PREDICTIVE EQUATIONS AND ENERGY EXPENDITURE: IS A GUESS GOOD ENOUGH?

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Lacking access to indirect calorimetry, many clinicians need to be able to predict a patient's energy requirements; equations are available that provide a quick and non-invasive way to do so, and these can be a valuable addition to the clinician's tool box. However, as with any tool, the results will be poor if the user fails to understand how the tool works, or lacks skill in using it properly. The equations do have limitations! Predictive equations cannot transform incorrect or inaccurate data into a useful result, they cannot replace other essential components of patient assessment (such as physical examination), and they are no substitute for ongoing close monitoring of the nutrition support patient.

Understanding the origins of the predictive equations can help in using them more appropriately. The number and type of subjects used in developing the equations may indicate the most appropriate population in which they can be used, and suggests some weaknesses of the equations. For example, the Harris-Benedict equations were developed from a group of young (average age 29) and lean (average BMI 21) Americans at the beginning of the 20th century when lifestyle and diet were very different from ours (1). The Schofield equations used more than 7000 people from 23 different countries, with a wide range of ages and weights but with a preponderance of men; a significant number (more than 10% of the total) were very fit military personnel (2,3). The Mifflin-StJeor equations were based on a group of contemporary Americans (50% were obese!) (4) The Ireton-Jones equations, notably, were developed using sick hospital patients, but may be quite rigid in their application to some diagnostic groups (5).

It is important to note the assumptions underlying each equation, and the reasons for their format (the existence of different equations for men and women, for example, or separating by age group). It may be appropriate to use an age value other than the patient's actual chronological age, or to use an adjusted weight value in the equation. The use of adjustment factors (such as 'stress' or 'activity' factors) (6,7) may allow a hospital patient's needs to be predicted from an equation developed in healthy people – but there are many pitfalls here, and an enormous potential for increasing the errors inherent in this method.

There are other considerations too: to avoid overfeeding, it is important to ensure that the predicted requirement is viewed as the patient's total needs (rather than distinguishing between protein and non-protein energy). Additionally, expressing the result as a range (rather than a fixed value) makes it clear that it is an estimate and avoids implying an unrealistic level of accuracy, which can undermine the credibility of the clinician.

References

[1] Harris JA, Benedict FG. A biometric study of basal metabolism in man. Carnegie Institute Publication no. 279. Washington DC: Carnegie Institute, 1919.
[2] Schofield WN, Schofield C, James WPT. Basal metabolic rate – review and prediction. Hum Nutr Clin Nutr 1985;39C, suppl. 1:5–96.
[3] Schofield WN. Predicting basal metabolic rate, new standards and review of previous work. Hum Nutr Clin Nutr 1985;39C:1–41.
[4] Mifflin MD, StJeor ST, Hill LA, et al. A new predictive equation for resting energy expenditure in healthy individuals. Am J Clin Nutr 1990;51:241–247.
[5] Ireton-Jones C, Jones J. Improved equations for predicting energy expenditure in patients. Nutr Clin Pract 2002;2:29–40.
[6] Barak N, Wall-Alonso E, Sitrin MD. Evaluation of stress factors and body weight adjustments currently used to estimate energy expenditure in hospitalized patients. JPEN 2002;26:231–238.
[7] Shetty PS, Henry CJK, Black AE, Prentice AM. Energy requirements of adults: an update on basal metabolic rates (BMRs) and physical activity levels (PALs). Eur J Clin Nutr 1996;50 Suppl 1:S11–S23.

ANTHROPOMETRIC PARAMETERS AND SERUM LEPTIN LEVELS IN CHILDREN WITH COELIAC DISEASE

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Introduction: Leptin, a protein hormone mainly produced by adipocytes, reflects body fat content. Leptin levels correlate positively with body mass index (BMI) and body fat content and are lower in patients with anorexia or caloric malnutrition due to chronic non-malignant illnesses. Children with coeliac disease often have a period of nutritional impairment prior to diagnosis. The aim of this study was to compare serum leptin levels in children with untreated coeliac disease to levels in controls, to determine key anthropometric variables in all children and to correlate leptin levels with BMI.

Methods: Fourteen children with newly diagnosed but untreated coeliac disease were enrolled at Sydney Children's Hospital, Randwick from February to June 2006 along with 14 control children without coeliac disease (but with other gastrointestinal symptoms). Controls were matched for gender and age (± 6 months). Anthropometric parameters (height, weight, mid arm circumference (MAC),Tricep skin fold thickness (TSF), and Body mass index(BMI) and serum leptin levels (by ELISA) of all the children were measured and recorded. SPSS version 13.0 was used for data entry and analysis.

Results: The mean (SD) age of children with coeliac disease was 8.8 (4.9) years and of controls was 8.8 (4.6) years. There was no difference in the anthropometric parameters or serum leptin levels between children with coeliac disease and controls. There was a positive correlation between serum leptin level and BMI in all children ($r = 0.38$, $p = 0.05$).

