CHANGES IN MUSCLE TEXTURE AND PROTEIN PROPERTIES OF BEIJING FATTY CHICKEN AND YELLOW PLUMAGE BROILERS

T. Zhou, W.W.Zhou, X. Chen, Y.Liu, R.T. Dai*

Laboratory of Meat products processing, College of Food Science and Nutritional Engineering, China Agricultural University, Beijing 100083,China

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Introduction

Beijing Fatty chicken（BFC）， which is very popular among consumers as Chinese indigenous chicken，has a unique taste and texture though they generally have slower growth rates than the commercial broilers, such as Yellow plumage broilers(B), and the BFC muscles possess firmer textures than those of the B. Many researches indicated that temperature and duration of cooking have a large effect on physical properties of meat and eating quality (Combes.et al ,2003). Thermal processing in meat and poultry strongly influences texture, protein changes, cooking yield and other important quality factors associated with platability and consumer acceptance of the final product (Murphy & Marks, 2000). The principal proteins responsible for meat texture include collagen and myofibrillar proteins (Dawson et al , 1991).Although thermal processing have an important effect on meat texture and flavor, most researches related to BFC have focused on breed resource characteristics and the factors influence the growth rate (Chen JL.2006). There is no information regarding the effect of heating temperature on changes in texture and protein properties of the BFC. The objective of this study was to evaluate changes in texture and protein properties of BFC and B during heating in the range 50-90□.

Materials and Methods

Pectoralis major muscles from BFC aged 16 weeks and B aged 38 days of similar live weights (1.5 ± 0.2 kg). were dissected from the carcasses after chilling at 4℃ for 24 h. The muscle strips (2.0 × 2.0 × 6.0 cm)were individually weighed, packed into tightly sealed retorting bags, and stored at 4℃ for 24h. Samples were heated in boiling water to the designated internal temperatures(50-90℃).Shear force of the muscle samples (1.0 × 2.0 × 0.5cm), perpendicular to the axis of muscle fibers, was measured in 10 replicates for each treatment on both chicken breeds using a Warner-Bratzler shear apparatus (Dawson et al., 1991). Cooking losses were calculated from differences in the weight of raw and cooked muscle strips. Sarcoplasmic proteins and Myofibrillar proteins were extracted according to the method of Silvina et al. (1999) The extracted proteins were run on SDS-polyacrylamide gel electrophoresis according to the method of Weber and Osborn (1969).Data were evaluated statistically as a one-way ANOVA using the SPSS 10.0 computer programme (Steel & Torrie, 1980).

Results and Discussion

Cooking loss and shear force: With the increase of cooking temperature, cooking losses of both BFC and B Pectoralis major muscles were increased(Figure 1).. Cooking losses of BFC muscles were higher than those of B muscles at all temperatures tested（$p<0.01$）Similar findings were previously reported (Saowakon.2005). Shear force of B increased slowly with increase of temperature, while shear force of BFC muscle increased sharply when heating temperature increased from 60□ to 70□, and followed by decreasing after 70□(Figure 1).The shear values of BFC muscles were greater than those of the B at all temperatures tested. Shear force values for both breeds have no distinct change when cooking temperature surpass 80□.

Protein degradation: The SDS-PAGE pattern of myofibrillar proteins from raw and heated B and BFC *Pectoralis muscles* was presented in Figure 2 The result indicated that protein subunits with a molecular weight greater than 116KDa decreased with increasing cooking temperature, and disappeared when heated to 60□ for BFC; while for B myofibrillar proteins, protein subunits with a molecular weight greater than 116KDa still existed when cooking temperature reached 90□.Protein subunits with a molecular weight about 45KDa decreased with increasing cooking temperature and disappeared when heated to 80□for both BFC and B myofibrillar proteins. SDS-PAGE pattern of sarcoplasmic proteins from raw and heated B and BFC *Pectoralis muscles* was similar to that of sarcoplasmic proteins (result not shown).

Conclusion

Cooking losses was increased with the increasing internal temperature both for BFC and B. BFC muscles were tougher than B muscles at all temperatures tested. Heating temperature significantly facilitate degradation

of both myofibrillar and sarcoplasmic proteins. The formation of low molecular weight protein of BFC muscle need shorter cooking time and lower cooking temperature. The results partly explained the preference of BFC over B for most consumers.

