Validity of resting energy expenditure predictive equations in underweight, normal weight, and overweight adult in- and outpatients

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Background & objective

When indirect calorimetry is not available, predictive equations are used to calculate resting energy expenditure (REE). The validity of these predictive equations were examined in comparison to REE measured with indirect calorimetry in BMI groups.

Methods

Equations were included when based on body weight, height, age, and/or gender. REE was measured with indirect calorimetry. A prediction between 90% and 110% of the measured REE was considered accurate. The bias and root-mean-square error (RMSE) were used to evaluate how well the equations fitted the REE measurement. Subgroup analysis was performed for BMI, sex as wells as inpatients and outpatients. A new equation was based on linear regression analysis.

Conclusion:

Currently available predictive equations cannot replace indirect calorimetry for assessment of energy needs of inpatients and outpatients, however this new equation performed better and more consistent across BMI groups, as well as for both genders, inpatients and outpatients.

Results

29 predictive equations and 415 patients (227 inpatients and 188 outpatients) were included. Based on REE data of patients with BMI<25 a new equation was developed and combined with an existing equation for BMI>25 based on healthy subjects.

Weijs equation:
BMI<25:REE=11.355*weight(kg)+7.224*height(cm) -4.649*age(y)+135.265*sex(F=0;M=1) - 137.475;
BMI>=25: REE=14.038*weight(kg) + 4.498*height(cm) - 0.977*age(y)+137.566* sex(F=0;M=1)-221.631

Overall the new equation performed better than the best performing well known WHO equation based on weight and height (51.3% vs 45.3% accurate). In BMI groups, the new equation predicted accurately in 44% of underweight, 52% of normal weight and 59% of overweight/obese patients. While most equations underpredicted REE, bias of the new equation was +3.2% (UW +5.1%; NW +1.1%; OV +3.0%; OB +5.7%). The WHO equation based on weight and height performed as well for the underweight (44%), and the original Harris-Benedict equation performed as well for the overweight/obese (55%).

Table The percentage patients with accurately predicted REE in BMI groups

Equation	All patients (n=415)	BMI<18.5 (n=124)	BMI18.5-25 (n=172)	BMI 25-30 (n=65)	BMI>30 (n-54)
Weijs[1]	51%	44%	52%	60%	57%
WHO[2]	45%	44%	44%	54%	43%
H&B '84[3]	38%	27%	35%	55%	56%

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