

Predicting Resting Metabolic Rate in Healthy Adults using Body Composition and Circumference Measurements

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ABSTRACT

Measurement of resting metabolic rate (RMR) is an important factor for weight management. Previous research has reported several variables to estimate RMR such as body size, percent fat (%BF), age, and sex; however, little is known regarding the effect of circumference measures in estimating RMR. **PURPOSE:** The purpose of this study was to develop a model to estimate RMR using waist circumference (WC), an easily obtainable measure, and cross-validate it to previously published models. **METHODS:** Subjects were 140 adult men and women, ages 18-65 years. RMR was measured through indirect calorimetry, %BF was measured through air displacement plethysmography, and fat mass and fat-free mass were determined from %BF and weight. Other variables collected were: weight, height, age, sex, ethnicity, body mass index, WC, hip circumference, waist-to-hip ratio, waist-to-height ratio, and %BF estimated from bioelectrical impedance analysis. Subjects were randomly divided into derivation and cross-validation samples. A multiple regression model was developed to determine the most accurate estimation of RMR in the derivation sample. The cross-validation sample was used to confirm the accuracy of the model and to compare the accuracy to published models. **RESULTS:** The best predictors for estimating RMR were body weight, $r = 0.70$, $p = 0.031$, age, $r = -0.30$, $p = 0.012$, and sex, $r = 0.51$, $p = 0.018$. Other factors failed to account for significant variation in the model. The derived equation for estimating RMR is: $\text{RMR (kcal/day)} = 843.11 + 8.77(\text{weight}) - 4.23(\text{age}) + 228.54(\text{sex, M} = 1, \text{F} = 0)$, $R^2 = 0.68$, $\text{SEE} = 173 \text{ kcal/day}$. Cross-validation statistics were: $R^2 = 0.54$, $p \leq 0.05$, $\text{SEE} = 199 \text{ kcal/day}$, and total error = 198 kcal/day. In published models, R^2 ranged from 0.47 to 0.57, SEE ranged from 192 to 213 kcal/day, and total error ranged from 212 to 1311 kcal/day. **CONCLUSIONS:** Cross-validation to published models for estimating RMR were similar to those of the derived model; however, the total error in the derived equation was lower than any of the previously published models. Several published models considerably overestimate RMR compared to the current model. The results of this study suggest that RMR can be reasonably estimated with easily obtainable measures which allow for estimation and implementation of RMR for weight management in clinical practice.