Productive performance, gut morphometry, and nutrient digestibility of broiler chicken in response to low and high dietary levels of citric acid

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Primary Audience: Poultry Nutritionists, Researchers

SUMMARY

Two experiments were conducted to evaluate the effects of dietary citric acid (CA) on productive performance, gut morphometry, and nutrient digestibility in broiler chickens. In Experiment 1, 200 7-day-old male Ross 308 broiler chicks were used to examine the effects of 0, 10, 20, and 30 g/kg CA up to day 42 of age in 5 replicates of 10 birds each. In Experiment 2, 90 7-day-old male Ross 308 broiler chicks were used to investigate the effects of 0, 30, and 60 g of CA per kg of diet in 3 replicate of 10 birds each up to day 42 of age. In both experiments, inclusion of 30 g/kg of CA increased proventriculus, gizzard, and ileum weight percentage and villus length, crypt depth, and goblet cell number in the duodenum, jejunum, and ileum compared to control birds. Ileal digestibility of crude protein (CP), apparent metabolizable energy (AME), and total phosphorus (tP) were improved. In Experiment 2, administration of CA at 60 g/kg of the diet significantly reduced ileal digestibility of CP, AME, and tP at 30 d of age (P < 0.01). Data obtained from these experiments demonstrated that addition of 30 g/kg of CA to the diet improved almost all zootechnical indices as well as nutrient retention in broiler chicken. In contrast, an increased level of CA up to 60 g/kg resulted in retarded growth and suppressed nutrient digestibility despite the stimulatory effect on gut morphometry and absorbing surface.

Key words: Broiler, citric acid, ileal digestibility, morphology, nutrient retention

DESCRIPTION OF PROBLEM

The first report dealing with administration of citric acid (CA) to animal diets was Shohl [1], showing it prevented rickets in rats. The data lay dormant for almost 20 years until Pileggi et al. [2] examined the effects of dietary organic acids in rats and showed that some compounds resulted in better performance, while others had no positive effect. During the last 50 years, an increasing number of reports on the use of organic acids have appeared in the literature. As a result, organic acids such as lactic, propionic, fumaric, malic, and in particular CA are becoming widely accepted as nonantibiotic feed additives [3] and are used as growth promoters in diets for pigs, chickens, and rabbits [4]. The recommended levels for CA inclusion in poultry diets were confined to 0.5 to 1.5% in the pioneering research [4]. The recommended level of CA, however,