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EFFECT OF DIETARY ACIDIFICATION AND ALKALINIZATION ON ILEAL DIGESTIBILITY AND TibIA PARAMETERS OF BROILER CHICKENS

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Abstract

The objective of this study was to determine the effects of dietary acidification and alkalinization on ileal nutrients digestibility, serum enzyme activities and bone mineralization in broiler chickens. The birds were allotted to 5 dietary treatments for 35 d, each of which was replicated 5 times with 10 chicks per replicate. The dietary treatments consisting a nutritionally balanced basal diet supplemented with 10, 20 and 30 g/kg citric acid (CA) or Ca (OH)₂ (ALK: 8.9 g/kg for growth period and 8.6 g/kg for finisher period) from day 7 up to day 42 of age. Inclusion of 30 g/kg CA significantly increased tibia ash, tibia Ca content, ileal digestibility of crude protein and apparent metabolizable energy corrected to zero nitrogen retention at day 42 of age (P<0.05). Lactate dehydrogenase activity in serum was significantly elevated in the birds fed on the 30 g/kg CA-treated diets, whereas alkaline phosphatase activity was decreased (P<0.05). The results indicated that ALK diet significantly reduced tibia ash, tibia P and Ca contents. In conclusion, these findings demonstrate that inclusion of 30 g/kg CA bring about great economical benefits as nutrients digestibility and bone mineralization improvements. Also, the prominent impact of alkalinized diet was reduction of nutrients absorption.

Keywords: citric acid, calcium hydroxide, broiler chicken, serum enzyme activity, nutrient digestibility

Introduction

Inclusion of citric acid (CA) in poultry diet creates an acidic condition (pH 3.5 to 4.0) in gut favouring development of lactobacilli and other beneficial bacteria. Dietary acidification increases the activities of gastric enzymes, leading to improvements in digestion and absorption of protein and fibre (MARTIN et al., 2011). The CA appears to have a positive impact on histology of the small intestine, thereby facilitating nutrient absorption and growth performance in broiler chicken (NOURMOHAMMADI and AFZALI, 2013). On the other side, NOUROMOHAMMADI et al. (2012) found that severe reduction pH in gut due to high dose dietary acidification brought about decreased digestion and absorption of nutrients, disrupted liver and kidney function in broiler chicks.

Despite of extensive body of research findings demonstrating favorite effects of acidified diets on performance, health and welfare of broiler chicken, effect of dietary alkalinization on poultry are not fully investigated. OWEN et al. (1994) reported that pH alteration of gut from the normal acid-base balance towards alkalinization affects health, welfare and production of broiler chicken. Therefore, the present study was conducted to evaluate the effects of acidified or alkalinized diets on ileal digestibility, intestinal histomorophology, bone mineralization, and serum enzyme activities in broiler chicken.

Material and Methods

A total number of 250 male Ross 308 broiler chicks were obtained from a commercial hatchery and randomly distributed into 25 floor pens in an environmentally controlled house. Each of the five treatments was replicated five times, with 10 birds per pen. The experimental period was divided into grower (7 to 21 d) and finisher phases (22 to 42 d). The basal diet was supplemented with 10, 20 or 30 g/kg CA to provide three of the experimental diets. An experimental diet was also provided by addition of Ca (OH)₂ in the form of mile of lime (8.9 g/kg for growth period and 8.6 g/kg for finisher period). The pH value for the alkaline solution was set as 12.3. At day 42 of age, blood were collected from two killed birds in non heparinised tubes and kept on ice slashes until they were subjected to serum collection by centrifu ging the whole blood sample at 2,500 g for 10 min. The serum samples were analyzed for the activity of alkaline phosphatase (ALP) alanine aminotransferase (ALT) aspartate aminotransferase (AST) and lactate dehydrogenase (LDH). At day 30 of age, titanium oxide (1 g/kg of diet) was added to all the diets for five days and was used as an analytical marker to determine the effect of treatments on digestibility of crude protein (CP), apparent metabolizable energy corrected to zero nitrogen retention (AMEn), calcium (Ca) and phosphorous (P). Tibia ash was determined by removing