Conclusion: Children with coeliac disease did not vary from a control group in terms of anthropometric parameters and serum leptin levels. However, serum leptin levels were

positively correlated with BMI. Serum leptin levels are likely not specifically altered in coeliac disease.

MEASURED VERSUS ESTIMATED ENERGY EXPENDITURE OF CHILDREN WITH SEVERE CEREBRAL PALSY

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Background: There have been a limited number of studies comparing measured with estimated resting energy (REE) in children with severe cerebral palsy (CP), and only one study that has related measured REE with dietary energy intake and body composition parameters. REE and dietary energy intake is important to assess in this group of children so that dietitians and clinicians can tailor their advice and/or nutritional therapies, such as gastrostomy tube feeding, to suit the specific requirements, and optimise the care, of these children.

Aims: (i) To measure REE and dietary energy intake in children with severe CP, (ii) to compare measured REE with estimated REE, (iii) to relate measured REE with body composition parameters, and (iv) to compare dietary energy intake with measured REE.

Methods: Children aged 4 - 18 years with a diagnosis of quadriplegic CP were recruited from a multi-disciplinary Dysphagia Clinic at the Children's Hospital at Westmead (CHW). The clinic assesses and treats developmentally disabled children with complex feeding and nutritional problems. REE was measured in the morning for 20 minutes using an open circuit, flow through, ventilated hood indirect calorimeter (Datex Deltatrac II MBM-200 Metabolic Monitor, Datex-Engstrom Division Instrumentarium Corp., Helsinki, Finland). All children were fasted overnight (from midnight) and were afebrile and in a rested state. REE was calculated from measured gas exchange over 20 minutes and extrapolated to estimate REE (kcal/24h). Dietary energy intake of the children with CP was assessed by a three-day weighed food record. Weight and height were measured using standardised techniques, and fat and fat-free mass (FFM) measured by skinfold anthropometry. The control children for this study were from a separate control database consisting of 111 (42F, 69M) healthy children who had previously undergone anthropometric and REE measurements at CHW.

Results: Forty-one (11F, 30M) children with CP participated in the study. Their measured REE was significantly lower ($p < 0.001$) than that estimated from the control group adjusted for FFM, and was widely variable; 68.2 ± 25.3 % and 61.2 ± 22.1 % of estimated for females and males with CP, respectively. In addition, the measured REE of children with CP was poorly correlated with body composition parameters, with FFM being the most significant predictor, accounting for only 34 % of the variation ($p<0.001$). Finally, energy intake from food records compared with measured REE suggested that the children with CP were consuming almost three times their energy requirements, indicating gross overestimation of energy intakes.

Significance & Conclusions: The energy requirements of children with CP are on average significantly reduced, widely variable and poorly correlated with body composition parameters making it difficult to estimate accurately. In addition, food records grossly overestimate energy intakes in children with CP and should be used with caution.

COMPATIBILITY OF RANITIDINE WITH SELECTED PARENTERAL NUTRITION ADMIXTURES

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Introduction: Ranitidine hydrochloride (RHCl) has been reported to have variable stability/compatibility in parenteral nutrition (PN) admixtures and during simulated Y-site delivery. Different source ingredients used to compound the PN admixture, such as amino acid solutions, organic/inorganic phosphate or calcium salts, different drug brands and concentrations might have an effect on compatibility between the drug and the PN admixture.

Aim: To evaluate the stability/compatibility of RHCl injection after addition to selected PN admixtures or during simulated Y-site injection.

Methods: Six neonatal/paediatric (NPN) and two adult (APN) admixtures were prepared under aseptic conditions. (1) NPN samples were prepared by mixing RHCl (Peptoran™, Pliva, Croatia) undiluted at 25 mg/mL or diluted to 5 mg/mL with Sodium Chloride 0.9%, with each NPN admixture in a 1:1 v/v ratio. The test solutions were mixed and stored in clean test tubes at room temperature (RT). All manipulations were conducted in a certified ISO Class 5 laminar airflow hood. Samples were examined first under normal fluorescent light with unaided eye, followed by further examination against white and black background. with a halogen light reflector from below and at a 90° angle to enhance the visibility of any low level turbidity and small particles. Inspection was performed immediately, 15 min after mixing, then at intervals of: 0.5, 1, 2, 3 and 4 hrs. (2) A typical 200mg daily dose of RHCl (Zantac™, Glaxo-SmithKline) was added to 2 litre 2000 kcal APN bags (0.1mg/mL) which were then stored for 72 hours at RT. Samples taken at 0, 24, 48, 72 hrs were inspected visually and analysed for RHCl by HPLC using Cimetidine as internal standard.

Results and Discussion: Precipitation and turbidity were found in 5 out of 6 NPN admixtures after mixing with RHCl