Lõhmus Mare. 2005. Endocrinology, behaviour and immunity related to energetic condition in birds

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Abstract

In a series of experiments, I explored the effects of energetic and endocrine regulation of migratory activity, feeding behaviour, social decision making and immunity in birds. Bird migration is an energy demanding event and prior to migration birds must build up large fuel stores. Because stored energy is costly to carry around, a fine-tuned system is necessary that at appropriate times shifts between catabolic and anabolic processes. In a repeated measures experiment, it was shown that the amount of stored fat strongly influences whether a migrating red-eyed vireo directs its orientation in a seasonally appropriate direction or if it shows activity towards other directions. The behaviour of migrating passerines was also greatly influenced by corticosterone – a hormone influencing processes related to energy deposition and locomotor activity. By combining blood sampling with orientation cage tests I demonstrated that migratory active red-eyed vireos with higher than average baseline levels of corticosterone were also more active and displayed a more appropriate orientation direction than the birds with lower levels of corticosterone. Corticosterone also increased the feeding frequency compared to control treated birds. A hormone that is directly involved in appetite regulating mechanisms and fat metabolism is leptin. Leptin is very likely involved in migratory hyperphagia and behavioural control but since not much was known about leptin in birds some experiments with non-migrating birds were needed. I showed that leptin rapidly lowered the food intake in great tits compared to control birds after an intramuscular injection. A chronic treatment with leptin via osmotic pumps in male Asian blue quail caused an initial decrease in body weight, feeding behaviour, and in plasma cholesterol and triglyceride levels. Surprisingly the leptin treatment also seemed to affect the male-female interaction pattern. However, effects of leptin on behaviour may also differ depending on the social situation. When testing the social factor in combination with leptin treatment I observed that whereas individual feeding time of a quail depended on leptin levels, risk-taking behaviour was mostly dependent on social factors. Besides being a satiety factor leptin also regulates the immune functions. In an in vitro experiment I demonstrated that the mitogen activated T-lymphocyte proliferation in domesticated turkeys is positively correlated with the concentration of added leptin. Similarly, long-term administration of leptin in Asian blue quail induced a stronger in vivo T-cell response to the mitogen treatment than in the birds receiving the control solution. My studies illustrate the complexity of the endocrine regulation of behaviour related to energetic condition and immunity.

ISBN 91-628-6579-10