Basal versus resting metabolic rate as measured in calorimetric chambers

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Christophe Montaurier[1-2], *Yves Boirie*[1-3], *Corinne Malpuech-Brugère*[1-2], *Ruddy Richard*[1-2-4].

[1]*Université Clermont Auvergne, INRA, UNH, Unité de Nutrition Humaine, F-63000 Clermont-Ferrand, France,*

[2]*CRNH Auvergne, F-63009, Clermont-Ferrand, France,*

[3]*CHU Clermont-Ferrand, service de Nutrition Clinique,* [4]*CHU Clermont-Ferrand, service de Médecine du Sport, Clermont-Ferrand, F-63003 France*

Introduction: Many studies involving measurement of energy expenditure (EE) are often confused with the term "basal metabolic rate" (BMR) and “resting metabolic rate” (RMR). RMR is usually carried out using a canopy, over a short time (less than one hour), with subjects in decubitus position, quiet but awake. However, the lowest values of energy metabolism (BMR) can only be measured when the volunteer is deeply asleep, i.e. during the night. Methodological tools such as calorimetric chambers are able to perform both measurements since they continuously measure all kinetics changes of EE over 24 hours or more.

Methods: EE and heart rate (HR) were continuously measured using two open-circuit whole-body calorimetric chambers located at Clermont-Ferrand, France. EE was calculated using the Brouwer’s equation (Brouwer 1965) from the minute-to-minute measurement of gas exchanges.

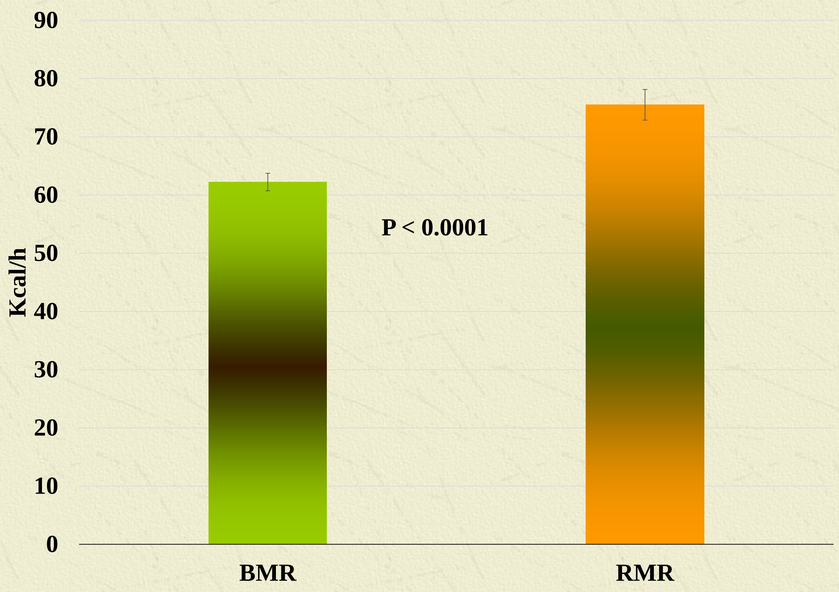
Among several studies regarding EE, BMR were collected from the sleep periods by considering at least 2 consecutive hours for which 48 male volunteers were asleep, when their HR and EE were the lowest. This period averaged 218.1±12.3 min. Increases in EE above 15% associated with HR peaks were considered as resulting from waking up and were excluded.

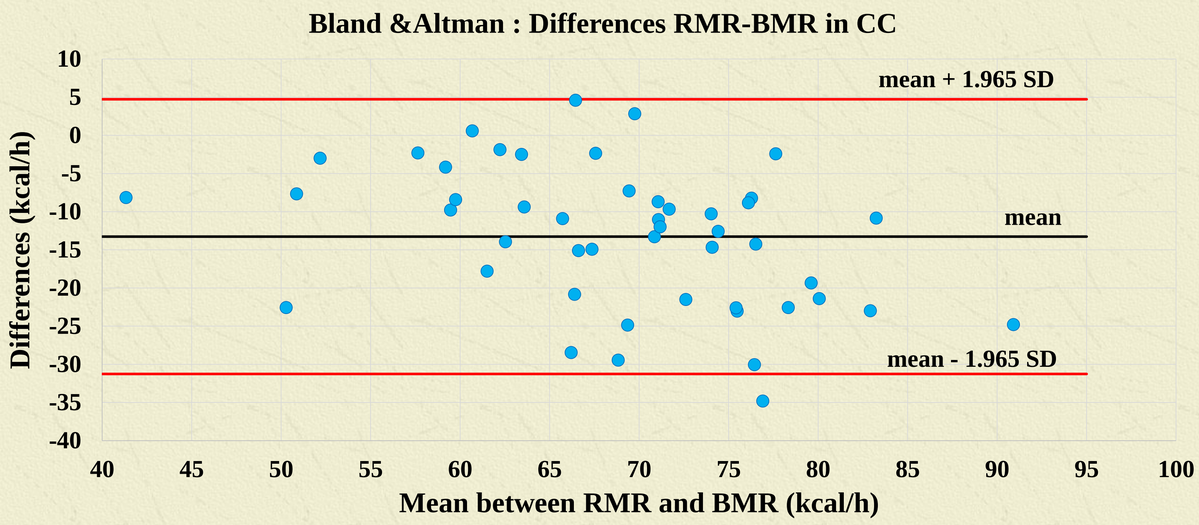
Then, volunteers were also asked to lie down on their bed in the morning just after waking, such like under a canopy, for RMR measurement.

