2019 Reciprocal Meat Conference– Meat and Poultry Quality and Composition-
Measurement and Prediction

Meat and Muscle Biology™

The Use of Bioelectrical Impedance to Assess Shelf-Life of Beef *Longissimus Dorsi*

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Keywords: beef, bioelectrical impedance, shelf-life attributes
Meat and Muscle Biology 3(2):111

Objectives

To evaluate quality attributes of beef *longissimus dorsi* (LD) during 15 d of simulated retail display using surface and internal bioelectrical impedance analysis (BIA) measurement techniques.

Materials and Methods

The experiment was designed as a split-plot with loin as the whole-plot and pairekd steaks as the sub-plot. Display day (DD) was treated as the sub-plot treatment. Postmortem age time (PM) and DD were treated as fixed effects. Beef strip loins (N = 18; IMPS #180), obtained from 3 commercial processors (PM = 27, 34, or 37 d), were fabricated into 12 2.54-cm thick steaks (N = 216). Steaks were subdivided into 6 consecutively cut pairs and pairs were randomly assigned to one of 6 display days: 0, 3, 6, 9, 12, and 15. For all pairs, one steak was allocated to microbiological analysis and pH and the paired steak for BIA, objective color assessment, proximate composition, and TBARS. Surface BIA (S-BIA) and internal BIA (I-BIA) assessment were compared. Steaks were packaged on styrofoam trays with a moisture absorbent pad, overwrapped with polyvinyl chloride film, and displayed under fluorescent lighting at 0–4°C in coffin-style retail cases.

Results

There was a PM × DD interaction (P < 0.05) for S-BIA values. From d 0 to 12 of display, steaks aged 27 d had higher (P < 0.05) S-BIA values than steaks aged 34 and 37 d; however, on d 15 of display, steaks aged 34 d had 22% higher (P < 0.05) S-BIA values than steaks aged 37 d, but had similar (P > 0.05) values compared to steaks aged 27 d. There was no PM × DD interaction (P < 0.05) for I-BIA values; however, an effect on PM and DD was found (P < 0.05). Steaks aged 27 d were 17% higher for I-BIA values (P < 0.05) than 37 d, but similar (P > 0.05) to steaks aged 34 d. For all PM aging times, d 0 had the lowest (P < 0.05) I-BIA values among all display days with 81.44. D 3 was the second lowest (P < 0.05) and 8% higher than d 0 for I-BIA values. D 6 was 16% higher (P < 0.05) than d 3 but similar (P > 0.05) to d 9 and d 12. D 12 and D 15 were similar (P > 0.05). There was a DD × BIA method interaction (P < 0.05). On d 0, 3, and 6, BIA values were different (P < 0.05); however, after d 6 onward, BIA values were similar (P > 0.05). Covariance component was smaller in I-BIA than S-BIA. There were no PM × DD interactions (P > 0.05) for a^* and b^* values; however, there was an interaction for L^* values. Postmortem aging had no effect (P > 0.05) on L^*; however, an effect on a^* and b^* was found (P < 0.05). For APC populations, there was a PM × DD interaction (P < 0.05). No PM × DD interaction or PM effect (P > 0.05) were found for TBARS; however, there was a DD effect (P < 0.05). There was no PM day × DD interaction (P > 0.05) or PM day (P > 0.05) for moisture content. Display day (P < 0.05) had an effect on moisture content. Moderate negative correlations occurred between S-BIA values and a*, b*, and moisture content with –0.48, –0.46, and –0.46, respectively; and –0.51, –0.48, and –0.43, respectively, for I-BIA. Conversely, moderate positive correlation was found between S-BIA values and APC and TBARS with 0.34 and 0.53, respectively; and 0.29 and 0.51, respectively, for I-BIA.

Conclusion

I-BIA has potential for use to assess shelf-life of retail steaks and it was more precise than S-BIA; however, I-BIA may translocate bacteria into the muscle. Protein degradation and WHC should be evaluated to better understand BIA changes over time.