Molecular regulation underlying the control of body weight and breast meat yield in broiler

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Our study aimed to determine the molecular regulation underlying the control of muscle growth related to protein intake of the diet. Our study focused on a population of 18 chickens aged 36 days fed with two different levels of dietary proteins and that showed variable growth performance and breast meat yield. Beside body weight, we measured several parameters in the breast Pectoralis major muscle including yield, protein content, ribosomal capacity (RNA/protein), total amount and level of phosphorylation of p70S6 kinase and S6 protein (involved in protein synthesis) and mRNA levels of several genes involved in the control of proteolysis (Atrogin-1 and MuRF-1), growth (IGF-I, IGF-II, IGF-BP5) or more specifically myogenesis (Myostatin, Myf-5). Principal component analysis showed that the inherent capacity of protein synthesis, estimated by the ratio RNA/protein, was positively related to growth capacity (especially body weight) of animals. Similarly, there is a positive relationship between body weight and muscle expression of the growth factor IGF-1. However, increasing body weight and breast meat yield was inversely related to muscle protein content. In addition, the breast muscle yield is negatively correlated with the activation of p70S6 kinase (estimated by its level of phosphorylation) and instead positively with the genes related to proteolysis MuRF-1 and Atrogin-1. This suggests that in animals that had the highest growth and breast meat yield, stimulation of protein synthesis is impaired and on the contrary proteolysis is increased in the muscle, which may partly explain its lower protein contents. Altogether our observations can be related to the fact that over a certain limit, increased growth rate and live weight can lead to the occurrence of severe breast muscle abnormalities, such as white striping or wooden breast, in which muscle deposition tends to shift from protein to fat and fibrous tissue.

Keywords: Muscle yield, growth, proteosynthesis, chicken