EFFECTS OF CARCASS CHILLING TREATMENTS ON POSTMORTEM CALPAIN ACTIVITY IN MULE DUCK BREAST MUSCLE

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Abstract –The purpose of this study was to investigate the effect of chilling treatments on postmortem calpain activity in mule duck breast muscle (BM). Forty duck carcasses were divided into 4 chilling treatments (n = 10 for each treatment group) in this study. BM samples were randomly taken from the carcasses from each treatment at 0, 4, 8 and 12 h of chilling for analysis. Results showed that the pH was not affected by the chilling treatments, but the calpain activity was. The significant decreasing in μ-calpain activity in duck BM occurred within the first 4-h chilling at 25 °C; however, that in the μ/m-calpain activity was very mild in the entire 12-h chilling period.

Key Words – Mule duck, Carcass Chilling, Calpain.

I. INTRODUCTION

Duck meat contains rich nutrition and low fat content [1] and is one of the important sources of poultry meat in Asia. Generally, avian skeletal muscle contains two ubiquitous calpains, μ- and μ/m-calpain, which are active in the presence of 10 μM and 30 μM Ca^{2+}, respectively [2-4]. It has been reported that μ-calpain, but not μ/m-calpain, correlates the degradation of desmin and troponin-T in postmortem duck muscle [2]. However, information regarding the temperature on postmortem calpain change in duck meat is still incomplete. Therefore, the purpose of this study was to investigate the effects of carcass chilling treatments on the changes in calpain activity in postmortem duck muscle.

II. MATERIALS AND METHODS

Mule ducks (~75 d, n = 40) were harvested in a local abattoir. The carcasses were randomly assigned into 4 chilling treatments: A) chilling at 5 °C for 12 h postmortem; B) chilling at 25 °C for 4 h and then at 5 °C until 12 h postmortem; C) chilling at 25 °C for 8 h and then at 5 °C until 12 h postmortem; D) chilling at 25 °C for 8 h and then at 5 °C until 12 h postmortem. A portion of BM samples was sampled at 0, 4, 8 and 12 h of chilling for pH and calpain activity analysis. The pH measurement, casein zymography and image analysis were done by the method of Chang et al. [2, 3]. All data was analyzed by the Mixed model procedure of SAS (PROC Mixed). A Tukey's test was used to separate multiple means at a 5 % significant level.

III. RESULTS AND DISCUSSION

Figure 1 showed that the mean pH observed at each sampling time did not differ among four treatments. However, the mean pH in four treatments significantly declined from 6.41±0.08 at 0-h samples to 5.90±0.08 at 4-h samples ($P < 0.05$). After 4-h chilling, the mean pH in four treatments remained unchanged among 4-h, 8-h and 12-h samples.

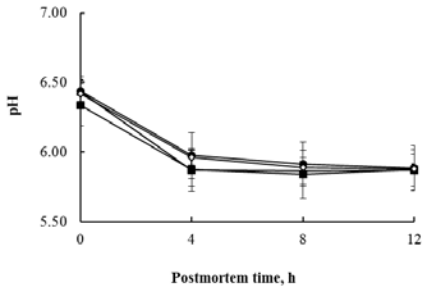

Figure 1. Effect of chilling treatments on changes in pH of mule duck BM during early 12 h postmortem storage. ●:Treatment A; ■: Treatment B; ▲: Treatment C; ◇: Treatment D. Bar = Standard error.

Figure 2 A showed that the μ-calpain bands gradually disappeared in 12-h of chilling in all treatments, but the μ/m-calpain bands remained clear in the entire chilling period. Image analysis results (Figure 2 B) indicated that μ-calpain activity in four treatments decreased with the chilling time ($P < 0.05$). However, the decreasing rate in μ-calpain activity was more rapid ($P < 0.05$) in treatments B, C and D than treatment A. It was shown that the μ-calpain activity in 4-h samples was lower in treatment B (36%), C (31%), and D (30%) than treatment A (65%). This might suggest that the first 4-h chilling at 25 °C was sufficiently enough to activate and autolyze the most of the μ-calpain (65-70%) present in duck BM. Figure 2 C also showed a decrease in μ/m-calpain activity with the chilling time in all treatments ($P < 0.05$). However, the decreasing rate in μ/m-calpain activity was much slower than that in μ-calpain activity. It was shown that the μ/m-calpain activity in 12-h samples was lower ($P < 0.05$) in treatment D (71%) than treatments A (86%) and B (82%), which was not different from treatment C (76%). This might indicate that a very mild activation and autolysis of μ/m-calpain occurred in duck BM, even chilled at 25 °C for 12-h.

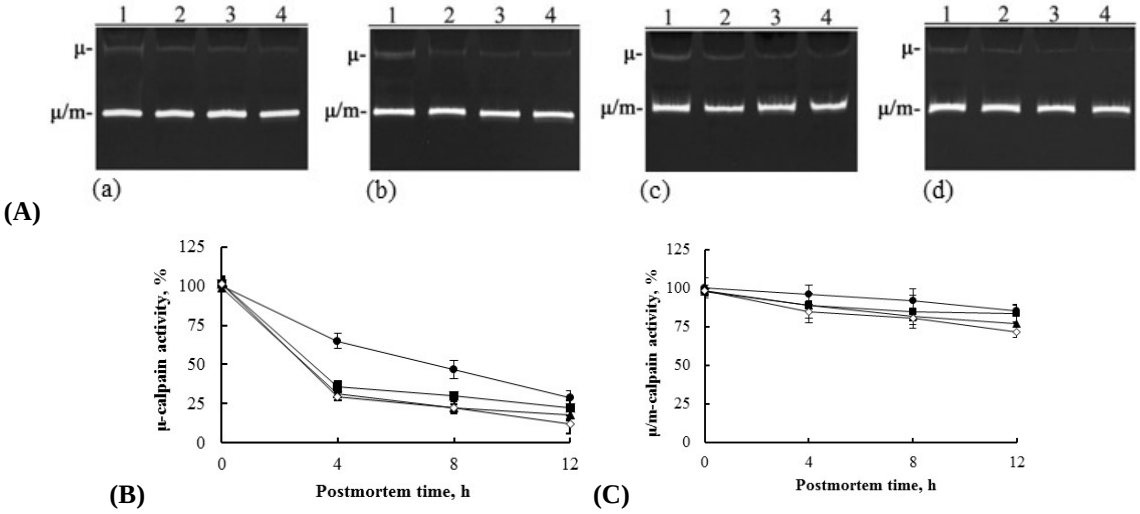

Figure 2. Casein gel (A) and the relative activity quantification of μ-calpain (B) and μ/m-calpain (C) showing postmortem changes in calpain activity of mule duck BM of four chilling treatments. (a) Treatment A; (b) Treatment B; (c) Treatment C; (d) Treatment D. μ = μ-calpain; μ/m = μ/m-calpain. Lane 1 = 0-h; lane 2 = 4-h; lane 3 = 8-h; lane 4 = 12-h. ●:A; ■:B; ▲:C; ◇:D. Bar = Standard error.

IV. CONCLUSION

The pH was not affected by the chilling treatments, but the calpain activity was. The significant decreasing in μ-calpain activity in duck BM occurred within the first 4-h chilling at 25 °C; however, that in the μ/m-calpain activity was very mild in the entire 12-h chilling period.

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