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Measurement of resting energy expenditure using novel, portable indirect calorimetry device ECAL compared with conventional measurements by QUARK RMR and prediction equation formulae

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Determination of resting energy expenditure (REE), measured by indirect calorimetry or estimated by prediction formulae, is important for clinicians and researchers for the assessment of energy balance and weight management and for dietary intervention studies.

The standard reference indirect calorimeter, QUARK RMR (Cosmed Inc, Rome, Italy), is expensive and rarely available or practical to use outside of acute hospital or research facilities¹. There is a need for a smaller portable device to be used practically in the community².

The aim of this study was to examine the accuracy, validity and patient acceptability of REE measurement by a new, portable, cheaper indirect calorimeter (ECAL, Energy Testing Solutions, Australia) compared with measurement by QUARK RMR and Henry prediction equation³.

Twelve healthy participants (3 male, 9 female) aged 25.2 (7.7) years and BMI 22 (1.4) kg/m² (mean (SD)) were recruited to the study. After fasting for 12 hours, REE was measured by QUARK RMR and ECAL device in randomised order, each for 15 minutes. Pulse and oxygen saturation were measured throughout. Acceptability and preference of QUARK RMR compared with ECAL device was recorded by questionnaire on completion of both measurements. REE was also determined by Henry prediction equation. Analysis of variance (ANOVA) was used to investigate differences between mean measurements of REE and paired samples t-tests were used to analyse differences in comfort and acceptability values.

Measurements of REE from QUARK RMR, ECAL and estimation of REE from Henry equation were 1486 (312), 1478 (196) and 1366 (101) kcal/d (mean (SD)) respectively. There was no significant difference between REE measurements by QUARK RMR, ECAL or Henry equation (ANOVA, $p=0.34$). Comfort and acceptability ratings for QUARK RMR were 90 (14) % and 91 (11) % compared with 36 (20) % and 52 (26) % for ECAL (mean (SD)) (both $p<0.001$) respectively. All participants preferred the measurement of QUARK RMR to ECAL.

In conclusion, preliminary data suggest that measurement of REE by ECAL may be accurate and valid compared with QUARK RMR and Henry prediction equation but significantly less comfortable and acceptable for patients than QUARK RMR measurement. Final analysis on completion of the study will show additional data including comparison of respiratory quotient (RQ), impact of recent diet and physical activity on REE and qualitative analysis of comfort and acceptability. Further recruitment to the current study and analysis of findings will determine if estimation of REE by ECAL is an accurate and valid measurement compared with QUARK and prediction equation formulae in a larger population of healthy adults.

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2. Madden AM, Parker LJF and Amirabdollahian F (2013) *J Hum Nutr Diet* 26, 587–595.
3. Henry CJ, (2005). *Public Health Nutr* 8, 1133–1152