RESEARCH HIGHLIGHT

(An) orexigenic hypothalamic neuropeptides are differentially expressed in high and low feed efficient quail lines

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The livestock and poultry industry is facing numerous challenges to keep up with the increasing demand for high quality animal protein due to the continuously increasing global human population, severe drought conditions around the world, and grains being used for ethanol production. Since feed costs are the majority of the total cost required to produce a live bird, feed efficiency (FE) is a trait of importance. It is beneficial to develop a more deep molecular understanding of the mechanisms that determine feed efficiency. Recently, this study used Japanese quail that were divergently selected for high and low feed efficiency as a model to determine the differential expression of several feeding-related hypothalamic neuropeptides.

Keywords: Feed efficiency; quail; hypothalamus; neuropeptides

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Livestock production systems of today face the challenge of meeting the substantial increase in global demand for high quality animal protein due to increased human population growth in one hand and serious drought conditions due to climate change on the other hand [1]. In the poultry industry, feed costs contribute to 70% of the total cost of producing a live bird. So, feed efficiency (FE) which is the bird's ability to convert feed into body weight is a trait of vital importance in maintaining sustainable agriculture.

Genetic selection has made spectacular progresses in increasing muscle yield and growth rate [2], however it has been applied without knowledge of the fundamental molecular and cellular mechanism changes that may also induce some undesirable consequences such as muscle disorders [3], ascites [4], lameness [5], and fat deposition[6]. Thus, it is critical to develop a deep molecular understanding of the mechanisms involved in regulating FE in order to keep up with the growing demand for high quality animal protein as well as avoiding the above mentioned undesirable changes. Here, we used first generation Japanese quail (Coturnix coturnix japonica) that were divergently selected for high and low FE and we found that the FE phenotype seemed to be achieved by reduced feed intake in female and increased body weight gain in male [7].

Feed intake is known to be regulated by the hypothalamic satiety and hunger centers which are composed of two different populations of neuronal cell types [8]. One neuronal cell type synthesizes the orexegenic neuropeptides: neuropeptide Y (NPY) and agouti-related peptide (AgRP). The other neuronal cell type synthesizes the anorexigenic

neuropeptides: pro-opiomelanocortin (POMC) and cocaine and amphetamine regulated transcript (CART). These (an)orexigenic neuropepides also interact with the central melanocortin (MCR) system, melanin concentrating hormone (MCH), corticotrophin releasing hormone (CRH), orexin, adiponectin, leptin, and ghrelin to regulate feeding behavior in mammals [9]. In an effort to better understand the molecular mechanisms involved in regulating FE, we determined the expression profile of feeding-related hypothalamic neuropeptides in low and high FE quails [7]. Our results showed that NPY, POMC, CART, and CRH mRNA and NPY and POMC protein expression was higher in LFE compared to HFE male quails, however they did not differ between females. When both males and females are plotted together, males exhibited increased levels of central POMC and CART mRNA only in the LFE and not the HFE genotype. The majority of the components of the central melanocortin system (MC1R, MC2R, MC4R, MC5R) mRNA levels were higher in the LFE when compared to the HFE males, but levels did not different between the LFE and HFE females. Orexin gene and protein expression were significantly higher in LFE compared to HFE male but did not differ between both male and female genotypes. Orexin receptors 1 and 2 (ORXR1 and ORXR2) were significantly higher in HFE compared to LFE males but they did not differ between the female genotypes.

In summary, we have identified several feeding-related hypothalamic neuropeptides that are differentially expressed between high and low FE Japanese quails. These results may open new vistas for the potential role of these neuropeptides as molecular signatures in feed efficiency.

Conflicting interests

The authors have declared that no conflicts of interests exist.

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