Published April 25, 2019

2018 Reciprocal Meat Conference – Meat and Poultry Quality

Meat and Muscle Biology™

Effects of Electrical Stimulation, Chilling Rate, and Carcass Size on Rates of Temperature Decline and pH Decline, and Beef Quality

B. A. Djimsa*, D. R. Woerner, M. N. Nair, J. N. Martin, R. J. Delmore, and K. E. Belk

Animal Sciences, Colorado State University, Fort Collins, CO, 80523, USA
*Corresponding author. Email: Blanchefort.Allahodjibeye_Djimsa@colostate.edu (B. A. Djimsa)

Keywords: beef color, beef tenderness, temperature and pH decline
Meat and Muscle Biology 2(2):87 **doi:10.221751/rmc2018.077**

Objectives

Growing carcass size and increased carcass mass makes it difficult for packers to appropriately chill beef carcasses, resulting in issues associated with tenderness and color. Beef processors are struggling to meet requirements for acceptable deep tissue (center of the round or chuck) temperatures in heavier carcasses prior to fabrication. Additionally, foodservice and retail customers expressed concerns relative to inconsistencies in tenderness among muscles of the round and color of the tenderloin. Furthermore, challenges of temperature induced toughening long considered resolved have resurfaced. To our knowledge, few studies have looked at the impact of the combination of chilling and electrical stimulation on tenderness, juiciness and color among current beef carcasses. Hence, this study aimed at determining the effects of carcass size, chill rate, and electrical stimulation on tenderness, juiciness, and color of beef.

Materials and Methods

Cattle ($N = 81, \leq 30$ mo) were randomly selected at a local plant and grouped into weight categories (Light, $n = 38$; Heavy, $n = 43$). The left or right side of each carcass was electrically stimulated (ES) and the opposite side was not stimulated (NS). Each carcass was assigned to a conventional rate of chilling (CC) or delayed chilling (DC). Both chilling protocols involved spray-chilling. Temperature and pH were measured for the *Semimembranosus* (SM), *Psoas major* (PM), and *Longissimus dorsi* (LD) at 45 min., 6 h, 12 h, and 32 h postmortem. Color measurements were taken from PM steaks. Loin steaks (2.5 cm) were aged for 14, 21, and 28 d and evaluated for tenderness using Warner-Bratzler shear force (WBSF) and slice force (SSF). Six trained panelists appraised tenderness, juiciness, and flavor intensity on 14 d steaks. The data were analyzed as repeated measures design using PROC MIXED of SAS (SAS Inst. Inc., Cary, NC). Chilling treatment served as a fixed effect ($\alpha = 0.05$).

Results

Carcass weight affected WBSF ($P = 0.001$) and tended to affect SSF values ($P = 0.055$). Heavy carcasses had lower WBSF values ($P < 0.05$). Aging decreased WBSF ($P < 0.0001$) and SSF values ($P = 0.006$). Electrical stimulation and chilling did not affect WBSF and SSF values ($P = 0.70$). Carcass weight, electrical stimulation, and chilling rate did not affect trained sensory panel ratings for tenderness, juiciness, and flavor ($P > 0.05$). Electrical stimulation decreased L*($P = 0.04$) and b* ($P = 0.04$) values but did not affect a* values ($P = 0.14$). Carcass size influenced temperature decline in SM and PM ($P < 0.0001$) but did not affect temperature decline in the LD. Electrical stimulation and chilling treatments did not affect temperature decline in SM, PM, and LD ($P > 0.05$). The LD temperature dropped more rapidly in CC light carcasses than DC light carcasses ($P < 0.0001$). For heavy carcasses, temperature decline rates were similar ($P > 0.05$) for CC and DC treatments. Carcass weight influenced pH decline in SM, PM, and LD ($P < 0.0001$), with pH decline occurring more rapidly in heavier weight carcasses ($P < 0.05$).

Conclusion

Heavier carcasses chilled more slowly, had a more rapid pH decline, and were more tender. The electrical stimulation and chilling regime investigated in this study did not affect sensory attributes, but did significantly impact color parameters.

