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Response of broiler chicks to essential and non-essential amino acid supplementation of low crude protein diets

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Abstract

A study was conducted to evaluate individual and combined responses of broiler chicks to non-essential crystalline amino acid supplementation of a low crude protein starter diet. Five-hundred-and-forty Ross 508-day-old male chicks were placed in 90 Petersime battery cages (6 chicks/cage). Birds were fed a pre-starter diet from placement until day 5 formulated to meet or exceed NRC (National Research Council, 1994. Nutrient Requirements of Poultry. 9th ed. (revised). National Academy Press, Washinngton, DC) recommendations. They were subsequently fed dietary treatments from 5 to 21 days of age. Treatments consisted of a control diet (220 g/kg CP), a low crude protein (180 g/kg) diet supplemented with L-Lys, DL-Met, L-Thr, and L-Ile, six treatments composed of individual additions of Gly, L-Ala, L-Asp, L-Glu, L-Pro or L-Leu to the low crude protein diet, and the low crude protein diet with the combined supplementation of the aforementioned amino acids. At day 13, the control and low crude protein diet supplemented with all the non-essential amino acids resulted in chicks with higher BW gain and feed conversion than all other treatments. At day 21, supplementation with Gly, Leu or Asp to the low crude protein diet resulted in similar BW gain of chicks fed the control diet. Supplementation with Gly or Leu to the low crude protein diet resulted in similar feed conversion to that of chicks fed the control diet. Feed intake was unaffected by dietary treatments. Chicks fed the low crude protein diet or the low crude protein diets supplemented with individual amino acids, except Leu, had lower blood plasma uric acid concentration than chicks fed the control. Nitrogen

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retention was lowest with the control diet. Results indicate that when feeding chicks a starter-phase diet reduced by 4% points in crude protein, there is additional need for non-essential nitrogen.

Keywords: Broiler; Crude protein; Glycine; Non-essential amino acids

1. Introduction

The efficiency of amino acid utilization is best when all amino acids are at or slightly below, but not above, their need for protein accretion and maintenance. In addition, formulating diets that meet, but do not exceed, amino acid needs also results in less nitrogen excretion. Formulating broiler diets on a digestible amino acid basis and utilizing the economically feasible commercial amino acid supplements (i.e. methionine, lysine, and threonine) results in diets marginally reduced in crude protein that support equal broiler growth to diets containing higher crude protein and excess amino acids (Kidd et al., 2002). The former reduction in dietary crude protein typically renders isoleucine as the fourth limiting-critical amino acid in broiler diets containing L-threonine (Kidd et al., 2004).

Published reports involving the inclusion of amino acids other than methionine, lysine, and threonine whereby crude protein is reduced to the extent that numerous amino acid supplements are needed, vary in impact on broiler productivity. For example, some researches have shown that reduced crude protein-amino acid supplemented diets support good growth and feed consumption of broilers (Lipstein et al., 1975; Schutte, 1987; Parr and Summers, 1991; Deschepper and De Groote, 1995; Yamazaki et al., 1996, 1998; Aletor et al., 2000). However, other research evaluating the impact of low crude protein-amino acid supplemented diets has demonstrated negative effects on broiler productivity (Edmonds et al., 1985; Fancher and Jensen, 1989; Holsheimer and Janssen, 1991; Jensen, 1991; Moran et al., 1992; Bregendahl et al., 2002). Differences in crude protein level, amino acid fortification, dietary ingredients, amino acid requirements imposed, bird age, and bird strain may have contributed to the discrepancies in the former reports. Moreover, it may be that non-essential amino acid needs also contributed to discrepancies in the former reports. The degree of limitation of most non-essential amino acids as dietary crude protein is reduced is unknown in broilers. Therefore, an experiment was conducted to evaluate the responses of the addition of various non-essential amino acids to a low crude protein diet in male broiler chicks.

2. Materials and methods

Day-old Ross × Ross 508 male broiler chicks were obtained from a commercial hatchery after being vaccinated against Marek's Disease (day 18 via in ovo administration) and Newcastle Disease and infectious bronchitis (via coarse spray at hatch). Upon arrival to the research facility, chicks were randomly allocated into 90 cages (four Petersime batteries; 6 birds/cage) in a completely randomised design, in a room having thermostatically controlled heating and ventilation. Each cage had one trough drinker and feeder. Lighting