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Impact of Two Levels of Low Voltage Electrical Stimulation on Beef Quality

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Objectives

Electrical stimulation (ES) prior to rigor mortis accelerates postmortem glycolysis, resulting in rapid postmortem depletion of glycogen and can partially simulate the physiological conditions created by stress. The objective of this study was to evaluate the influence of two levels of high voltage electrical stimulation on incidence of dark cutters, temperature decline, muscle pH, glycolytic potential, and meat quality.

Materials and Methods

Fifty beef carcasses were chosen at 3 collection times over 7 h; 14 at collection 1, 18 at collection 2, and 18 at collection 3. One side of each carcass received either 40 (E40) or 80 (E80) volts of ES. The paired side of each carcass served as a control and did not receive ES (C40 or C80). Temperature data loggers were placed into the sirloin of both sides of the first 4 carcasses from each collection period to monitor temperature decline. Muscle pH was measured on the *longissimus* muscle at 1, 12, 24, and 72 h postmortem. Steaks were fabricated from the *longissimus lumborum* for determination of WBSF, cook loss, glycolytic potential (GP), and objective color. Data were analyzed using PROC Mixed of SAS with fixed effect of treatment and random effect of carcass. Analysis of carcass temperature decline was conducted with control carcasses pooled to one treatment to better evaluate the effect of ES on temperature decline. Temperature data, WBSF, and pH were considered repeated measures. Significance was determined at $P < 0.05$.

Results

No dark cutting carcasses were observed in this study. A time by treatment interaction was observed for carcass temperature decline ($P < 0.001$) where ES sides stayed warmer for longer than control sides. A treatment by time interaction was observed for pH decline ($P < 0.001$) with C40 sides having an increased pH at 1 h postmortem compared to E80 sides. Carcass characteristics did not differ among treatments ($P > 0.05$). A treatment effect was observed for WBSF values ($P = 0.006$) with ES sides being more tender than C40 sides. A day effect was observed ($P = 0.009$) with steaks aged for 7 d being less tender than steaks aged for 14 d ($P = 0.007$). Cook loss did not differ among treatments ($P > 0.05$). A difference in cook loss by aging period ($P = 0.014$) was observed. Steaks aged for 3 d had less cook loss than steaks aged for 7 d (17.3% vs. 18.8% respectively; ($P = 0.017$) and tended to have less cook loss than steaks aged for 14 d (18.3%; $P = 0.065$). Glucose, lactate, and overall GP measurements did not differ among treatments ($P > 0.05$). Objective L* values for E80 sides were greater than C40 ($P = 0.0009$) and C80 ($P < 0.0001$), and E40 values were greater than C40 ($P < 0.0001$). Objective a* values for E80 sides were greater than C40 ($P = 0.002$) and C80 ($P = 0.035$), and E40 values were greater than C40 ($P < 0.0001$). Objective b* values were greater for E80 than C80 ($P = 0.005$) and C40 ($P = 0.001$), and E40 was greater than C40 ($P < 0.0001$).

Conclusion

These data suggest ES does not influence the incidence of dark cutters. However, utilization of an ES system can improve tenderness of steaks in addition to producing brighter, more red beef products. The results of this study indicate that similar quality characteristics can be obtained using 40 or 80 V of ES. Therefore, beef packing plants applying ES to carcasses may be able to reduce voltage without sacrificing quality.