ASSESSING BIOCHEMICAL CHANGES IN NORMAL AND HIGH-PH BEEF *LONGISSIMUS LUMBORUM* IN RELATION TO BIOELECTRICAL IMPEDANCE ANALYSIS

F. Najar[1*], E. Boyle[1], T. Houser[1], C. Vahl[2], J. Wolf[1], J. Gonzalez[3], J. Kastner[1], T. O'Quinn[1], M. Chao[1], K. Cox[4], S. Stroda[1], and M. Hunt[1],

[1]*Animal Science and Industry, Kansas State University, Manhattan, KS, USA*,

[2]*Department of Statistics, Kansas State University, Manhattan, KS, USA*,

[3]*Department of Animal and Dairy Science, University of Georgia, Athens, GA, USA*,

[4]*Quality Assurance, Seafood Analytics, Juneau, AK, USA*,

*fnajar@ksu.edu

I. OBJECTIVES

The study objective was to use external bioelectrical impedance analysis (BIA) to assess postmortem chemical changes in normal- and high-pH beef *longissimus lumborum* steaks during simulated retail display.

II. MATERIALS AND METHODS

The experiment was designed as a split-plot with loin as the whole plot. Display day and meat pH were treated as the sub-plot treatments. Data were analyzed using SAS version 9.4 (SAS Institute Inc., Cary, NC). Treatment effects were treated as fixed effects and evaluated using the PROC MIXED procedure in SAS. Differences were considered significant at $P < 0.05$. Beef strip loins ($n = 20$; postmortem age = 14 d) obtained from a commercial processor were sorted into 2 treatments: normal pH (5.61–5.64; $n = 11$) and high pH (6.2–7.0; $n = 9$). Loins were fabricated into five 2.54-cm-thick steaks ($n = 100$) and randomly assigned to one of 5 display days: 1, 3, 5, 7, and 9. Steaks were aerobically packaged and displayed in coffin-style retail cases under fluorescent lights at 0°C–4.4°C. External BIA, oxygen consumption (OC), metmyoglobin reducing activity (MRA), protein degradation, water-holding capacity (WHC), and pH were assessed on each display day.

III. RESULTS

There was no meat-pH × display-day interaction ($P > 0.05$) for external BIA values; however, an effect on meat pH and display day was found ($P < 0.05$). External BIA was 20% higher ($P < 0.05$) for high-pH meat than normal-pH meat. Steaks on day 1 had lower external BIA values ($P < 0.05$) compared to day 5 and 7, but similar ($P > 0.05$) to day 3 and 9. There was a meat-pH × display-day interaction for OC, MRA, WHC, and pH ($P < 0.05$). During retail display, normal-pH steaks had lower ($P < 0.05$) OC values than high-pH steaks. Additionally, MRA values were similar ($P > 0.05$) from day 1 to day 7; however, MRA values decreased 9% ($P < 0.05$) by day 9 for normal-pH meat, while high-pH meat remained constant ($P > 0.05$) over the 9 d of retail display. There was no meat-pH × display-day interaction ($P > 0.05$) or display-day effect for intact or degraded desmin; however, a meat-pH effect ($P < 0.05$) was found. Normal-pH meat had 33% and 43% higher ($P < 0.05$) amount of intact and degraded desmin, respectively, than high-pH meat. There tended to be a meat-pH × display-day interaction for troponin-T 40 and 30 KDa ($P = 0.0601$). In addition, no meat-pH × display-day interaction ($P > 0.05$) was found for troponin-T 36, 34, and 30 KDa. High-pH steaks had a greater ($P < 0.05$) WHC and pH than normal-pH beef over the display time. In high-pH beef, external

BIA values were moderately correlated with OC, MRA, and WHC (r = 0.35; $P < 0.05$). Additionally, a negative correlation occurred between external BIA and pH ($r = -0.48$; $P < 0.05$). External BIA was low to moderately correlated with degraded troponin-T (30 KDa), degraded portion, and WHC ($r = 0.28$; $P < 0.05$) for normal-pH beef. External BIA values were negatively correlated with pH, intact and degraded desmin, and intact and degraded troponin-T (36 KDa) ($r = -0.24$; $P < 0.05$).

IV. CONCLUSION

External BIA is a method that could be used to separate normal- and high-pH strip loins with potential for rapid, in-plant use to identify dark-cutting beef; however, BIA is not as strongly correlated to changes steaks undergo during retail display and after 14 d of aging.

Keywords: beef, impedance, pH