	Age (y)	Weight (kg)	BMI (kg/m²)	Lean Mass (kg)	Daily EE (kCal/24h)	PAL
Mean	**57**	**78,05**	**25,8**	**61,32**	**2326**	**1,57**
SEM	1,2	1,52	0,5	1,00	47	0,03

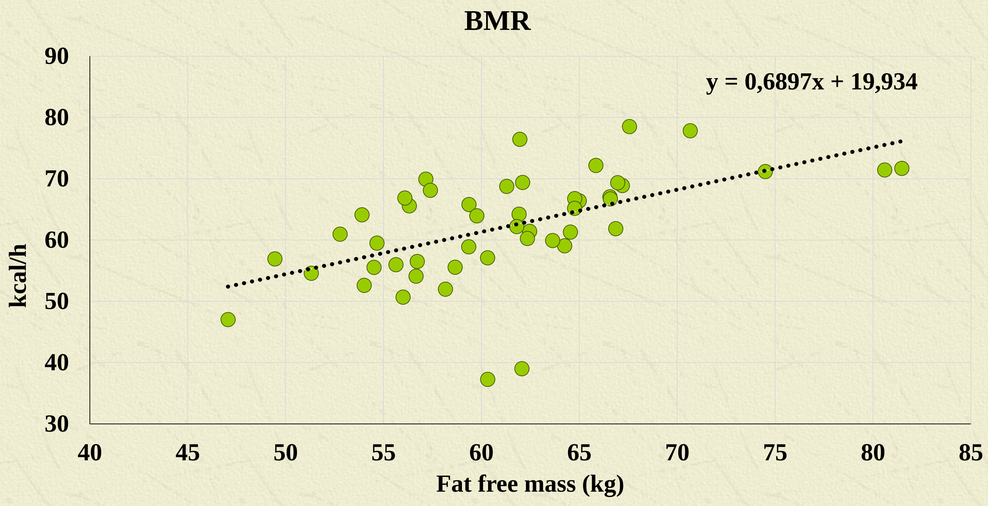
Results

BMR was significantly different from RMR (62.2±1.3 and 75.5±1.7 kcal/h respectively, P<0.0001), so that it represented 64.2 and 77.9 % of total EE, respectively. Difference between BMR and RMR is of -13.27 (SEM=1,3 and SD=9.16) kcal/h.

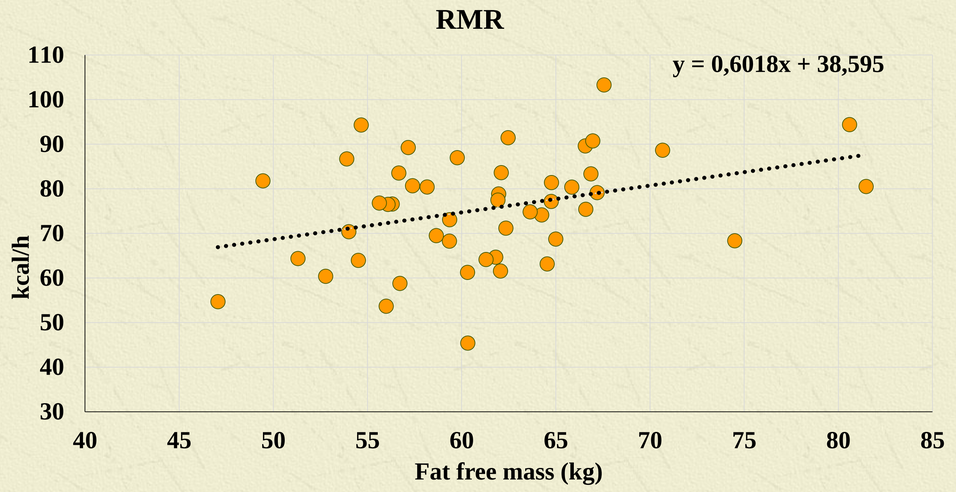




BMR is correlated to fat free mass (0.346 P<0.05).



RMR is correlated to fat free mass (0.546, P<0.05).



Conclusions : Energy expenditure during BMR is 17.6 % lower than RMR. The investigations often referring to the basal metabolism rate should rather talk about the resting metabolism rate when they are not asleep. The basal metabolism rate can only be measured during sleep and calorimetric chambers are appropriate for this activity.