FREE CALCIUM CONCENTRATION, CALPAIN-2 ACTIVITY, AND FINAL PRODUCT TENDERNESS OF ELECTRICALLY STIMULATED BEEF

B. Buseman[1*], T. Weber[1], J. Nasados[1], P. Bass[1], J. Van Buren[1], J. Lancaster[1], J. Smart[1], M. Doumit[2], G. Murdoch[1], W. Price[2], K. Insausti[3], and M. Colle[1],

[1]*Animal and Veterinary Sciences, University of Idaho, Moscow, ID, USA,*

[2]*College of Agriculture and Life Sciences, University of Idaho, Moscow, ID, USA,*

[3]*Agricultural Engineering School-IS FOOD, Public University of Navarra, Pamplona, Spain,*

*buse2360@vandals.uidaho.edu

I. OBJECTIVES

The objective of this study was to evaluate timing of electrical stimulation on free calcium concentration, calpain-2 activity, Warner-Bratzler shear force (WBSF), and consumer sensory analysis.

II. MATERIALS AND METHODS

Twenty-three crossbred beef steers were harvested and stimulated using extra-low voltage (21 V for 20 s) or not stimulated at exsanguination and at 1 h postmortem, resulting in 4 stimulation treatments: Not Stimulated-Not Stimulated, Not Stimulated-Stimulated, Stimulated-Not Stimulated, or Stimulated-Stimulated. Samples were cut from the *longissimus lumborum* (LL) and *semimembranosus* (SM) for free calcium and calpain-2 analysis on days 1, 4, and 14 postmortem. On day 4, steaks were cut from the LL and SM for WBSF and consumer sensory analysis and assigned to an aging period of 4 or 14 d. Free calcium concentration was analyzed by mixing samples with calcium ion strength adjuster (Hanna Instruments, Woonsocket, RI) and measuring ionic strength of the solution using a calcium selective electrode. Ionic strength of each sample was compared to a calibration curve to determine final concentration. Calpain analysis was conducted utilizing casein zymography. The volume of each band was recorded as a percentage of the day 0 control band ran on each gel. For WBSF analysis, six 1.27-cm cores were removed from each steak parallel to the muscle fibers, with care to avoid connective tissue and fat. Cores were sheared perpendicular to the muscle fibers, and peak shear force was recorded. One consumer sensory panel for each muscle group was held, with panelists receiving 5 samples. Samples were assigned to the panelists using an incomplete block design. Data were analyzed using the Mixed Model procedure of SAS (SAS Institute Inc., Cary, NC), with significance determined at $P < 0.05$.

III. RESULTS

There was a tendency for an aging period by stimulation treatment interaction for LL free calcium concentration ($P = 0.0503$). While all treatments had similar initial and final values, the Not Stimulated-Not Stimulated treatment showed an increase in free calcium concentration relative to the other treatments at 4 d of aging. No difference was observed for free calcium concentration in the SM between stimulation treatments ($P = 0.44$); aging, however, significantly increased SM free calcium concentration ($P < 0.01$). Stimulation did not impact native calpain-2 activity in the LL ($P = 0.71$) or SM ($P = 0.89$). Aging period did not significantly influence native clapain-2 activity in the LL ($P = 0.11$); however, it did show higher activity in the SM on day 14 ($P = 0.08$). Furthermore, stimulation treatment did not improve

WBSF in the LL ($P = 0.69$) or SM ($P = 0.61$). Aging period was significant in the LL, with steaks aged 14 d being more tender than those aged only 4 d ($P < 0.01$). Conversely, aging period did not significantly influence WBSF values in the SM ($P = 0.61$). Stimulation treatment did not influence consumer sensory scores for tenderness in the LL ($P = 0.56$) or SM ($P = 0.36$). In the LL, aging period did not show a significant influence on tenderness ($P = 0.71$). In the SM, consumers preferred samples aged 14 d over those aged 4 d ($P < 0.01$).

IV. CONCLUSION

In conclusion, the timing of electrical stimulation utilized in the current study did not influence free calcium concentration, calpain-2 activity, or beef tenderness; however, aging did improve tenderness.

Keywords: beef, calcium, calpain, electrical stimulation, tenderness