Title: Comparison of Ultrasound, Air Displacement Plethysmography and Skinfold Assessments of Body Composition in Collegiate and High School Wrestlers.

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Context: Each season minimum wrestling weight (MWW) must be established for high school and collegiate wrestlers. Valid assessment of body composition is critical to accurate certification. Air displacement plethysmography (ADP) and skinfolds (SF) are two methods accepted by high school and the NCAA weight certification programs (WCP). Alternative methods with lower cost and technical demands could improve accuracy, efficiency and safety of WCP.

Objective: To investigate the accuracy of ultrasound (US) and SF in assessing fat-free mass (FFM) as compared to ADP in collegiate and high school wrestlers.

Design: Cross-sectional

Setting: Research laboratory.

Participants: Forty-two wrestlers (age = 18.7 ± 1.8; body mass = 75.1 ± 13.4 kg; height 173.6 ± 7.0 cm) volunteered for the study prior to the competitive season (11 = HS; 31 = collegiate).

Interventions: Body composition was assessed using three methods during a single testing session. NCAA weight certification program methods were followed for three-site SF measures and ADP, while manufacturer guidelines were followed for US assessments. All skinfold measures were performed by a certified athletic trainer with 7 years experience conducting the NCAA WCP. All participants were hydrated prior to testing (urine specific gravity ≤ 1.020). Mean differences were tested using paired sample t-tests with Bonferroni’s adjustment (P < .016). Two simple linear regression analyses predicted ADP with SF or US as the independent variables. The MWW for collegiate wrestlers was calculated using each assessment method.

Main Outcome Measures: All testing methods estimated % body fat, which was converted to FFM and used as the dependent measure. The percentage of wrestlers with a lower MWW using US or SF as compared to ADP demonstrated clinical application.

Results: Mean comparisons demonstrated significant differences in FFM when assessed using ADP (64.7 ± 10.1kg) as compared to SF (63.4 ± 8.2kg; P = .005) and US (62.9 ± 7.9kg; P = .001). Predicting ADP with US produced an R² = 0.93 and standard error of estimate (SEE) = 2.8kg while SF predicted ADP with an R² = 0.94 and SEE = 2.5kg. MWW calculated using US an SF resulted in 45% (US) and 48% (SF) of the 42 wrestlers being assigned at least 1 weight class lower then the MWW assigned when using ADP.

Conclusion: While the mean differences of 1.3kg (ADP-SF) and 1.8kg (ADP-US) demonstrated a significant underestimation of FFM with the US and SF methods, the magnitude of agreement between each method and ADP was high with a “very good” to “excellent” prediction error (Lohman TG. 1992). Future research should determine if MWW calculated using US and SF methods put the high school or collegiate wrestler at a greater risk or if the ADP method puts the wrestler at a disadvantage.

Word Count: 448