

COMPARISON IN PERCENT BODY FAT MEASUREMENT AS DETERMINED BETWEEN AIR DISPLACEMENT PLETHYSMOGRAPHY, AND TWO BODY ADIPOSITY INDEX EQUATIONS

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The ability to measure body composition accurately is important for health, fitness, and sports performance. The use of inaccurate tools may lead to misclassification of health risk. The Body Adiposity Index (BAI) was recently introduced as a method of predicting body composition using hip circumference and height. Research has demonstrated a stronger correlation between BAI and body fat than between body mass index (BMI) and percent body fat (PBF) in Mexican-American and African-American Adults. A variation of the BAI formula from the FELS longitudinal study (BAI_{FELS}) has more recently been proposed as a better predictor of body fat than BAI.

PURPOSE: To examine the difference in body fat percentage using Air Displacement Plethysmography (Bod Pod) and two BAI equations. We also sought to examine the level of agreement among the various methods used to estimate body fat percentage.

METHODS: 366 healthy adults (194 = males; 172 = females; age = 37.27 ± 9.94 yrs; height = 1.73 ± 0.10 m; body mass = 77.12 ± 18.73 kg; body fat = 24.51 ± 8.50 percent; waist circumference = 84.6 ± 13.5 cm; hip circumference = 99.2 ± 9.4 cm; and BMI = 25.39 ± 4.52 kg/m²) volunteered for data analysis. Air displacement Plethysmography (Bod Pod) was used to assess PBF. Prior to measurement the Bod Pod was calibrated according to manufacturer's specifications and participants were asked to void the bladder and change into skin-tight clothing. A wall-mounted stadiometer was used to measure height and an anthropometric measuring tape was used to measure hip circumference to the nearest 0.1 cm. Body mass was measured to the nearest 0.01 kg using an electronic scale attached to the Bod Pod. A prediction equation was used to assess thoracic gas volume. PBF was predicted using BAI according to the following equation:

$$BAI = [hip\ circumference/height*1.5] - 18.$$

PBF was predicted for BAIFELS using the following equation:

$$BAI_{FELS} = 1.26*[hip\ circumference/height*1.4] - 32.85.$$

RESULTS: PBF for Bod Pod, BAI, and BAI_{FELS} was 24.51 ± 8.49 , 25.57 ± 4.49 , and $25.13 \pm 5.80\%$. Repeated Measures ANOVA found a significant difference in body fat percentage between methods. Bonferroni post hoc analysis revealed BAI to be significantly lower than Bod Pod and BAI_{FELS} - Significant correlations were greater between BAIFELS and PBF ($r=0.707$, $p<0.01$) and BAI and PBF ($r=0.715$, $p<0.01$) than between BMI and PBF ($r=0.539$, $p<0.01$) respectively. Bland-Altman plots revealed smaller mean differences for BAIFELS -0.60 than BAI and BMI (-1.04 and -0.87). Bland-Altman plots also revealed smaller limits of agreement for BAI_{FELS} (11-29 and -12.49) versus BAI and BMI (11.34 and -13.43 vs. 13.42 and -15.17). Visual inspection of the plots revealed numerous points outside the upper and lower limits for all comparisons.

CONCLUSION: The results from this study reveal the BAI_{FELS} to be a better predictor of PBF than BAI and BMI. However, due to the large limits of agreement we suggest fitness professionals utilize additional assessments such as waist circumference and BMI when categorizing health risk.