Prediction of basal metabolic rate in obese children and adolescents considering pubertal stages and anthropometric characteristics or body composition.

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Background/Objectives: To develop and crossvalidate new equations for predicting basal metabolic rate (BMR) in obese children and adolescents in relation to pubertal stages, anthropometric characteristics or body composition.

Subjects/Methods: A total of 1696 obese Caucasian children and adolescents (mean body mass index z-score: 3.5 ± 0.8) participated in this study. BMR was determined by indirect calorimetry and fat-free mass (FFM) and fat mass (FM) by bioelectrical impedance analysis. Equations were derived by stepwise multiple regression analysis using a calibration cohort of 848 subjects, and the equations were crossvalidated with a Bland and Altman method in the remaining 848 subjects.

Results: Two new specific equations based on gender (1: males; 0: females), pubertal stages (from 1 to 5, assessed according Marshall & Tanner methods) and body weight (BW, kg), stature (m) or body composition (kg) were generated as follows: (1) BMR = (BW × 0.044)+(stature × 2.836) − (pubertal stage × 0.148)+(gender × 0.781) − 0.551 (adjusted coefficient of determination (R^2_{adj}) = 0.69 and root mean squared error (RMSE) = 0.954 MJ); (2) BMR = (FFM × 0.082)+(FM × 0.037) − (pubertal stage × 0.125) +(gender × 0.706)+2.528 (R^2_{adj} = 0.70 and RMSE = 0.943 MJ). In the crossvalidation group, mean-predicted BMR was not significantly different from the mean-measured BMR (MBMR) for all children and adolescents, as well as for boys and girls (difference < 2 %), and the limits of agreement (±2 s.d.) were +1.95 and -1.98 MJ/d, (P=NS). BMR was predicted accurately (90-110% of MBMR) in 67% of subjects.

Conclusion: The new prediction equations considering the pubertal stages allow an accurate and more appropriate (vs equations using chronological age) estimation of BMR in obese children and adolescents.