EFFECT OF DIFFERENT ACUTE HEAT STRESS TEMPERATURE AND TIME ON BROILER PECTORALIS MAJOR ULTRA STRUCTURE

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I. INTRODUCTION

Chickens subjected to high environmental temperature typically demonstrate a stress response. Heat stress (HS) has long been recognized as one of the prominent environmental elements influencing the poultry industry [1]. From our previous experiment, HS temperature had a regression effect on chicken meat quality parameters. Among these results, moderate high temperature (36 °C) could aggravate broilers' meat quality through high glycolysis rate in the early time. However, as the HS temperatures raised to 40 °C, high temperature would help to improve the meat quality parameters [2]. This experiment was designed to test the changes of ultra-structure of broilers' pectoralis major under different HS temperature and try to explain the variation of meat quality parameters via ultra-structure.

II. MATERIALS AND METHODS

One hundred male broilers (Arbor Acres) were raised in same condition (25 ± 1°C). Eighty four broilers were randomly selected at six weeks of age and then randomly divided into 7 groups (12 broilers in each group), including six HS groups and one thermalneutral (TN) group. Each group consisted of 6 replicates. Broilers from six HS groups received different HS treatments as follows: (1) 36 °C for 1 h, (2) 36 °C for 2 h, (3) 38 °C for 1 h, (4) 38 °C for 2 h, (5) 40 °C for 1 h, and (6) 40 °C for 2 h. The control group did not receive the HS treatment, and remained at normal growing temperature of 25 ± 1°C. After treatment, replicates were moved to slaughter according to the move in sequence. Broilers were slaughtered and bled within 5 min. Then the left and right pectoralis major muscles were removed manually via knife-cutting after bleeding. The right breast was stored at 4 °C for aging and for ultra-structure analysis. Samples of Electron microscopy at 24 h post-mortem was collected and process as described by Luo et al. (2008) [3].

III. RESULTS AND DISCUSSION

From transmission electron pictures (figure 1), at 24h postmortem, Most myofibrils in 36 and 38 HS group had serious degradation than TN and 40 HS group, and 38HS group had significant degradation. Significant mitochondrion edemas in the degradation blanks were observed in 36°C group (C and G). For single myofibril lattice, 36 HS group had the most serious degrade. Z-line exhibited fuzzy and fracture. This degradation got weaken from 38 to 40 HS group. Instead, the detachment of myofibrils got thick in 40 HS group. The detachment of myofibrils will reduce light reflection rate at muscle surface and then decrease meat lightness. Less degradation myofibrils lattice in 38 and 40 HS group also contribute meat water holding capacity, which match the meat quality parameter changing trends as shown in table 1.

IV. CONCLUSION

Moderate high temperature (36°C and 38°C) had negative effect on chicken meat quality via myofiber damage, however, as the HS temperatures raised to 40 °C, high temperature would help to improve the meat quality parameters via modifying muscle structure.

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Table 3. Effects of heat stress temperature and time on the quality prameters of *pectoralis major* muscles (n = 12)

Item	Heat Stress Temperature, °C					Heat Stress Time, h			Significance		
	Control	36	38	40	SE	1	2	SE	Temp	Time	Temp × Time
L^*_{24h}	50.56^{b}	53.15^{a}	52.02^{ab}	50.89^{ab}	0.35	52.26	51.77	0.25	**	N.S.	N.S.
Drip loss (%)	1.10	1.40	1.20	1.17	0.12	1.22	1.21	0.08	N.S.	N.S.	N.S.
Cook loss (%)	13.33^{b}	16.08^{a}	14.15^{ab}	13.79^{ab}	0.61-0.66	13.94	14.72	0.44	*	N.S.	N.S.

* $P < 0.05$; ** $P < 0.01$

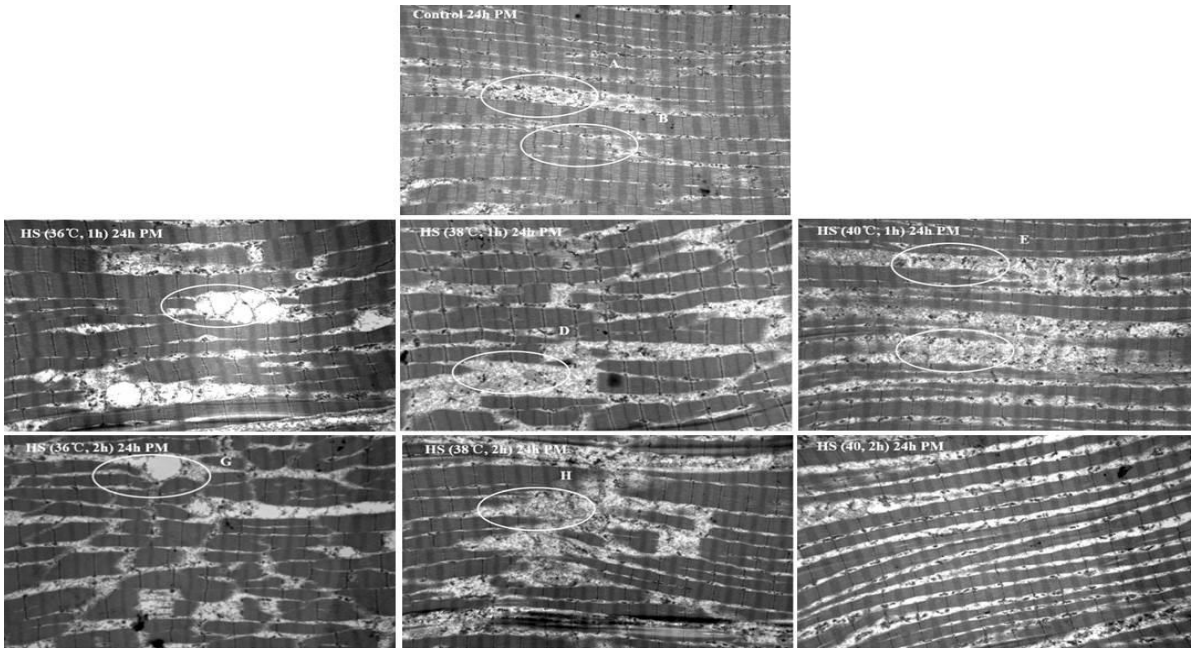

Figure 1. Effects of heat stress temperatures and time on the ultra-structure of pectoralis major muscles (10000 Magnification transmission electron micrographs). Left to right pictures represent 36°C, 38°C and 40°C heat stress tempperatures respectively. 1 h heat stress time placed at second line and 2h heat stress time placed at third line. Control group at the top of treatment group pictures.