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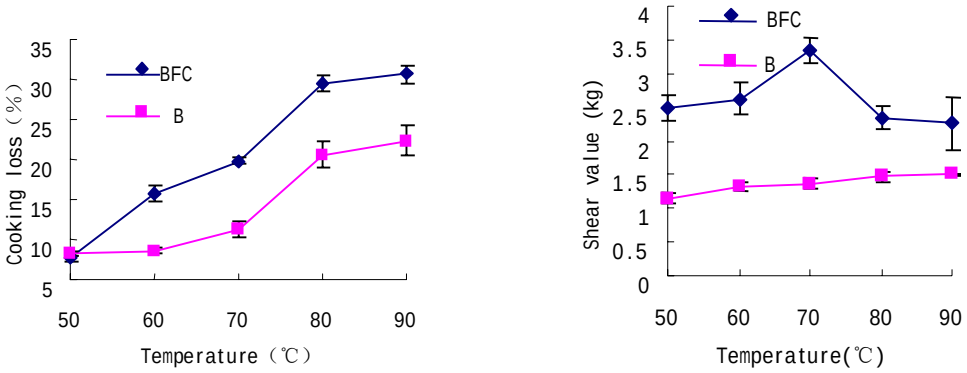

Figure 1. Effect of heating temperature on cooking loss and shear value of B and BFC Pectoralis muscles. Bars indicate the standard deviation from seven and ten determinations for cooking lose and shear value, respectively.

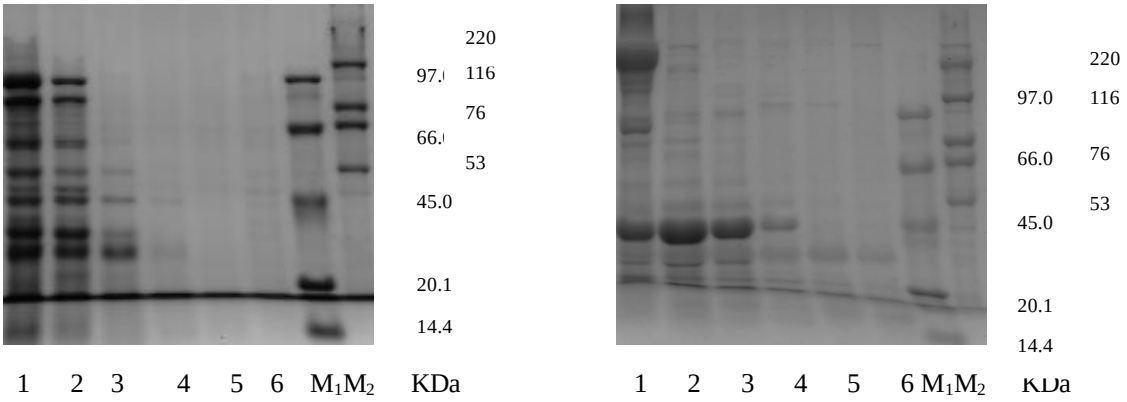

Figure 3 SDS-PAGE pattern of myofibrillar proteins from raw and heated BFC(left) and B(right)*Pectoralis muscles*; (M1) and (M2) low and high molecular weight protein standards; (1) raw; (2-6) muscles cooked to 50, 60, 70, 80 and 90℃,respectively. Protein load:20μl.

References

1. Chen JL. (2006). Study on conservation and utilization of Beijing Fatty Chicken. *Chinese farming and veterinary,33*,109-111.
2. Combes.S.,Lepetit.J.,Darche.B.,Lebas.F.(2003).Effect of cooking temperature and cooking time on Warner-Bratzler tenderness measurement and collagen content in rabbit meat. *Meat Science,66*, 91-96.
3. Dawson, P. L., Sheldon, B. W., & Miles, J. J. (1991). Effect of aseptic processing on the texture of chicken meat. *Poultry Science, 70*, 2359–2367.
4. Murphy, R. Y., & Marks, B. P. (2000). Effect of meat temperature on properties, texture, and cook loss for ground chicken breast patties. *Poultry Science, 79*, 99–104.
5. Saowakon Wattanachant (2005). Effect of heat treatment on changes in texture,structure,and properties of Thai indigenous chicken muscle.*Food chemistry,93*,337-348.
6. Silvina F,Yolanda S，Graciela Vet al(1999).Characlerizalion of muscle sarcoplasmic and myof'ibrillar protein hydrolysis caused by Lactobacillus plantarum[J].*Appl Environ Micro,65*,3540-3546.
7. Steel,R.G.J.,&Torrie,J.H.(1980).Principle and procedures of statistics: *a biometrical approach (2nd ed.)*. New York: Mc Graw-Hill.
8. Weber, K. and Osborn, M.(1969). The reliability of molecular weight determinations by dodecyl sulfate-polyacrylamide gel electrophoresis.*Journal of .Biology.Chemistry,24*,4406-4407.