Endocrine Control of Energy Metabolism in Birds

Buyse[1] J., Z. Song[1] ,. Y. Wang[1] and E. Decuypere[1]

[1]Laboratory of livestock Physiology, Department of Biosystems, KULeuven

The energy balance (net energy deposition) is the net result of energy intake (appetite) and energy expenditure. Both the short and long-term regulation of energy homeostasis is mediated by (neuro)endocrine factors that affect appetite and energy expenditure. The control and regulation of voluntary food intake in animals and humans is very complex, consisting of short-term (meal- to –meal) and long-term signaling systems, as well as the involvement of peripheral and central (brain) regulatory mechanisms. In addition, there are intense interactions between these mechanisms. With respect to short-term mechanisms, dietary (e.g. feed quantity and quality),sensory (e.g. smell, taste, aversion),social and cognitive (e.g. experience) factors are involved. Besides the triggering of intestinal osmo-,chemo- and mechanoreceptors, several gut peptides (species-dependent) are involved in hunger/satiation/satiety. Concerning the brain control centres, several hypothalamic nuclei expressing (an)orexigenic neuropeptides play key roles in appetite regulation as well as in the control of energy expenditure.
Recent studies in mammals have shown that AMPK (5'-AMP-actrivated protein kinase) plays a key role in appetite control at the hypothalamic level. However, information about its role in energy homeostasis in avian species is scarce. We have therefor initiated a series of studies in order to investigate the effects of fasting and refeeding on hypothalamic phosphorylated AMPK and (an)orexigenic neuropeptide gene expression. Taken together, the parallel increases in hypothalamic p-AMPK levels with upregulation of first-order AgRP and NPY and second-order MCH and orexin gene expression due to fasting, followed by a return to normal levels after refeeding, suggest that the appetite-regulating effect of AMPK is at least in part mediated by orexigenic neuropeptides (NPY,AgRP,MCH and orexins) rather than anorexigenic pathways (POMC and CART). In addition, thhe altered gene expression of Fatty Acid Synthase in response to fasting might be induced by AMPK via Sterol Regulatory Element Binding Protein-1 gene expression.

Keywords: endocrine control, energy metabolism

Corresponding author: Decuypere E., Laboratory of livestock Physiology, Department of Biosystems, KULeuven Kasteelpark Arenberg 30 bow 2456,3001 Leuven, Belgium.
E-mail: Eddy.Decuypere@biw.kuleuven.be

Transgenerational Effects of Temperature Training during the Last Days until Hatching in Quails

Tzschentke[1], B., and I. Halle[2]

[1]Institute of Biology, Perinatal Adaptation, Humboldt-University of Berlin, Germany,
[2]Friedrich-Loeffler-Institute, Institute of Animal Nutrition, Braunschweig, Germany

Early life environmental experiences may have distinct impact for the lifelong development, health and performance in poultry. In our previous investigations in broiler chickens we found that temperature training during the last days until hatching effects higher hatching rate, as well as better feed conversion and higher body weight at slaughtering compared with the conventionally incubated control group. Such environmental induced phenotypic changes may be even passed on the succeeding generations in an epigenetic fashion. The aim of the study was to investigate the transgenerational effect of temperature training during the last days of embryonic development on hatching performance, feed intake, body weight and laying performance in quails. In a first experiment (F1) quail eggs were incubated under conventional conditions (37-37.2°C, control) or under warm stimulation (38-38.2°C) from day 15 until hatching on day 18.5. In a second (F2) and third (F3) trial eggs from control and during F1 warm temperature trained group were incubated under conventional conditions. From all generations the following data were collected at hatch and during the subsequent growing period of 42 days: hatching rate, body weight of hatched chickens, body weight and feed intake. In the following laying trial from day 43 until 80 (F1 and F2) laying performance (set point of eggs, laying intensity, feed intake, egg weight) was recorded.
In the F1 trial temperature training increased hatching rate by 7% and body weight of the hatched chickens. Similar results were found in F2, but not in F3. It is interesting, that body weight and feed intake were not different in males and females of both groups during the F1 trial. But, in the F2 and F3 trials body weight was significantly higher in the during F1 temperature trained groups. Feed intake was only slightly increased, which results together with the higher body weight in a better feed conversion. In both laying trials (F1 and F2) the time of laying the first eggs was earlier and the mean egg weight at the start of laying period was higher in the temperature trained group compared with the control.
In conclusion, phenotypic changes induced by temperature training during the critical period of the development of thermoregulation before hatching (F1) may be transferred over the next generations (F2 and F3).

Keywords: transgenerational effects, prenatal temperature training, hatching rate, body weight, laying performance

Corresponding author: Tzschentke B., Institute of Biology, Perinatal Adaptation, Humboldt-University of Berlin, Philippstr. 13, 10115 Berlin, Germany
E-mail: barbara.tzschentke@rz.hu-berlin.de