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Abstract

Concurrent and Construct Validity of Methods to Estimate Fat-Free Mass in Children, Adolescents, and Young Adults

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ABSTRACT

INTRODUCTION: Indirect methodologies are available to estimate fat-free mass (FFM) as a skeletal muscle mass surrogate in field settings at low cost. However, there is a lack of knowledge related with the FMM estimations variability introduced by the available methods and its correlations with performance constructs. The association between repeated measures of FFM by different methodologies and strength tests must provide a valuable construct validity analysis, which allows us to select the best method to assess the functional body composition.

PURPOSE: To analyze validity and agreement between laboratory and field methods to estimate FFM in children, adolescents, and young adults, and their relationships with strength.

METHODS: We studied a dataset of participants aged 6-21y (531 assessments, 287 boys). FFM was evaluated by isotope dilution method (REF), dual-energy X-ray absorptiometry (DXA), bioelectrical impedance analysis (BIA) and anthropometry (ANT). Isometric strength was assessed by limb dynamometry and dynamic strength as sprinting and jumping. Concurrent validity was analyzed by differences between methods and concordance correlation coefficient (CCC), agreement by Bland-Altman analysis, and construct validity by individual associations.

RESULTS: FFM from ANT had the lowest bias in girls (-2.33±4.41kg, $P \leq 0.0001$) and from BIA in boys (-1.79±4.51kg, $P \leq 0.0001$). The best CCC was found for FFM-BIA (girls, 0.764; boys, 0.926). The highest correlation with constructs was found for handgrip and FFM-BIA in girls (r=-0.743) and FFM-REF in boys (r=0.812; both $P \leq 0.001$).

CONCLUSION: Our results showed BIA was the best method to estimate FFM. Nonetheless, there was not a single method which correlated the best with all strength constructs. The low coordinative requirement of isometric strength test could be one of the reasons to find a better correlation with FFM than explosive dynamic tests, and this leads us to speculate that isometric strength is more dependent of body composition than dynamic tests. These findings needed to be refuted with additional constructs.