

Effect of varying dietary zinc levels and environmental temperature on the growth performance, feathering score and feather mineral concentration in commercial broilers

ABSTRACT

This study aimed to investigate the effects of dietary zinc (Zn), environmental temperatures and Zn× temperature interaction on growth, feathering score and mineral composition of broilers. A total of 256 d-old Avian male broiler chicks were randomly allocated to a 4×2 factorial arrangement with four corn-soybean meal basal diets (containing 44 mg Zn/kg) supplemented with 0, 40, 60 mg/kg Zn (Diets 1, 2 and 3, respectively; 0.8% Ca for these three diets) and non-Zn supplementation, 1.6% Ca (Diet 4) and two temperature conditions (low: 26, 24, 22°C vs. high: 30, 28, 26°C). All birds were given feathering coverage scores for back, breast, wing, under-wing and tail. The wing and tail were further evaluated for the occurrence and severity of defect feathers. Feathers were then pooled for mineral composition analysis. The results showed that in high temperature conditions, broilers fed Zn-unsupplemented, 0.8% Ca ration (Diet 1) had significantly ($p<0.05$) lower ADFI and ADG (wk 1-6) than birds under low temperature conditions. However, when the birds were fed 40 and 60 mg/kg Zn supplementation (Diets 2 and 3), the ADFI and ADG in both temperature conditions were not significantly different. In low temperature conditions, the ADFI, ADG ($p<0.05$), all feather coverage ($p<0.01$) and tail defect scores ($p<0.001$) of birds fed Diet 4 (excess Ca) were significantly poorer than those fed Diet 1. More Ca ($p<0.05$) was retained in the feathers of broilers fed Diet 4 under high temperature conditions. Broilers fed the Zn-unsupplemented ration (Diet 1) had significantly higher feather phosphorus ($p<0.01$) and potassium ($p<0.05$) concentrations than those fed the 60 mg/kg Zn-supplemented ration (Diet 3). A reduction of feather phosphorus ($p<0.01$) and potassium ($p<0.05$) and higher manganese ($p<0.05$) concentrations were observed in Diet 4 broilers as compared to those fed Diet 1. Under high temperature conditions, broilers had lower iron ($p<0.05$) and higher manganese ($p<0.05$) concentrations in feathers. Broilers kept in high temperature conditions had a higher Zn requirement and 40 mg/kg Zn supplementation was sufficient for the birds to achieve optimum growth. Supplemental Zn ameliorated the adverse effect of high temperature on growth and occurrence of tail feather defects. Excess Ca disrupted Zn metabolism to exert a detrimental effect on growth performance and normal feathering and this was elucidated in the birds kept in low temperature conditions.

Keyword: Zinc; Environmental temperature; Growth; Feathering score; Minerals; Broiler