Growth rate within the feeding regime seems to drive early postmortem metabolism and beef tenderization: a proteomic approach

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Introduction: Rearing practices such as finishing regime (FR) and growth rate (GR) may change the biochemical and structural properties of skeletal muscles, which directly impact postmortem (PM) metabolism and aging response. Thus, the aim of this study was to evaluate the effects of FR and GR on PM metabolism and aging response in a proteomic approach.

Materials and Methods: Thirty-six Angus x Nellore crossbred steers were randomly assigned to one of four treatments: 1) feedlot, high GR (FH); 2) feedlot, low GR (FL); 3) pasture, high GR (PH) and 4) pasture, low GR (PL). Samples from the *Longissimus thoracis* (LT) muscle were collected at 15 min PM for pH *in vitro* system (0, 0.5, 2, 4, 8, 12 and 24 h PM) and proteomic analysis. Three 2.5-cm thick LT muscle samples were collected at 24 h PM and aged or not aged for 7 and 14 d for Warner-Bratzler shear force (WBSF) and proteomic analysis. Muscle pH was normalized to 0 h PM and WBSF was normalized to non-aged meat so that their relative Δ was evaluated. Significant protein spots (fold change ≥ 1.5; $P \leq 0.05$) were identified by liquid chromatography-mass spectrometry (LC-MS/MS) analysis.

Results: A treatment × time PM interaction was observed for relative ΔpH ($P = 0.050$). Steaks from FH and PH animals had higher pH decline ($P < 0.05$) than those from FL and PL animals at 0.5 h (8.7, 8.0, 6.1 and 6.3%) and 2 h (11.6, 11.3, 9.6 and 9.5%) PM, respectively. Steaks from FH animals also had higher pH decline ($P < 0.05$) than those from FL and PL animals at 4 h (14.0, 12.6 and 11.6%) PM, respectively. Steaks from FH, FL and PH animals had lower pH decline ($P < 0.05$) than those from PL animals at 8 h (17.0, 15.9, 16.4 and 14.6%), 12 h (18.7, 15.9, 17.7 and 15.9%) and 24 h (19.8, 19.7, 19.1 and 18.6%) PM, respectively. During PM time, overabundances of phosphoglycerate mutase-2 and triosephosphate isomerase were observed at 15 min PM while an overabundance of glycogen phosphorylase was observed at 24 h PM for FH animals. For PH animals, an overabundance of phosphoglucomutase-1was observed at 15 min PM while an overabundance of beta-enolase was observed at 24 h PM. In addition, overabundance of pyruvate kinase was observed at 15 min PM for FL animals while an overabundance of creatine kinase M-type was observed at 24 h PM for PL animals. A treatment × aging interaction was observed for relative ΔWBSF ($P = 0.049$). Steaks from FH (39.7%) and PH (43.3%) animals had higher WBSF decline ($P < 0.05$) during the first 7-d of aging than those from FL (28.9%) and PL (30.3%) animals. In addition, steaks from FL (18.5%) and PL (27.6%) animals had higher WBSF decline ($P < 0.05$) from 7-d aging than those from FH (6.7%) and PH (10.6%) animals. During aging time, α-actin, myosin light chain 2 and troponin T (fast isoform) were overabundant in non-aged beef when compared to 7- and 14-d aged beef in all treatments.

Conclusion: In general, the higher pH decline during the early PM associated with the greater abundance of glycolytic enzymes during 15 min and 24 h PM may be an indicative of a greater glycolytic metabolism in FH and PH muscle, which also may have influenced WBSF decline during the first 7-d aging. Therefore, GR within the FR seems to drive early PM and beef tenderization.

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