Functional Ecology

British Ecological Society

Links between metabolic rates and growth depend on food availability

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Metabolic rates determine the energetic cost of living and can differ dramatically between individuals. At the very minimum is an individual's standard (or resting) metabolic rate (SMR) – the energy it must expend on the maintenance of tissues and bodily functions needed to sustain life. Metabolic rates are thought to have important impacts on fitness, but results thus far are equivocal. Some studies find a negative while others find a positive correlation between SMR and different measures of fitness such as growth and survival. These inconsistencies might arise because links between metabolism and fitness depend on environmental conditions. Consideration of an individual's aerobic scope (AS), in addition to its SMR, might also improve our understanding of the links between energy metabolism and fitness. Aerobic scope (the difference between SMR and maximal metabolic rate – after exhaustive exercise) determines the extent to which an individual can increase its metabolic rate above SMR to finance key functions such as digestion, locomotion, growth and reproduction.

We examined the links between individual variation in both SMR and AS and growth rates of brown trout *(Salmo trutta)* under different levels of food availability. We measured the SMR and AS of 120 juvenile trout and then fed each fish either a low, intermediate, or unlimited food ration in individual tanks in the laboratory. After two weeks we measured how much they had grown and examined whether the growth rates of individuals differing in their SMR and AS depended on food level. We found

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that an individual's SMR was not correlated with its AS but both metabolic traits affected growth. However, their effects depended on each other and also on food level. Growth was faster at higher food levels, but individuals with different SMR and AS performed differently at each food level such that there was no combination of SMR and AS that was associated with the fastest or slowest growth at all food levels. These results demonstrate the importance of AS in explaining growth rates and provide evidence that links between individual variation in metabolism and fitness can depend on environmental conditions, in this case food level.