MUSCLE WATER PROPERTIES BY TIME-DOMAIN NUCLEAR MAGNETIC RESONANCE IN RAW INTACT BROILER *PECTORALIS MAJOR* WITH THE WOODY BREAST CONDITION

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I. OBJECTIVES

In addition to having unique tactile properties in the raw state, woody breast (WB) fillets (*pectoralis major*) also exhibit altered muscle water characteristics, with increased moisture content and decreased water-holding capacity (WHC) compared to normal fillets. Time-domain nuclear magnetic resonance (TD-NMR) is a rapid analytical methodology that provides information about muscle water properties, such as mobility, compartmentalization, and relative content. Previous studies have shown a relationship between water properties measured with TD-NMR and the WB condition. However, these studies utilized only small subsamples of the *pectoralis major* and did not analyze the relationships between the water properties and WHC. The objective of this study was to investigate effects of WB on muscle water properties determined by TD-NMR and their relationship with WHC in raw intact broiler breast fillets.

II. MATERIALS AND METHODS

Pectoralis major muscles ($n = 144$) from 8-wk-old broilers deboned at 3 h postmortem were collected from a commercial plant and categorized as normal, moderate WB, or severe WB based on fillet hardness and rigidity. For WHC, fillet purge loss was determined based on weight differences before and after overnight storage at 4°C. Muscle water properties were determined by TD-NMR based on the following measurements: relaxation parameters mobility (time constant of peak, T), distribution (area of peak relative to other peaks, P), and relative abundance (peak area per 100 g meat, A); values were transformed using an inverse Laplace algorithm.

III. RESULTS

There were 3 water components identified in raw broiler breast meat: hydration water (T-HW), intra-myofibrillar water (T-INTRA), and extra-myofibrillar water (T-EXTRA). As WB scores increased (from normal to severe), time constant T-HW increased ($P < 0.05$) from 0.39 to 0.44 ms, T-INTRA from 49 to 57 ms, and T-EXTRA from 205 to 235 ms. There was also an increase in the proportion of extra-myofibrillar water (P-EXTRA) from 18% to 39% ($P < 0.05$) and increases in the relative abundance of intra-myofibrillar water (A-INTRA) from 385 to 404 unit/100 g meat and extra-myofibrillar water (A-EXTRA) from 88 to 273 unit/100 g. However, P-HW decreased from 0.79% to 0.35%, P-INTRA from 81% to 60%, and A-HW from 3.65 to 2.25 unit/100 g. In addition, the WB condition resulted in increased ($P < 0.05$) purge loss from 1.14% to 1.84%. Correlation analysis revealed that the strongest overall correlation ($r = 0.64$) was between A-EXTRA and purge loss. There was no correlation ($P > 0.05$) between A-INTRA and purge loss. Within normal fillets, purge loss correlated to T-HW, T-INTRA, A-INTRA, and A-EXTRA ($r \geq 0.38$, $P < 0.001$). Within the severe WB group, only the A-EXTRA correlated to purge loss ($r = 0.5$; $P < 0.001$).

IV. CONCLUSION

The WB condition has a significant impact on water mobility, compartmentalization, and abundance within raw breast fillets. The WB condition results in increases in water mobility, P-EXTRA, A-INTRA, and A-EXTRA but decreases in P-HW and P-INTRA. In normal broiler *pectoralis major*, T-HW, T-EXTRA, A-INTRA, and A-EXTRA are involved in meat purge loss. However, A-EXTRA may be a key factor responsible for the poor WHC in WB meat.

Keywords: extra-myofibrillar water, intra-myofibrillar water, meat water-holding capacity, nuclear magnetic resonance, wooden breast myopathy