POTENTIAL FACTORS RELATED TO MUSCLE DEGENERATION IN WHITE STRIPING CHICKEN BREAST

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I. OBJECTIVES

White striping (WS) in chicken breast is characterized as white lines, mostly fat and collagen deposition parallel to the muscle fiber direction, that impact palatability. Histologically, chicken breast with WS has muscle lesions, mainly due to myodegeneration as well as increase in the fibrosis and chronic lipidosis. Research has shown a correlation between a heavier, faster-growing bird and WS myopathy. Therefore, it is postulated that the myofiber regeneration ability of fast-growing birds would be diminished and damaged muscle fibers would instead be replaced with collagen and fat deposition. The fibrosis and fat deposition are fibroblasts and adipocytes that share common fibro/adipogenic progenitor (FAP) cells. FAPs are located at the stromal vascular fraction of skeletal muscle, indicating that WS formation might be correlated with the expression of this cell lineage. In this study, the alteration of expression of FAP and satellite cells and changes in muscle fiber characteristics were examined in growing chickens.

II. MATERIALS AND METHODS

Ross 708 broiler chicks ($n = 288$) were divided into 12 pens with 24 birds in each pen. Two broilers from each pen were harvested at 2 and 4 wk of age, and *M. pectorales major* and *M. tibialis* were removed and weighed. Two subsamples were collected from each muscle. One was fixed in 4% paraformaldehyde for 4 h and then left in 30% sucrose overnight. The other was frozen in isopentane chilled by liquid nitrogen. All samples were stored in −80°C. Tissue sections were 5 micrometers thick for immunohistochemical analysis. Tissue sections were rinsed with deionized water, followed by 3 washes of TBS and 0.3% Triton (TBST). Then, sections were blocked with blocking buffer (5% donkey serum, 1% BSA, and TBST) for 2 h at room temperature and then incubated with primary antibody overnight at 4°C. The sections were washed 3 times with TBST and incubated with secondary antibodies for 1 h at room temperature. The slides were rinsed in TBS for 20 min before mounting in mounting medium with DAPI. Pictures were acquired by ECHO fluorescence microscope and processed by ImageJ software.

III. RESULTS

The 4-wk-old chicken muscle had a greater amount of PDGFRα compared to the 2-wk-old chicken muscle. In both the thigh and breast muscles, the muscle fiber diameters in the 4-wk-old chickens were much larger than in the 2-wk-old chickens. However, there appeared to be less Pax7 in the muscles of 4-wk-old chickens than in muscles of the 2-wk-old chickens. The PDGFRα and Pax7 amounts were less pronounced in *M. tibialis* than in *M. pectorales major*. The 4-wk-old chicken breast that visibly displayed WS had more amounts of PDGFRα with greater reduction in Pax7 than 4-wk-old chicken breast without visible WS.

IV. CONCLUSION

The increased muscle cross-section would be expected to cause greater pressure on the peripheral fibers, resulting in the myopathy. The decrease in the satellite cells could decrease the capability of repairing of damaged muscle fiber. The greater expression of PDGFRα suggested that the damaged muscle fiber was more apparent and would be infiltrated with the collagen or fat tissue as an indication of impaired regenerative capacity.

Keywords: chicken, fibro/adipogenic progenitors, myopathy, satellite cells, white striping