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Measured and predicted resting metabolic rate of Paralympic athletes

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INTRODUCTION:
Resting metabolic rate (RMR) is an important determinant of daily energy expenditure. In Paralympic athletes, resting metabolism may be affected by a unique body composition, missing or inactive body parts, and neurological conditions. This study aimed to assess the RMR and its potential predictors in Paralympic athletes. Secondly, we evaluated the level of agreement between athletes' measured and predicted RMR.
METHODS:
In this cross-sectional study, the RMR of 67 Paralympic male (n=37) and female (n=30) athletes competing in various sports was assessed. Disabilities that may affect RMR included spinal cord injury (n = 22), neurological disorders (n = 8) and spasms (n = 16). RMR was assessed by ventilated hood indirect calorimetry, body composition was assessed by dual energy X-ray absorptiometry and a fasted blood sample was collected by venipuncture. Multiple regression analyses were conducted with measured RMR as dependent variable and based on previous literature, age, fat free mass, blood concentrations of triiodothyronine (T3) and thyroxine (T4), the presence of a spinal cord injury, neurological condition and spasms as independent variables. Furthermore, measured RMR was compared with estimated RMR according to commonly used prediction equations (including revised Harris and Benedict (H&B), Cunningham, Schofield, and others) and prediction equations developed for spinal cord injury patients (Chun and Nightingale). Differences between measured and predicted RMR were analyzed by Bland-Altman analysis, individual accuracy, and intraclass correlation (ICC).
RESULTS:
The age, height, body mass and fat free mass were 29±10 y, 1.62±0.19 m, 63.1±11.2 kg and 43.9±7.3 kg for females, and 26±8 y, 1.71±0.20 m, 69.7±14.5 kg and 55.5±10.5 kg for males, respectively. The measured RMR was 1386±258 and 1686±302 kcal/day for females and males, respectively. Regression analysis identified fat free mass, T3 concentration and the presence of a spinal cord injury as the main predictors of RMR (adjusted $R^2=0.71$; $F=50.3$; $p<0.001$). Despite minor proportional bias ($r=-0.220$; $p=0.009$), the Chun equation scored best on accuracy (63% of individuals within 10% of measured RMR), had a good reliability (ICC 0.79) and a low bias and limits of agreement (-67 kcal; -433.9 to 300.2 kcal) compared with measured RMR. Also, the H&B equation, based on weight instead of fat free mass, predicted RMR with small bias (13 kcal), good reliability (ICC 0.77), but slightly higher limits of agreement (-369.1 to 395.6 kcal) and less individual accuracy (56% of individuals within 10% of measured RMR) compared with the Chun equation.
CONCLUSION:
In conclusion, fat free mass, T3 concentration and the presence of a spinal cord injury are the main predictors of RMR in Paralympic athletes, accounting for 71% of the variance in measured RMR. Both the Chun and the H&B equations show good agreement with the measured RMR, and should therefore be considered the preferred prediction equations for the RMR of Paralympic athletes.

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