 1.78 with correlation between mean and difference of $r = 0.14$ $p = 0.13$. The associations did not change when the heaviest 5% of girls were removed from the sample.

Conclusions: The Dezenberg and Houtkooper equations did not show systematic bias due to weight status, and the estimates of FM correlated highly with DXA. Dezenberg skinfold equation and the Houtkooper resistance equations were optimal for field measurement of FM in this group of peripubertal girls.