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Project #F028

Role of Dietary Supplementation of L-Glutamine and L-Glutamate in Gut Development, Muscle Protein Synthesis, and Growth of Broiler Chickens

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"Possible Benefits of L-Glutamine Added to Broiler Diets"

Continuous genetic selection of broiler chickens for faster growth has resulted in significant improvements in growth and meat yield, but this has also associated with increased incidence of metabolic disorders, skeletal abnormalities, and enteric disease as birds are becoming more dependent at hatching. Glutamine (Gln) has been shown to promote gut mucosal development and associated immunity, which help birds to achieve their genetic potential without the "metabolic disorders" associated with rapid growth. In addition, intracellular Gln contents are shown to be related to enhanced humoral immunity, increased protein synthesis, and decreased proteolysis in muscle. The aim of this study was to determine the effects of dietary L-gln supplementation to diets for newly hatched broiler chickens on growth, meat yield, humoral immunity, and protein synthesis. L-Glutamate (Glu) is also supplemented as Glu could be converted to Gln during metabolism. We proposed to conduct a series of in vivo and in vitro experiments to determine growth performance, gut associated immune responses, and muscle protein synthesis to dietary L-Gln and L-Glu supplementation. L-alanine was used as a nonspecific nitrogen source to achieve diets of the same nitrogen levels among treatments. For Study 1, within 8 h of hatching, 400 broiler chickens were allotted randomly to 5 dietary treatments: NC (without added Gln and Glu), GN5 (with 0.5% Gln), GN10 (with 1.0% Gln), GU5 (with 0.5% Glu), and GU10 (with 1.0% Glu). Each treatment had 8 replicates with 10 birds per cage. Growth performance, carcass characteristics, gut morphology, plasma immunoglobulins were measured. For Study 2, within 8 h of hatching, 30 broiler chickens were allotted randomly to 4 dietary treatments: NC (without added Gln and Glu), GN10 (with 1.0% Gln), and GU10 (with 1.0% Glu). Each treatment had 10 replicates with one bird. At 35 d of age, all the chickens (n = 10 per treatment group) were used to measure rates of protein synthesis. Plasma amino acids were determined at 5 wks of age as well. In both studies, all birds had free access to drinking water and feed. GN5 had greater ($P < 0.05$) weight gain than other treatment groups only during Starter phase. GN10 had greater ($P < 0.05$) weight gain during Grower, Finisher, and overall 6 wk phases. GU10 had greater

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($P < 0.05$) weight gain only during Finisher phase. When measured at the end of wk 1, lengths of villi and crypts were not affected by Gln and Glu supplementation. Carcass characteristics (% of each tissue) were not affected by Gln and Glu supplementation. Plasma IgA concentrations in GN5 and GU5 were greater ($P < 0.05$) than in NC at 6 wk of age where as IgG did not differ among treatments. When measured at 5 wk of age, GN10 had greater ($P < 0.05$) protein synthesis in breast muscle and leg muscle than other treatments. This study shows potential benefits of supplemental glutamine at 1.0% on growth, humoral immunity, and muscle protein synthesis of 6 wk-old broiler chickens. Feed grade L-Gln is now introduced in limited areas of South America and Asia. Its availability will be expanded to the U.S. in the near future. Use of feed grade L-Gln could benefit the poultry industry by improving the efficiency of broiler production.

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