POSTMORTEM ENERGY METABOLISM IN *LONGISSIMUS LUMBORUM* OF BRAHMAN AND ANGUS STEERS

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I. OBJECTIVES

During the first several hours postmortem, the biochemical and energetic status of muscle shifts considerably. These changes influence the development of meat quality attributes and may contribute to variation in tenderization rate between Brahman and Angus. The objective of this study was to determine muscle pH and temperature decline, glycolysis, and energy status in these breeds.

II. MATERIALS AND METHODS

Steers of primarily Angus or Brahman genetics (80%–100%; $n = 14$ per breed) were reared together and harvested at the University of Florida Meat Lab. Temperature and pH decline of the *longissimus lumborum* (LL) were evaluated at 1, 3, 6, 9, and 24 h postmortem, and samples of the LL were collected at 1, 3, 6, and 24 h postmortem. Muscle samples were immediately frozen in liquid nitrogen and stored at −80°C until further analysis. For metabolite analysis, LL was powdered in liquid nitrogen and diluted in perchloric acid (phosphocreatine; ATP; glucose; glucose 6-phosphate; lactate) or hydrochloric acid (glycogen). Then, samples were homogenized with ceramic beads; those diluted in perchloric acid were centrifuged, and supernatant was collected for analysis. Samples for the glycogen assay were heated at 100°C for 2 h to hydrolyze glycogen to glucose and centrifuged, and the supernatant was collected. Glycogen, glucose, glucose 6-phosphate, and lactate were quantified at all time points, whereas ATP was determined at 1, 3, and 6 h and phosphocreatine at 1 h. Metabolites were quantified using enzymatic methods. Data were analyzed using SAS (SAS Institute Inc., Cary, NC), and the model included the fixed effects of breed, time, and their interaction. Time was considered a repeated measure.

III. RESULTS

The decline in muscle pH postmortem tended to differ between breeds (breed × time, $P = 0.07$). Brahman LL exhibited higher pH at 6 and 9 h ($P = 0.02$). Temperature decline postmortem also exhibited distinct patterns between breeds (breed × time, $P = 0.0008$), with Brahman LL being lower at 1, 3, 6, and 9 h postmortem. As expected, time influenced glycolytic metabolites (glycogen, glucose, glucose 6-phosphate, and lactate; $P < 0.0001$), but pattern between breeds was similar. Glycogen declined from 1 to 24 h postmortem, whereas glucose and lactate increased. Breed tended to influence phosphocreatine content at 1 h ($P = 0.097$), with higher values observed in Brahman LL. Both breed ($P = 0.02$) and time ($P < 0.0001$) impacted ATP. Breeds exhibited similar rates of ATP decline; however, ATP in Brahman LL was generally higher, particularly at 1 h ($P < 0.01$).

IV. CONCLUSION

Breeds exhibited similar changes in glycolytic metabolites postmortem. However, Brahman LL maintained improved energy status early postmortem, which may be due to increased

capacity to generate ATP using pathways other than anaerobic glycolysis, or alternatively, decreased ATP utilization. This may contribute to protracted pH decline in Brahman LL. These results will be used in conjunction with proteolysis markers and mitochondrial function analyses to better understand meat quality development in Brahman and Angus.

Keywords: Brahman, glycolysis, pH, postmortem metabolism, temperature