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Effect of Probiotic Feeding on Oxidative Stability and Meat Quality Attributes of Breast Muscle from Chickens Exposed to Chronic Heat Stress

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Objectives

Heat stress (HS) has long been known to reduce the productivity of broiler chicken, decreasing breast muscle size and protein content, as well as damage to various tissues including skeletal muscle. Recently, feeding a dietary probiotic supplement to broilers has been suggested to alleviate these negative impacts by improving their gut health and nutrient absorption. However, little research has been performed to determine the effect of probiotic feeding on meat quality of broilers exposed HS, especially concerning oxidative stability and meat quality attributes. Furthermore, heat shock proteins (HSPs), which are chaperon proteins produced in response to heat stress, could be potentially related to oxidation stability in skeletal muscle by interfering with apoptosis mechanism. Therefore, the objective of this study was to determine the impact of probiotic feeding on oxidative stability, HSP expression, and meat quality characteristics of breast muscle from heat-stressed chickens.

Materials and Methods

Two hundred forty male Ross 708 broilers were assigned to 48 pens in temperature-controlled rooms. Using a 2 × 2 factorial design, HS broilers were kept at either 32°C or the thermoneutral room at 21°C. Controlfed broilers were fed a regular diet, while probioticsfed received Sporulin (250 ppm; containing 3 strains of *B. subtilis*). Forty-eight chickens (12 birds/treatment) were harvested at d 46. At l d postmortem, paired breast muscles (M. pectoralis) were collected for the meat quality analyses such as, drip loss, cook loss, Warner-Bratzler shear force, and display color. 2-thiobarbituric acid reactive substances (TBARS), phospholipid, and 2,2-diphenylpicrylhydrazyl (DPPH) were measured. Western blots for HSP70 and HSP27 were performed. Data were analyzed using the PROC MIXED procedure of SAS (SAS Inst. Inc., Cary, NC), and means were separated using least significant differences ($P < 0.05$).

Results

Probiotic feeding significantly decreased TBARS and phospholipid contents in HS chicken breast ($P < 0.05$). HS increased the DPPH radical scavenging activity in chicken breast ($P < 0.0001$). However, probiotic feeding had no impacts on the DPPH radical scavenging activity in HS chicken breast ($P > 0.05$). HS increased HSP70 in chicken breast ($P = 0.08$), whereas probiotic feeding had no significant impact on HSP70. Based on the qualitative Western blot analysis of HSP27, HS increased HSP27 in the breast muscle compared to its counterpart. Neither HS nor probiotics had impacts on water-holding capacity, shear force, and color stability ($P > 0.05$).

Conclusion

The results of this study indicate that probiotic feeding could alleviate oxidative deterioration of breast muscle from broilers undergoing HS, possibly through the decrease in phospholipid and increase in antioxidant capacity of the muscle. Further studies elucidating the underlying mechanisms behind antioxidant property associated with probiotics supplementation and possible involvement of HSP activity would be highly warranted.

