THE INFLUENCE OF BEEF CARCASS WEIGHT ON TROPONIN-T DEGRADATION AND HEAT SHOCK PROTEIN 70 IN TWO DIFFERENT MUSCLES

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I. OBJECTIVES

This study was to evaluate troponin-T (TnT) degradation and heat shock protein 70 (HSP70) in 2 muscles (*semimembranosus* [SM] and *longissimus thoracis et lumborum* [LD]) from different weight beef carcasses and how they correlate to carcass measurements during slaughter, processing, and aging.

II. MATERIALS AND METHODS

Heavy (>430.9 kg; $n = 22$), average (351.5 to 385.6 kg; $n = 23$), and light (< 317.5 kg; $n = 20$) beef carcasses were randomly selected over 5 nonsequential days at a commercial abattoir. Carcasses were monitored for temperature and pH at 45 min, 4 h, and 24 h after exsanguination in the SM and LD between the 12th and 13th rib. After a 24-h chill, ribeye area, 12th rib fat, and yield grade were evaluated by trained personnel. Upon fabrication, subprimals were transported to the North Dakota State University meat laboratory and aged. After 14 d, 2.5-cm steaks were collected from the cranial end of the ribeye roll and the proximal end of inside round for shear force. Meat samples from the LD and SM were collected at day 3 and day 14. Western blots for TnT and HSP70 were performed on day-3 and day-14 LD and day-3 SM. Reactive bands for TnT were observed at 40, 38, 36, 34, and 30 kDa. LSMEANS were measured using PROC MIXED procedure of SAS (SAS Institute Inc., Cary, NC), and Tukey test was performed for mean comparison. Pearson correlation coefficients were determined using PROC CORR of SAS.

III. RESULTS

Carcass weight did not influence ($P > 0.05$) HSP70 abundance in LD or SM. In day-3 SM, heavy carcasses had less 40-kDa ($P = 0.02$) and greater 34-kDa ($P = 0.03$) and 30-kDa ($P = 0.03$) TnT than light carcasses. Alternatively, in day-14 LD, light carcasses had greater 30 kDa ($P = 0.007$) TnT than heavy carcasses. Carcass weight was negatively correlated with 30-kDa TnT in day-14 LD ($r = -0.34$, $P = 0.03$) and 40-kDa TnT in day-3 SM ($r = -0.44$, $P = 0.03$) and positively correlated with 30-kDa TnT in day-3 SM ($r = 0.43$, $P = 0.04$). There were negative correlations between 24-h pH and 30-kDa TnT in the day-3 and day-14 LD ($r = -0.33$, $P = 0.03$; $r = -0.319$, $P = 0.04$, respectively) and between 4-h pH and 30-kDa TnT ($r = -0.43$, $P = 0.04$) in day-3 SM. There was a tendency of positive correlations between 4-h pH and 24-h pH with HSP70 abundance in day-3 SM ($r = 0.30$, $P = 0.06$; $r = 0.27$, $P = 0.08$, respectively). In addition, 24-h temperature and ribeye area were negatively correlated with 30-kDa TnT in the day-3 LD ($r = -0.33$, $P = 0.05$; $r = -0.32$, $P = 0.02$, respectively). Moreover, drip loss percentage and shear force were also negatively correlated with the 30-kDa TnT band in day-14 LD ($r = -0.27$, $P = 0.04$; $r = -0.31$, $P = 0.03$, respectively).

IV. CONCLUSION

HSP70 protein was not influenced by carcass weight. TnT degradation was greater in heavy carcasses in the day-3 SM and in light carcasses in the day-14 LD. In the LD, correlations

between the 30-kDa TnT band and carcass weight as well as ribeye area were negative, indicating that the LD may have less protein degradation as the carcass got heavier. In the SM, there was an opposite observation where the larger carcasses had more 30-kDa TnT degradation product. Based on the correlation data, these differences do not seem to be temperature or pH dependent. Interestingly, the LD and SM respond differently to increases in carcass weight with regard to protein degradation during aging.

Keywords: beef, carcass size, heat shock protein, troponin-T