

Effects of low-protein diets on acute phase proteins and heat shock protein 70 responses, and growth performance in broiler chickens under heat stress condition

ABSTRACT

A study with a 4×2 factorial arrangement was conducted to investigate the effects of 4 dietary protein levels and 2 environmental conditions on acute phase proteins (APP), brain heat shock protein (HSP) 70 density, and growth performance of broiler chickens. Day-old broiler chicks (Cobb 500) were fed isocaloric diets but with various levels of crude protein (CP), namely, (1) 21.0 and 19.0% CP in starter and finisher diets, respectively (control), (2) 19.5 and 17.5% CP in starter and finisher diets, respectively (Diet A), (3) 18.0 and 16.0% CP in starter and finisher diets, respectively (Diet B), and (4) 16.5 and 14.5% CP in starter and finisher diets, respectively (Diet C). Equal numbers of birds from each diet were subjected to either $23 \pm 1^\circ\text{C}$ throughout or $33 \pm 1^\circ\text{C}$ for 6 h per d from 22 to 35 d of age. From d 1 to 21, feed intake (FI) and weight gain (WG) decreased linearly ($P = 0.021$ and $P = 0.009$, respectively), as CP level was reduced. During the heat treatment period (d 22 to 35), there were significant ($P = 0.04$) diet \times heat treatment interactions for FCR. Diet had no effect on FCR among the unheated birds, but the ratio increased linearly ($P = 0.007$) as dietary CP level decreased. Irrespective of ambient temperature, there was a significant linear decrease in FI ($P = 0.032$) and WG ($P < 0.001$) as dietary CP level decreased. Low-CP diets improved the survivability of heat-stressed broilers when compared to those fed control diets. Low-CP diets linearly decreased ($P < 0.01$) APP (ovotransferrin and alpha-acid glycoprotein) responses. Both APP and HSP 70 reactions were elevated following heat treatment. In conclusion, feeding broilers with low-CP diets adversely affect the growth performance of broilers under heat stress condition. However, low-CP diets were beneficial in improving the survivability. Because APP are involved in the restoration of homeostasis, the adverse effect of low-CP diet on the synthesis of these proteins could be of concern.

Keyword: Low-protein diet; Acute phase proteins; Heat shock protein 70; Heat challenge; Broiler chickens