THE USE OF WHOLE BODY CALORIMETRY TO COMPARE MEASURED VERSUS PREDICTED ENERGY EXPENDITURE IN POSTPARTUM WOMEN

BACKGROUND

Pregnancy and postpartum periods are characterized by major physiological changes, including body weight alterations to support the developing fetus and accumulation of energy stores in preparation for lactation. Postpartum weight retention can have adverse health outcomes including prepregnancy obesity in subsequent pregnancies and future long-term obesity. Predictive equations for energy expenditure may be used for individualized nutritional counseling, to assist women to achieve an optimal weight status through behavior change. However, there is little published information describing the accuracy of predictive equations for calculating **total energy expenditure** (TEE) for postpartum women, or how **resting energy expenditure** (REE) (and the subsequent equation accuracy) might change throughout the postpartum period.

THE STUDY

This longitudinal study compared measured with predicted resting energy expenditure (REE) and total energy expenditure (TEE) in postpartum women. Participants were ≥18 y of age and had a singleton term pregnancy (37-42 weeks). REE was measured at 3 months postpartum (n = 52) and 9 months postpartum (n = 49), whereas TEE was measured once at 9 months postpartum (n = 43) by whole body calorimetry (WBC). Measured REE (REE_{WBC}) was compared with 17 predictive equations; measured TEE plus breast milk energy output (ER_{WBC}) was compared with the estimated energy requirements/Dietary Reference Intakes equation (EER_{DRI}). Fat and fat-free mass were measured by dual-energy X-ray absorptiometry. Group-level agreement was assessed by Pearson correlation, paired t test, and Bland-Altman (bias) analyses. Individual-level accuracy was assessed with the use of Bland-Altman limits of agreement (LOA), and by the percentage of women with predicted energy expenditure within 10% of measured values ("accuracy").

FINDINGS

At a group level, the best equation predicting REE_{WBC} was the DRI at 3 months postpartum and the Harris-Benedict at 9 months postpartum. At an individual level, the Food and Agriculture Organization/World Health Organization/United Nations University (FAO/WHO/UNU) height and weight equation was the most accurate at 3 months postpartum (100% accuracy) and 9 months postpartum (98% accuracy), with the smallest LOA. Equations including body composition variables were not more accurate than equations that used anthropometric measurements. EER_{DRI} accurately predicted ER_{WBC} in 58% of lactating women, and in 79% of nonlactating women. Individual variability was higher with larger LOA, in lactating women compared with nonlactating women (Figure 3A-B). The EER_{DRI} for lactating women after 6 months postpartum recommends adding 400 kcal/d to account for breast milk energy output. Our findings suggested that this leads to high rates of inaccurate predictions. Replacing the single 400-kcal/d recommendation with the amount of breast milk energy output estimated for each woman through the use of the infant weighing technique improved individual level accuracy of the EER_{DRI} by ~35%.

FIGURE 1.

Energy requirements measured by whole body calorimetry (ER_{WBC}) compared with estimated energy requirements (EER_{DRI}) in lactating (n = 24) (A) and nonlactating (n = 19) (B) women. Each point is an individual subject. All subjects have 2 values; some values overlap.

DRI: Dietary Reference Intake
WBC: Whole Body Calorimetry

● EER_{DRI} ● ER_{WBC}
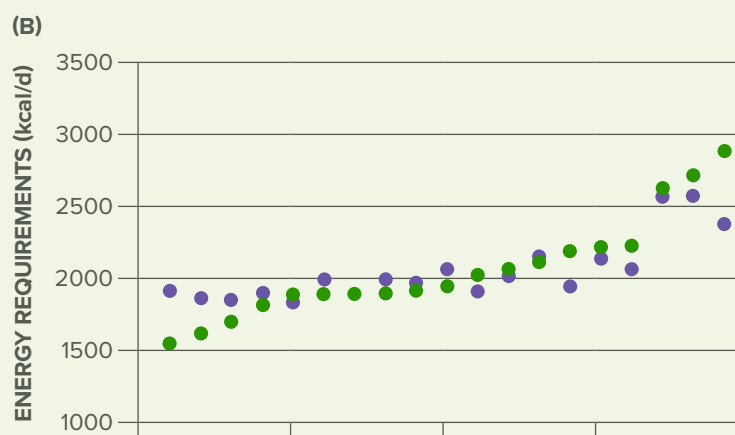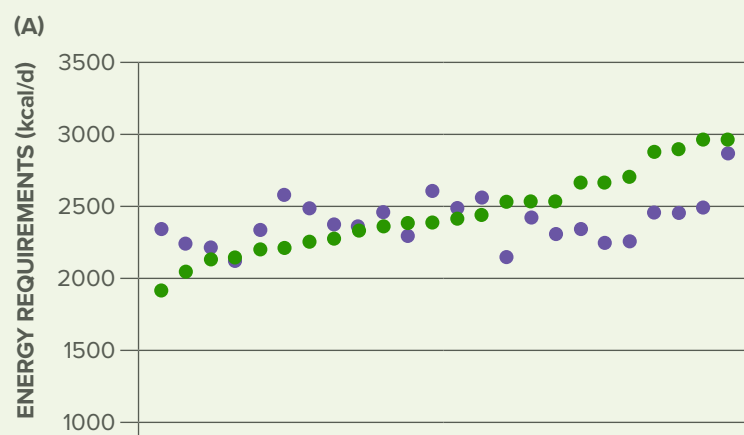
CONCLUSION

Many REE predictive equations were accurate for group assessment, with the FAO/WHO/UNU height and weight equation having the highest accuracy for individuals. EER_{DRI} performed well at a group level, but inaccurately for approximately one-third of women. Additional studies are needed to understand the physiology driving energy expenditure and the contribution of lactation to total energy requirements in the postpartum period, both short and long term. This will ultimately assist in supporting appropriate diet- and weight-management interventions in this population.

Pereira, L.C.R., Purcell, S.A., Elliott, S.A., McCargar, L.J., Bell. R.C., Robson P.J., Prado, C.M., ENRICH team. (2019). The use of whole body calorimetry to compare measured versus predicted energy expenditure in postpartum women. *The American Journal of Clinical Nutrition*, 109(3): 554-565.

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