INFLUENCE OF ZINC AND RACTOPAMINE HYDROCHLORIDE SUPPLEMENTATION ON THE PROTEOME OF EARLY POSTMORTEM BEEF *LONGISSIMUS THORACIS* MUSCLE

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I. OBJECTIVES

Production practices to improve growth and efficiency can impact early postmortem metabolism and tenderness. The objective of this experiment was to investigate the impact of growth improvement strategies on the muscle proteome of *longissimus thoracis* (LT) muscle of beef finishing steers.

II. MATERIALS AND METHODS

Yearling steers were assigned dry rolled corn diets based on growth potential and initial body weight: non-Zn supplemented control (CON-NO; 36 mg Zn/kg dry matter; $n = 5$), supranutritional Zn supplementation (SUPZN-NO; CON diet + 60 ppm Zn from $ZnSO_4$ + 60 ppm Zn from Zn amino acid complex; $n = 5$), CON + ractopamine hydrochloride (RAC) supplementation (CON-RAC; 300 mg RAC-steer^{-1} d^{-1}; $n = 5$), and supranutritional Zn supplementation + RAC supplementation (SUPZN-RAC; $n = 5$). Zn treatments were fed for the entire 89-d trial and RAC supplementation for the final 28 d for RAC treatments. At finishing weights, 1 steer per treatment was harvested at the ISU Meat Lab on 5 separate dates. LT muscle pH measurements were taken at 1, 3, 6, and 24 h postmortem. LT muscle samples were taken at 1 h and 1 d postmortem and frozen until protein analysis. Steaks were fabricated and aged for 1, 3, 7, or 14 d postmortem and Warner-Bratzler shear (WBS) force values were determined. Sarcoplasmic proteins were extracted and used for mass spectrometry (liquid chromatography-tandem mass spectrometry) analysis using tandem mass tagging. WBS and pH data were analyzed as a 2 × 2 factorial using the mixed procedure of SAS version 9.4 (SAS Institute Inc., Cary, NC) with fixed effects of Zn, RAC, and the interaction, with harvest date as a fixed block. Significance was denoted by $P < 0.05$ and trends by $P < 0.10$. Proteomic data were analyzed using *t* tests. Significance was set at $P < 0.10$.

III. RESULTS

Zn supplementation trended for a lesser ($P = 0.06$) pH value at 6 h postmortem, and RAC supplementation resulted in a greater ($P = 0.04$) pH value at 6 h postmortem. These differences are driven by the individual treatments, not the interaction. At 1 d postmortem, Zn supplementation trended for lesser ($P = 0.06$) WBS values, and RAC supplementation resulted in greater ($P < 0.01$) WBS values. At 1 h postmortem, a greater abundance of soluble actin and lesser abundance of vinculin was observed in SUPZN-RAC compared with SUPZN-NO or CON-RAC. A lesser abundance of soluble myosin 7 and troponin-T was observed in CON-NO compared with CON-RAC or SUPZN-RAC. A lesser abundance of myosin regulatory light chain 2 was detected in SUPZN-NO compared with CON-NO, CON-RAC, or SUPZN-RAC. At 1 d postmortem, lesser abundance of AMP deaminase and greater abundance of malate dehydrogenase was detected in SUPZN-NO compared with CON-NO or SUPZN-RAC. A greater abundance of pyruvate dehydrogenase subunit beta was detected in SUPZN-NO compared with CON-NO or CON-RAC. A greater abundance of

fructose bisphosphate aldolase and glyceraldehyde phosphate dehydrogenase was observed in CON-RAC compared with CON-NO or SUPZN-RAC.

IV. CONCLUSION

At 1 h postmortem, several structural proteins differed in abundance between rapid growth treatments. These structural proteins are not typically soluble in muscle potentially indicating differences in cellular remodeling of the muscle structure. At 1 d postmortem, differences in metabolic proteins in the proteome were identified which may play a key role in the observed differences in early postmortem metabolism of rapid growing animals. The results represent a complex response to management practices that can influence meat quality.

Keywords: beef tenderness, pH decline, proteomics, postmortem metabolism