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Development and validation of a new anthropometric predictive equation for estimating fat mass in elite male soccer players

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INTRODUCTION:

This study aimed i) to develop and validate an anthropometric soccer-specific equation for predicting FM using dual energy X-ray absorptiometry (DXA) as a reference method; ii) to assess the performance of existing soccer-specific predictive equations.

METHODS:

Eighty male soccer players (age 24.4 years, BMI 23.7 kg/m²) participating in the first Italian league underwent anthropometric measurements and DXA scan during the in-season period. The participants were divided into development and validation groups. The validation group returned for a second assessment three months later and was included in an analysis of longitudinal validity.

RESULTS:

The best developed model was: $FM (kg) = -9.905 + (\text{sum of triceps, iliac crest, abdominal, and front thigh skinfolds (mm)} \times 0.175) + (\text{thigh circumference (cm)} \times 0.258) - (\text{ethnicity} \times 1.577) - (\text{age (years)} \times 0.068)$, $R^2=0.73$, standard error of estimation (SEE)=1.01 kg, where ethnicity is 1 for black and 0 for white. Cross-sectional validation showed r^2 values ranging from 0.71 to 0.72 with SEE equal to 0.80 kg and 0.86 kg for the baseline and the second assessments, respectively. Concordance correlation coefficients (CCC) were 0.84 at baseline and 0.86 at the second visit. The agreement analysis showed no mean bias at any time ($p>0.05$) and lower 95% limits of agreement (LoA) ranging from -1.5 kg to 1.8 kg. Longitudinal validation demonstrated a high accuracy at both group ($r^2= 0.80$, SEE= 0.37 kg, CCC= 0.90) and individual (mean bias= 0.04 kg, 95%LoA= -0.7 kg to 0.8 kg, $r= 0.117$) levels.

CONCLUSION:

The FM estimated from existing predictive equation differed from DXA for all the cross-sectional and longitudinal assessments, showing less accuracy compared to the new equation. This study presents a new soccer-specific predictive equation based on four skinfolds and a circumference, allowing for a valid and sport-specific assessment of FM across the competitive season.

Topic: Training and Testing

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