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# Addendum: Does Regular Physical Activity Generally Reduce Basal Energy Expenditure? Arguments Against an Alleged Paradigm Change. A Short Report

## Addendum

In our article (2) we had criticized that energy turnover was calculated per subject (largely varying in body mass), not per kg body mass in the publication of Careau et al. (3). However, the conclusion in the last paragraph of our article that “Careau et al. did not consider body mass” is not fully correct. They applied corrections for sex, age, the proportion of fat and fat-free mass, which we mentioned in section 5. But they argue with residuals of regression analysis in the figures, whereas in real physiology absolute energy consumption per subject counts. Therefore, absolute values and the values after correction should have been displayed to allow analysis of possible confounders.

A critical point, however, has been overseen by these authors as well as by us. Careau et al. presented a significant negative correlation between the residuals of activity energy expenditure (AEE) and basal energy expenditure (BEE). They concluded that high activity reduces BEE.

Activity energy expenditure (AEE), however, was not independently measured, but calculated as

$$AEE=0.9*TEE - BEE$$

BEE is thus correlated with itself resp. its negative value and therefore exerts a large negative effect on AEE merely by the calculation! The simplified equation (b contains influences of age, sex and body composition) is therefore:

$$AEE=0.9*TEE - BEE=a*BEE + b$$

As BEE amounted to a large part of daily energy expenditure (at least 50%), a significant correlation was inevitable. In subjects with high physical activity (e. g. athletes) this effect might be reduced, but they were excluded by the authors! In the less active population only independent measurements of physical exercise e. g. by movement analysis might deliver a proof for the conclusions of Careau et al.

Additionally, we exchanged letters with Vincent Careau and Herman Pontzer after the publication of our short report. Careau presented articles (e.g. (1)) who state that division of energy consumption by body mass is only allowed, if the regression curve passes through the origin. But to our knowledge regression equations are only valid for the range where measurements exist (in our figure 2 the mean values range from 40 to 80 kg). Also, large numbers of units defined as ratios are used every day (e. g. velocity). Is there any reason not to calculate energy consumption per kg body mass for different groups and to compare means

without considering regression lines? Even Allison (1) who initiated the criticism admitted that the ratio of 2 variables can be used to estimate a third variable.

The mean kcal/kg for small active subjects in Africa and South America calculated from the data in one of Pontzer’s articles (4) are approximately 40% higher than for North American citizens (figure 2 in our article). Without knowing the complete data base, we cannot prove this statistically, but it is a reasonable result. Strangely Pontzer himself explains this in a personal communication by a “law” that energy expenditure is principally higher in small subjects, obviously independent of the amount of exercise. But every exercise physiologist knows that daily energy turnover may increase fourfold in physically active subjects, with low as well as high body mass.

Our conclusions correspond to the interpretation by Westterterp (5): “Energy expenditure is determined by body size and body composition and by food intake and physical activity. Body size and body composition are the determinants of resting energy expenditure. Higher weight results in higher energy requirement through a higher maintenance cost of a larger body. Activity-induced energy expenditure is the most variable component of total energy expenditure. Smaller and leaner subjects generally move more as activity energy expenditure in larger subjects is not higher in proportion to the cost of moving with a higher body weight.”

## Conflict of Interest

*The authors have no conflict of interest.*

## References

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## CORRESPONDING ADDRESS:

Univ. Prof. a. D. Dr. med. Dieter Böning  
Institut für Physiologie, Campus Mitte  
Charité – Universitätsmedizin Berlin  
Virchowweg 6, 10117 Berlin, Germany  
✉: dieter.boening@charite.de