

Validation of a predictive method for an accurate assessment of resting energy expenditure in medical mechanically ventilated patients

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Objective: Use comparison with indirect calorimetry to confirm the ability of our previously described equation to predict resting energy expenditure in mechanically ventilated patients. Design: Prospective, validation study. Setting: Eighteen-bed, medical intensive care unit at a teaching hospital. Patients: All adult patients intubated >24 hrs were assessed for eligibility. Exclusion criteria were clinical situations that could contribute to erroneous calorimetric measurements. Interventions: Resting energy expenditure was calculated using the original Harris-Benedict equations and those corrected for usual stress factors, the Swinamer equation, the Fusco equation, the Ireton-Jones equation, and our equation: resting energy expenditure (kcal/day) = $8 \times \text{weight (kg)} + 14 \times \text{height (cm)} + 32 \times \text{minute ventilation (L/min)} + 94 \times \text{temperature (}^\circ\text{C)} - 4834$. Measurements and Main Results: Resting energy expenditure was measured by indirect calorimetry for the 45 included patients. Resting energy expenditure calculated with our predictive model correlated with the measured resting energy expenditure ($r^2 = .62, p < .0001$), and Bland-Altman analysis showed a mean bias of -192 ± 277 kcal/day, with limits of agreement ranging from -735 to 351 kcal/day. Resting energy expenditure calculated with the Harris-Benedict equations was more weakly correlated with measured resting energy expenditure ($r^2 = .41, p < .0001$), with Bland-Altman analysis showing a mean bias of 279 ± 346 kcal/day between them and the limits of agreement ranging from -399 to 957 kcal/day. Applying usual stress-correction factors to the Harris-Benedict equations generated wide variability, and the correlation with measured resting energy expenditure was poorer ($r^2 = .18, p < .0001$), with Bland-Altman analysis showing a mean bias of -357 ± 750 kcal/day and limits of agreement ranging from -1827 to 1113 kcal/day. The use of the Swinamer, Fusco, or Ireton-Jones predictive methods yielded weaker correlation between calculated and measured resting energy expenditure ($r^2 = .41, p < .0001$; $r^2 = .38, p < .0001$; $r^2 = .39, p < .0001$, respectively) than our equation, and Bland-Altman analysis showed no improvement in agreement and variability between methods. Conclusions: The Faisy equation, based on static (height), less stable (weight), and dynamic biometric variables (temperature and minute ventilation), provided precise and unbiased resting energy expenditure estimations in mechanically ventilated patients.

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