BASIC METABOLIC RATE IN PATIENTS WITH SHORT BOWEL SYNDROME: MEASURED VERSUS ESTIMATED

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Rationale

Patients with short bowel syndrome (SBS) are often in high risk of malnutrition and targeted nutritional therapy is mandatory, including home parenteral nutrition (HPN). The Harris-Benedict equation is widely used to predict basal metabolic rate (BMR), but it may over- or underestimate the energy needs for these patients. A study showed that there is a difference between BMR-m and BMR-hb in patients with SBS (1), however this topic needs further investigation.

The aim of this study was to compare BMR measured by indirect calorimetry (BMR-m) as gold standard with BMR estimated by the Harris-Benedict equation (BMR-hb).

Methods

A cross-sectional investigation of ambulatory patients with SBS stratified according to treatment with home parenteral nutrition (HPN) and oral nutrition therapy (ONT).

The following data were recorded:

- Demographics: Age, gender and diagnosis
- Use of HPN or ONT
- Anthropometric measurements:
  - Hand grip strength (Hydraulic hand dynamometer NC70142 from North Coast)
  - Weight (Seca 701 electronic scale)
  - Standing height (Seca 222 stadiometer).
- Bioelectrical Impedance Analysis (BioScan 920-II from Maltron)
- Indirect calorimetry (Jaeger Oxycon Pro from Carefusion)

Statistics

Differences were tested using t-test, paired samples t-test and a Bland-Altman plot. Significance level: $p<0.05$.

Discussion

In this study we found a divergence between predicting the energy needs with the Harris-Benedict equation compared to measuring with indirect calorimetry on patients with SBS. The equation overestimated BMR in patients on ONT especially in patients with low values of BMR, and underestimated BMR in patients on HPN especially in patients with high BMR.

Although the nutritional assessments were performed under standardized conditions, we are aware, that this is only a small study and sources of error is a factor to be taken into consideration. The study might be influenced by selection bias, as we are a tertiary referral centre and therefore most of our patients are more complicated patients with SBS.

Even though all patients were fasting before the nutritional assessments were performed, we didn't register, when the patients had the last portion of HPN, which might be as near as two hours before measurement. This might influence the measurement of bioelectrical impedance (FM and FFM) and lead to a higher BMR.

The question is if the overestimation of BMR with the Harris-Benedict equation in SBS patients on ONT, is due to a nutritional adaptation caused by underfeeding. The causality of this can not be proven in a cross-sectional study like this, so it would be interesting to make a longitudinal study to uncover the effect of nutritional adaptation.

It is our belief that it is important to measure BMR to determine the appropriate energy needs of SBS patients, because the consequence of estimating BMR could be underfeeding or overfeeding as well as refeeding syndrome.

Results

Overall 44 patients (19 males and 25 females) were included. Age was 62.6±12.8 years (mean±SD) (Table 1). Of these 21 (48%) received HPN. We found that patients on ONT had a higher BMI (p=0.03) and HGS (p=0.01) (Table 2).

In total BMR-m was 1220±241 kcal and BMR-hb was 1256±216 kcal (ns). The mean difference between the two methods (BMR-hb – BMR-m) was -54±174 kcal in patients on HPN and 118±112 kcal in patients on ONT. The mean difference between the 2 groups (HPN vs. ONT) was statistical significant ($p<0.01$).

In patients on ONT BMR-hb overestimated BMR-m especially in patients with low BMR-m. In patients on HPN BMR-hb underestimated the BMR-m especially in patients with high BMR-m (Figure 1).

Table 1

Demographics in 44 patients with short bowel syndrome on oral nutrition therapy (ONT) compared to patients on home parenteral nutrition therapy (HPN).

	Total	ONT	HPN	P-value
Number	44	23	21	
Age (years)[1]	62.6±12.8	60.4±13.1	65.1±12.3	0.23
Female	25	13 (52%)	12 (48%)	-
Male	19	10 (53%)	9 (47%)	-
IBD	9	6 (67%)	3 (33%)	-
Ischemia	5	3 (60%)	2 (40%)	-
Radiation damage	5	3 (60%)	2 (40%)	-
Other gastro diseases	17	5 (29%)	12 (71%)	-
Other diseases	8	6 (75%)	2 (25%)	

[1] Mean±SD

Table 2

Nutritional assessments in 44 patients with short bowel syndrome on oral nutrition therapy (ONT) compared to patients on home parenteral nutrition therapy (HPN).

	Total	ONT (mean±SD)	HPN (mean±SD)	P-value
Number	44	23	21	
Weight (kg)	57.0±13.9	60.7±11.2	52.9±15.6	0.06
Height (m)	1.66±0.1	1.67±0.1	1.65±0.1	0.48
BMI[1] (kg/m^2)	20.4±3.9	21.6±3.4	19.1±4.1	0.03
HGS[2] (kg)	25.6±12.2	29.9±12.7	20.9±9.9	0.01
FFM[3] (kg)	42.9±9.5	44.8±8.9	40.7±9.8	0.15
FFMI[4] (kg/m^2)	15.3±2.0	15.9±1.6	14.7±2.3	0.06
FM[5] (kg)	14.1±6.8	15.9±6.5	12.2±6.8	0.08
BMR-m[6] (kcal)	1220±241	1191±167	1252±304	0.41
BMR-hb[7] (kcal)	1256±216	1309±182	1198±240	0.09

[1]BMI = Body Mass Index, [2]HGS = Hand Grip Strength, [3]FFM = Fat Free Mass,[4]FFMI = Fat Free Mass Index,[5]FM = Fat Mass,
[6]BMR-m = Basal Metabolic Rate measured by indirect calorimetry

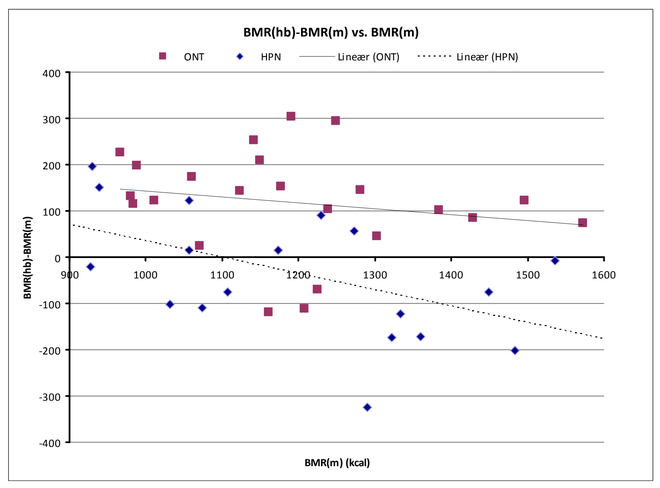

Figure 1
BMR(hb) – BMR(m) vs. BMR(m). The measured basal metabolic rate (BMR-m) compared to the difference in BMR respectively measured an estimated by the Harris-Benedict equation.

Conclusion

This study showed that basal metabolic rate (BMR) by Harris-Benedict equation overestimated BMR in patients with short bowel syndrome on oral nutrition (ONT) especially in patients with low values of BMR, and underestimated BMR in patients on home parenteral nutrition (HPN) especially in patients with high BMR. Thus it is important to measure BMR to determine the appropriate energy needs of short bowel patients.

References:

(1) Ideal weight better predicts resting energy expenditure than does actual weight in patients with short bowel syndrome - Araújo EC, Suen VM, Marchini JS, Vannucchi H.- Nutrition. 2007 Nov-Dec;23(11-12):778-781.

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