Relationship between fitness performance and a newly developed continuous body composition score in U.S. adolescent boys

Peter D Hart, PhD

Background: Body composition (BC) assessment typically requires the administration of a single test and can have different evaluation outcomes depending on the selected test and the specific population. The purpose of this study was twofold. Firstly, to develop and validate a novel continuous body composition (CBC) score using the continuous response model (CRM). Secondly, to examine the relationship between CBC scores and fitness performance. Methods: Data from the 2012 NHANES National Youth Fitness Survey (NNYFS) were used and consisted of N = 212 adolescent boys 12 to 15 years of age. CBC scale variables included body mass (BM), body mass index (BMI), arm circumference (AC), waist circumference (WC), calf circumference (CC), calf skinfold (CSF), triceps skinfold (TSF), and subscapular skinfold (SSF). Fitness performance variables included cardiorespiratory fitness (CRF, ml/kg/min), leg strength (LS, lb), modified pull-ups (MPU, #), grip strength (GS, kg), and plank (PL, sec). Samejima’s CRM, factor analysis, convergent validity coefficients and score reliability were used to validate the CBC scale. Multinomial logistic regression and multiple linear regression were used to examine the relationship between CBC scores and fitness performance variables. Results: Factor analysis of the CBC scale variables retained a single factor (loadings > .81, 88% explained variance) with strong internal consistency (α = .96). The CRM analysis indicated all CBC scale variables fit a unidimensional construct with adequate discrimination (as: 0.71 to 2.16) and difficulty (bs: -0.04 to 1.44). CBC scores (Mean = 0, SD = 1.00) displayed strong reliability (SEE.θ = 0.22, r.θ = .95) with lower values representing smaller-more-lean individuals and higher values representing larger-less-lean individuals. All fully adjusted regression models showed significant (ps < .05) negative relationships between CBC scores and CRF, MPU, and PL and positive relationships between CBC scores and LS and GS. Conclusion: The CRM-derived CBC score is a novel measure of BC and found to be positively associated with strength performance and negatively associated with endurance performance in U.S. adolescent boys.