No evidence for different metabolism in domestic mammals

Recently, Milla et al.[1] concluded that "livestock species are relatively large mammals with low basal metabolic rates, which indicate moderate to slow life histories". While this claim may appear counterintuitive—production animals should be characterized by fast growth, a feature of a comparatively fast pace of life—the analyses performed in that study do not allow any claims to be made with respect to the comparative level of metabolism in domestic species.

When comparing one measurement that depends on another between two groups of organisms, such as absolute or mass-specific metabolism, which depends on body mass, it is the nature of the relationship between the measurements that must be investigated (for example, in a linear model in which 'group' is used as a co-variable), not the differences between measurement averages of the two groups.

Figure 1a,b shows two idealized groups that vary in the body mass range of their individuals, but not in the level of metabolism, arbitrarily set to 293 kJ per $kg^{0.75}$ per day (as in ref. [2]). In log–log space, both the slope and the intercept of their respective regression lines are identical (as indicated by the gray and dotted red regression lines). However, owing to the difference in body mass range in these groups, they distinctly differ in the average level of metabolism that is calculated as the mean of all individual group data points (the squares in Fig. 1a,b; Fig. 1b corresponds to Fig. 3a in Milla et al., and the squares represent the boxplots of Fig. 4b in Milla et al.). Comparing these averages when detached from the underlying body mass is meaningless. Therefore, any conclusions drawn by Milla et al. as to whether livestock species are characterized by a low or high level of metabolism are premature.

When dealing with the phenomenon of metabolism, one can use three different units: absolute metabolic rates (joules per day, refer to Fig. 1a), 'mass-specific' metabolic rates (joules per body mass and day, refer to Fig. 1b), and relative metabolic rates (joules per metabolic body weight and day, refer to Fig. 1c). Note that the reference frame can be chosen to facilitate any possible statement[3]: large animals have higher absolute metabolic rates (Fig. 1a), larger animals have lower 'mass-specific' metabolic rates (Fig. 1b), or relative metabolic rates do not change with body mass (Fig. 1c).

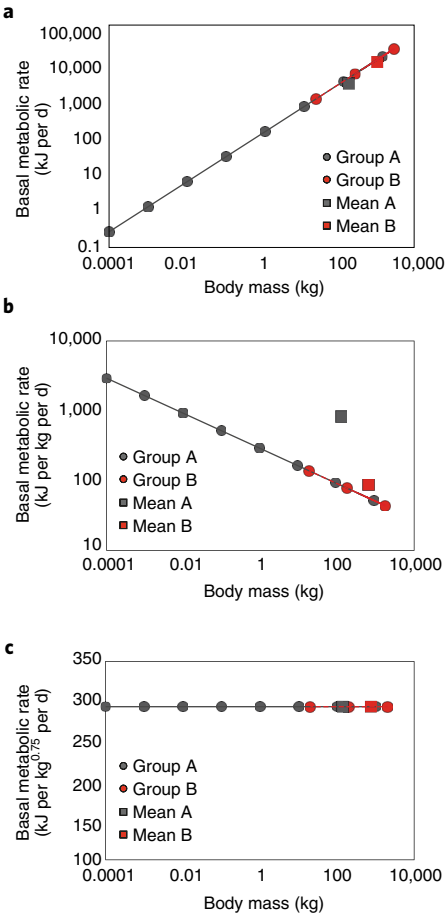

Fig. 1 | Three different methods of displaying the same model dataset of two groups of animals. The daily basal metabolic rate, calculated for each individual's body mass as 293 kJ per $kg^{0.75}$ per d, is shown for groups A and B (representing the wild and domesticated species in Milla, et al.[1]). **a**–**c**, Results are displayed as absolute metabolic rates (kJ per d) (**a**), mass-specific metabolic rates (kJ per kg per d) (**b**), and relative metabolic rates (kJ per $kg^{0.75}$ per d) (**c**). The squares indicate the average calculated from the individual data points of the datasets. Note that although both groups follow an identical pattern of metabolism with body mass, the calculated averages differ in **a** and **b**, suggesting a higher (**a**) or lower (**b**) level of metabolism for group B, whereas no difference in the levels of metabolism between the groups is evident in **c**.

The choice of the reference unit may be driven by the desire to make a certain rhetorical argument. The only unit that would, in theory, allow a reasonable comparison of the calculated average levels of metabolism is one that applies the correct 'body mass correction' based on the actual body mass scaling in the dataset; in the model example, that is metabolic body weight (Fig. 1c). ❐

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Competing interests

The author declares no competing interests.