EFFECTS OF GENETIC STRAIN OF BROILERS ON PROTEOME PROFILES OF NORMAL AND WOODY BREAST MUSCLE

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I. OBJECTIVES

Wooden or woody breast (WB) is a myopathy in the *Pectoralis major* of fast-growing broilers and downgraded due to undesirable appearance and impaired nutritional quality. The objective of this study was to evaluate differences in growth and proteomes of normal (NB) and WB among 5 genetic broiler strains.

II. MATERIALS AND METHODS

For each of 5 strains, 128 chicks were randomly assigned to 8 pens (1 pen/block) and raised at the Mississippi State University Poultry Farm according to an approved animal welfare protocol (IACUC-16-542). After 8 wk, 4 birds/pen were randomly selected and evaluated for WB at 24 h postmortem according to Tijare et al. (2006) where breast samples were grouped into NB and WB. Completely randomized designs were used to evaluate the differences among 5 genetic strains with respect to the body, carcass, and breast weights for both NB and WB groups. Tukey's Honestly Significant Difference test was used to separate treatment means among strains ($P < 0.05$). A two-tailed *t* test was used to evaluate the difference between NB and WB within each strain ($P < 0.05$). A group of live male birds (1 bird/pen) were also evaluated for WB myopathy by manual palpation. Within each strain, 4 birds with NB and 4 birds with WB were selected. Next, the birds' cranial breast muscles were collected and snap-frozen in liquid nitrogen. The whole muscle proteomes (3 samples/strain, 2 gels/sample) were analyzed using two-dimensional gel electrophoresis and liquid chromatography-tandem mass spectrometry for protein spots that exhibited a fold change of 2.0 threshold in spot intensity ($P < 0.05$).

III. RESULTS

Birds from strains 1, 3, and 5 in the WB group were heavier than those in the NB group ($P < 0.05$). Although there were no differences in breast weights within WB meat ($P > 0.05$), WB meat from all strains was heavier than breast meat from NB ($P < 0.05$). Within WB, strain 5 had a greater breast percentage than strains 1, 3, and 4 ($P < 0.05$). WB from strains 2–5 had a greater breast percentage than that of NB ($P < 0.05$). Within NB—when compared with strain 5—alpha-actin, ubiquitin carboxyl-terminal hydrolase, cofilin-2 muscle isoform, and voltage-dependent anion-selective channel protein 2 were underexpressed ($P < 0.05$) in strain 2; nucleoside diphosphate kinase and voltage-dependent anion-selective channel protein 2 were underexpressed ($P < 0.05$) in strain 3; and myozenin-1 isoform X2 was underexpressed ($P < 0.05$) in strain 4. Within WB—when compared with strain 5—alpha-actinin-2 and gelsolin were overexpressed ($P < 0.05$) in strain 1; elongation factor 2 and

myozenin-3 were underexpressed ($P < 0.05$) in strain 1; adenosylhomocysteinase and LIM domain-binding protein 3 were underexpressed ($P < 0.05$) in strain 2; and myozenin-3 and LIM domain-binding protein 3 were underexpressed ($P < 0.05$) in strain 3. Desmin, serum albumin precursor, annexin A5, actin-related protein 3, ubiquitin carboxyl-terminal hydrolase, and troponin T were underexpressed ($P < 0.05$), while mitochondrial 60 kDa heat shock protein and myosin-binding protein H were overexpressed ($P < 0.05$) in strain 4 compared to strain 5.

IV. CONCLUSION

Protein profiles of broiler breast were affected by genetic strains and the presence of WB myopathy. This helps us understand how breast muscle proteins affect the growth performance of broiler strains and further elucidates the etiology of WB development in different commercially available genetic strains.

Keywords: genetics, poultry, proteomics, woody breast myopathy