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Functional/Physicochemical Properties and Oxidative Stability of Ground Meat from Broilers Exposed to Different Photoperiods

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Objectives

Prolonged photoperiod (light) is a common practice in the broiler industry to maximize feed intake, growth and yield. Several studies, however, have found negative impacts of extended photoperiod on animal welfare-related characteristics (e.g., leg abnormalities). While the previous research has primarily focused on animal growth/welfare aspects, the effect of photoperiod on functional properties and quality attributes of broiler meat has not been evaluated. Thus, this study was aimed to determine functional properties, physicochemical attributes and oxidative stability of ground meat from broilers reared under different photoperiod conditions.

Materials and Methods

Ross 308 broiler chicks (n = 432) were assigned to 4 rooms with 6 pens per treatment, which were equipped with one of the following photoperiods (T20, T18, T16, and T12; the hours of lighting per day), started from Day 15. At 42 d of age, the broilers (n = 12/treatment) were randomly taken, slaughtered and chilled for 24 h at 2°C. At 1 d postmortem, tenderloins and leg muscles were separated from the carcasses and stored at –40°C until further processing. In three batches, meat samples were ground using 1/4 in plate and formed into patties (100 g each). The ground samples were measured for pH, protein solubility, emulsion activity index, protein denaturation, salt-induced water uptake and subsequent cooking loss and final yield. The patties were displayed at 2°C under light (l × 1800) and color stability, lipid oxidation (TBARS) and thiol contents were examined. The patties were also measured for purge/cooking loss and texture profile analysis (TPA). All data were analyzed using the PROC MIXED procedure of SAS (v.9.4). Means were separated using least significant differences ($P < 0.05$).

Results

T20 samples had the lowest sarcoplasmic protein solubility among treatments, while T18 had a lower myofibrillar protein solubility compared to other treatments ($P < 0.05$). The emulsion activity index of T20 was higher in sarcoplasmic fraction than T12 ($P < 0.05$). T20 group also had a lower extractable protein concentration compared to other treatments, which subsequently resulted in an increase in protein denaturation ($P < 0.05$). T20 samples had a lower value of pH, salt-induced water uptake, and cooking loss, while T18 had a lower final yield than T16 and T12 ($P < 0.05$). No differences in physicochemical traits of patties were found between treatments, indicated by TPA, purge and cooking loss results ($P > 0.05$), however T20 had a greater display weight loss than T12 ($P < 0.05$). T20 patties maintained the highest L* and hue angle values during entire display, which could be attributed to its inferior water-holding capacity ($P < 0.05$). Both lipid (TBARS) and protein oxidation (thiol content) were increased with display ($P < 0.05$), but no significant photoperiod effect was found ($P > 0.05$).

Conclusion

The results from the present study indicate that extended photoperiod would result in adverse impacts on functional/technological properties and oxidative stability of broiler meat. This is the first study reporting the importance of broiler housing condition (photoperiod) and its subsequent impacts on final meat quality and processing properties. The findings would provide insights into development of mitigating strategies for the poultry industry to prevent quality deteriorations of broiler meat due to the extended photoperiod.