BEEF ABATTOIR WATER USAGE MAY BE REDUCED THROUGH LOW-VOLUME SPRAY CHILLING WITHOUT DETRIMENTAL IMPACTS ON BEEF QUALITY OR SALEABLE YIELD

N. C. Hardcastle[1*], J. F. Legako[1], J. C. Brooks[1], M. F. Miller[1], S. R. Pohlman[2], S. R. Howard[2], G. Dolezal[2], and D. R. Woerner[1],

[1]*Animal and Food Science, Texas Tech University, Lubbock, TX, USA*,

[2]*Cargill Protein, Cargill, Wichita, KS, USA*,

*nicholas.hardcastle@ttu.edu

I. OBJECTIVES

Commercial beef processing plants utilize spray chilling, or the intermittent spraying of cold water, to reduce postmortem beef temperatures. Conventional spray chilling requires 40 to 150 L of water per side, and this study was aimed at evaluating the effect of a sustainable reduced water spray protocol. In this study, 2 spray chilling protocols were evaluated for chilling rate, saleable yield, microbial load, and carcass quality attributes.

II. MATERIALS AND METHODS

Over a 6-wk period, 1,905 carcasses, of varying composition and breed (97.18% Beef and 2.82% Holstein), free of dressing defects, were selected at a commercial beef abattoir. For each side ($N = 1{,}905$ paired sides), hot side weight and removed kidney and pelvic weight were obtained on the harvest floor. Alternating sides were assigned to either conventional, high-volume water (HW; 104 L water/side), or reduced, low-volume water (LW; 3 L water/side) chilling treatments. Treatment application lasted for 28 h postmortem with a fixed spray pattern of chilled water (3°C–4°C) and circulating air (56.63 m^3/min). Each week, 12 carcasses ($n = 72$ paired sides) were selected for continuous temperature monitoring of the deep muscle and subcutaneous fat and pre- and post-chill aerobic plant count and coliform load. After chilling, sides ($N = 1{,}905$ paired sides) were subject to USDA grading and weighed to obtain chilled side weight. Eighty-five carcasses ($n = 85$ paired sides) were selected for a cutout to determine saleable yield, trim, fat, and bone. Cutout weigh back allowed for ±1% of the side weight. One steak was collected from each cut strip loin ($n = 85$ paired steaks) for a fresh 3-d Warner-Bratzler shear force (WBSF) and slice shear force analysis (SSF). Data were analyzed using the GLIMMIX and Freq procedures of SAS (SAS Institute Inc., Cary, NC). For all models, side was nested in carcasses; chilling treatment was observed as the fixed effect, and replication as a random effect (α= 0.05). Cooked peak temperature was included as a covariate for WBSF and SSF ($P < 0.01$).

III. RESULTS

Spay protocols did not affect hot side weight ($P = 0.53$) or kidney and pelvic weight ($P = 0.60$). HW sides had greater ($P < 0.001$) chilled side weight yielding a 1.12% lower ($P < 0.001$) shrink than LW. No differences in pre- and post-chill aerobic plant count ($P \geq 0.17$) and coliform ($P \geq 0.10$) counts occurred between treatments. Though HW resulted in greater ($P = 0.02$) marbling scores than LW, USDA quality grade distribution did not differ ($P = 0.43$). Sides of LW possessed a lesser fat thickness ($P < 0.01$) opposite the ribeye, resulting in a lower ($P < 0.01$) numerical yield grade than HW; however, no difference in USDA yield grade distribution occurred ($P = 0.59$). The HW chilling protocol resulted in a greater ($P = 0.01$) total cutout weight, due to increased cutout weights of trim ($P = 0.03$) and fat (*P* < 0.01), but no difference in total subprimal yield occurred (*P* = 0.34). There were no differences in WBSF (*P* = 0.31) or SSF (*P* = 0.20) between treatments.

IV. CONCLUSION

Results show that the LW protocol utilized 97.52 kg less water/side than HW and yielded a 2.08 kg chilling side loss. The loss of trimmings and fat, which were affected by water volumes, should be taken into consideration, as HW resulted in 0.37 kg more trim and 0.56 kg more fat per side. Ultimately, processors operating in areas where water is limited can reduce water volumes during spray chilling to increase sustainability without altering beef quality, safety, and saleable subprimal yield.

Keywords: beef, carcass cutout, quality, spray chill, water