RESTING ENERGY EXPENDITURE OF MASTER ATHLETES

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What we wanted to find out:

• Resting energy expenditure (REE) is an important contributor to total energy expenditure (*Figure 1*). It is thought to decrease with age, due to decreases in fat free mass (FFM) and physical activity.

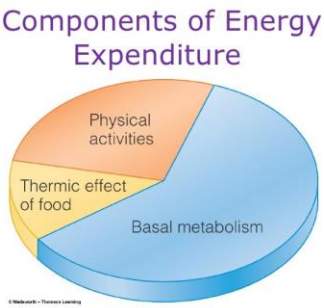
•However, masters athletes maintain high levels of physical activity.

• Different equations exist to predict REE, so that because actual measurements can be avoided.

• Valid and reliable REE values are crucial for dietary and exercise interventions involving master athletes

• We hypothesized that most of the existing equations would underestimate REE in master athletes.

Figure 1: *Components of Total Energy Expenditure (TEE)*



Which measurements we took:

• During the 2018 WMA championships in Málaga, 113 athletes participated.

• Resting energy expenditure was measured (REE_m) with indirect calorimetry (Quark RMR, Cosmed, *Figure 2*).

• The influences of age, sex, height, body weight, FFM, training hours per week, ambient temperature, and athletic specialization were determined statistically.

• Total energy expenditure (TEE) was calculated by the sum of the measured REE = basal metabolism and the thermic effect of food plus an individual physical activity level *(Figure 1).*

Figure 2: *Measurement of indirect calorimetry. Oxygen consumption and carbon dioxide production is measured while subject is lying for 30 minutes under a canopy.*

What the diagram shows:

*Figure 3 shows that women have lower REE than men (comparing black and gray bars), and that **most** of the equations underestimated the REEm of masters athletes (left-most set of bars vs. all other sets)*

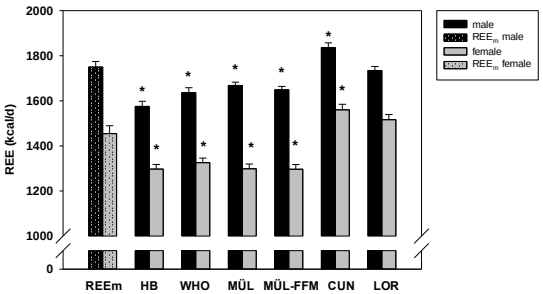


Figure 3: *Comparing measured REE (REE_m) in male (black bars) and female masters (gray bars) with the predictions from different equations. Harris & Benedict (H&B), World Health Organization (WHO), Müller (MÜL), Müller-FFM (MÜL-FFM, Cunningham (CUN), and De Lorenzo (LOR).*

What we found:

• All estimated REEs with equations for the general population differed from the measured ones of masters athletes (*Figure 3, Table 1*).

•The equation put forward by De Lorenzo for young athletes provided the most accurate prediction of REE also for masters athletes, closely followed by FFM-based Cunnigham's equation.

• The other commonly-used prediction equations to estimate REE in masters athletes are less accurate.

• Body weight FFM, FM, sex and interestingly temperature are important predictors of REE.

	underestimation (%)		**accurate estimation (±10%)**		overestimation (%)	
	men	women	**men**	**women**	men	women
Harris & Benedict	51.9	50.0	48.1	47.1	0	2.9
WHO/FAO	36.7	52.9	63.3	41.2	0	5.9
Müller	27.9	50.0	65.8	47.1	6.3	2.9
Müller-FFM	32.5	51.5	66.2	45.5	1.3	3.0
Cunningham	6.6	0	68.4	**63.6**	25.0	36.4
De Lorenzo	17.7	11.8	**72.2**	61.8	10.1	26.5

Table 1: *Percentage of underestimated, accurately estimated and overestimated cases by the different prediction equations.*

What we conclude from this study:

We conclude that REE in masters athletes is primarily determined by body composition and ambient temperature. Our study provides a first estimate of energy requirements for masters athletes in order to cover adequately athletes' energy and nutrient requirements to maintain their health status and physical performance.

This study has been published in Frontiers in Physiology 12:641455 (2021)
The full paper can be downloaded for free on https://www.frontiersin.org/articles/10.3389/fphys.2021.641455/full