AN INVESTIGATION OF COLLAGEN CHARACTERISTICS AND COLLAGENASE ACTIVITY IN WOODY BREAST MEAT

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I. OBJECTIVES

Woody breast is a relatively new quality issue in the broiler industry. Breast meat with this myopathy exhibits tough and rubbery texture. Greater collagen content is observed in woody breast meat, but the relationship between the collagen characteristics and the abnormal texture of woody breast meat has not been delineated. Therefore, the objective of this study was (1) to characterize collagen properties and (2) to assess native collagenase activity of normal and woody breast meat.

II. MATERIALS AND METHODS

A total of fourteen Ross line chicken breast fillet samples (7 severe woody breast and 7 normal) were collected, packaged, and frozen at approximately 8 h postmortem. The cranial region of each breast was pulverized in liquid nitrogen and used to measure collagen content (hydroxyproline content), mature collagen crosslink density (pyridinoline and deoxypyridinoline concentration using liquid chromatography with a fluorescence detector), collagenase activity (gelatin-zymography measuring MMP-2 activity), and pH. Warner-Bratzler shear force (WBSF) of cooked breast meat and perimysial thermal stability (differential scanning calorimeter) were conducted using the middle and caudal region of the breast meat.

III. RESULTS

Woody breast meat had greater collagen content (3.89 vs. 2.08 mg collagen/g muscle; $P < 0.01$), pyridinoline density (0.23 vs. 0.14 mol/mol collagen; $P < 0.05$), deoxypyridinoline density (0.07 vs. 0.04 mol /mol collagen; $P < 0.01$), and perimysial thermal stability (peak denaturation temperature: 65.47°C vs. 63.72°C; $P < 0.05$) than normal breast meat. In addition, woody breast meat had more collagenase activity (13.24% vs. 7.84% active MMP-2; $P < 0.05$) and a greater pH (6.17 vs. 5.83; $P < 0.01$) than normal breast meat. Although significant differences in collagen characteristics were detected between woody breast and normal meat, WBSF did not differ between woody breast and normal meat (4.33 vs. 5.97 kgf, respectively; $P > 0.10$). It should be noted that other studies reported similar findings with varying WBSF values, which indicates that WBSF may not be a suitable assessment method of woody breast meat texture.

IV. CONCLUSION

These results indicated that woody breast meat had greater collagen concentration and mature collagen crosslink densities compared to normal breast meat, which may have resulted in the observed increase in perimysial thermal stability and the abnormal palpable hardness of the fillets. On the other hand, a greater collagenase activity was found in woody breast meat compared to normal breast meat, which was likely enhanced by the greater free calcium content and the more neutral pH found in woody breast meat. Additional research linking collagen characteristics and collagenase activity with the observed dissipation of woody breast

meat over storage (Byron et al., 2019) is needed to develop better postmortem handling strategies to minimize the impact of this quality defect.

Keywords: collagen, collagen crosslinks, collagenase activity, differential scanning calorimetry, woody breast