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# Accuracy of resting metabolic rate prediction equations in female rugby players

Jack O'Neill, Ciara Walsh, Senan McNulty, Martha Corish, Hannah Gantly,
Domenico Crognale and Katy Horner

*University College Dublin, Dublin, Ireland*

**Abstract**

This study aimed to investigate (1) the accuracy of resting metabolic rate (RMR) prediction equations in female rugby players on a group and individual level; and (2) whether individual differences in the accuracy of prediction equations is associated with muscle damage or energy availability.

RMR was assessed in 14 female provincial and club rugby players (Age: 20–34 years, FFM: 47–63 kg, FM: 15–37%) training a minimum of twice per week. Participants attended the laboratory following an overnight fast and having avoided strenuous exercise for 24 hours. RMR was measured over 30 minutes by indirect calorimetry, and taken as the 10 minutes with the lowest variation. Body composition was assessed by air displacement plethysmography, muscle damage indicated by creatine kinase (CK) and risk of low energy availability assessed by the Low Energy Availability in Females Questionnaire. Accuracy of RMR prediction equations relevant to the general population and athletes were assessed including the Harris Benedict (1919), Cunningham (1980) and Ten Haaf FFM (2014) based equations.

Measured RMR was 1748 ± 146 kcal/day (range: 1474–2010 kcal/day). Predicted RMR determined by the Harris-Benedict equation (1601 ± 120 kcal/day) was significantly lower than measured RMR ($p < 0.001$), whereas predicted RMR using the Cunningham (1753 ± 146 kcal/day, $p = 0.89$) and the Ten Haaf (1781 ± 115 kcal/day, $p = 0.33$) equations did not differ from measured RMR. On an individual level, 50% (n = 7), 86% (n = 12) and 79% (n = 11) of participants fell within 10% of the measured RMR value when RMR was predicted by Harris-Benedict, Cunningham and Ten Haaf equations respectively. CK values were 182 ± 155U/L (range: 25–490U/L). When correlations of the whole group were studied, the difference between predicted and measured RMR was not associated with CK ($r = 0.13$). However, in the two individuals who fell outside the 10% range of that predicted by the Cunningham equation, one above and one below, CK values were 428U/L and 166U/L respectively. Muscle damage (as indicated by a high CK value) could therefore be one potential explanation for the higher measured RMR in the individual who was above the Cunningham predicted value.

In this cohort of female rugby players, the Cunningham equation showed the best accuracy on a group and individual level, suggesting this may be the most suitable prediction equation for this population. Further studies with larger sample sizes and investigating underlying reasons for why RMR measured values may differ from predicted values are needed.

**Conflict of Interest**

There is no conflict of interest