Methionine requirements and immune function in broiler chicks

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The amino acid methionine is essential for optimal growth of broiler chickens (Garcia *et al.* 2000). Baker (1997) determined the digestible methionine requirement for starter broilers to be 0.4%. In addition to the requirements for growth, methionine has been shown to have beneficial effects on the immune status of animals (Tsiagbe *et al.* 1987). Methionine is required to provide the building blocks for immune cells and tissues, including nonspecific mechanisms (skin and mucosa) and specific mechanisms (T and B lymphocytes), especially in newly hatched chicks that are highly susceptible to infection during the first two weeks of life (Kautsos *et al.* 2001). However there is a lack of consistency in the findings of investigators addressing the methionine requirements for optimal growth and immune response.

An experiment was conducted to determine the methionine requirements for growth and immune responsiveness in broiler chicks, and in so doing to provide novel data for formulating starter diets. One–day–old Ross broiler chicks were divided on the basis of body weight uniformity and randomly assigned to 6 groups (with 5 replicate pens of 7 birds each). Birds were housed in a temperature and air controlled floor housing facility with free access to feed and water. From day 1 to 21, one group of chicks was fed a methionine–deficient basal diet (0.30% methionine), whereas four other groups received the diets supplemented with methionine levels of 0.45%, 0.60%, 0.75% and 0.90%. The last group, which served as the control was fed a commercial (0.405% methionine) starter diet. The chicks were immunized against infectious bronchitis virus (IBV) and Marek's disease virus (MDV) at the hatchery. Birds were identified by wing bands, and weighed individually at weekly intervals. To find out the effect of graded dietary levels of digestible methionine on the body and lymphoid organ weights, and cellular– and humoral–mediated immune response, at three weeks of age, a cellular immune response was elicited by an intradermal injection of phytohemagglutinin (PHA–P) and measured after 24 h. In addition, body weight, relative bursa and spleen weights, and antibody titer against IBV were determined.

Diets supplemented with methionine (0.45%, 0.60%, 0.75% and 0.90%) were found to be significantly (P<0.001) effective in improving the cellular immune response of broiler chicks as compared with the basal and commercial diets. In contrast, methionine supplementation did not significantly affected body weight gain, antibody production against IBV and relative lymphoid organ weights. This study suggests that methionine markedly influences cellular components of an immune response indicating that immune cell proliferation may be sensitive to a range of intracellular sulphydryl compounds interlinked to methionine metabolism, including glutathione and cysteine. This study demonstrated that the methionine requirement for cellular immune response is greater than that required for optimal growth.

Baker, D.H. (1997). Ideal amino acids profiles for swine and poultry and their applications in feed formulation. *BioKyowa Technical Review* 9, 1–24.

Garcia, N.M., Pesti, G.M. and Bakalli, R.I. (2000). Influence of dietary protein level on the broiler chicken's response to methionine and betaine supplements. *Poultry Science* 79, 1478–1484.

Koutsos, E.A. and Klasing, K.C. (2001). Interactions between the immune system, nutrition, and productivity of animals. In: *Recent Advances in Animal Nutrition*, pp. 173–190 (eds. P.C. Garnsworthy and J. Wiseman). Nottingham University Press, Nottingham.

Tsiagbe, V.K., Cook, M.E., Harper, A.E. and Sunde, M.L. (1987). Enhanced immune response in broiler chicks fed methionine–supplemented diets. *Poultry Science* 66, 1147–1154.