Published April 25, 2019

2018 Reciprocal Meat Conference – Meat and Poultry Quality

Meat and Muscle Biology™

Carcass Chilling Method and Electrical Stimulation Effects on Meat Quality and Color in Lamb

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Keywords: carcass chilling method, color, electrical stimulation, lamb, muscle

Meat and Muscle Biology 2(2):107 **doi:10.221751/rmc2018.096**

Objectives

To determine the effect of early postmortem carcass vascular rinsing and chilling combined with electrical stimulation on meat quality and color of lamb meat.

Materials and Methods

Five treatments were implemented on carcasses (average hot carcass weight 23.4 kg) from lambs (8 mo; $n = 21$). Treatments included a control with no electrical stimulation (ES) or vascular rinsing (C), control with ES (CES:15 Hz, 700 mA, 500 µs pulse width, 45 s pulse duration), Rinse & Chill (RC; G415), RC with ES applied before the rinse (ESRC:15 Hz, 700 mA, 500 µs, 45 s), and RC with ES applied after the rinse (RCES:15 Hz, 600 mA, 1000 µs, 45 s). The RC process involved vascular rinsing out residual blood early postmortem (PM) using a chilled isotonic substrate solution (98.5% water; balance: glucose, polyphosphates, maltose; 14°C). Carcass pH and temperature were taken at 0.75, 1, 2, 3, 4, 5, 8, 12, and 24 h PM. At 24 h PM, both *Longissimus et lumborum* (LL) and *Semimembranosus* (SM) muscles were excised. On 3 d PM, SM, and LL were cut up (15 mm thickness) and vacuum packaged. Color chops (15 mm) were aged fresh to 6 d PM then displayed. Remaining samples were frozen and stored (–18°C). LL was also aged to 22 d PM (2°C) before being cut up (15 mm) and frozen. Color measurements (CIE L*a*b*, chemical states of myoglobin) were obtained on 0, 1, 3, and 5 d of display. Reflectance spectrophotometry was used to estimate oxymyoglobin (OMb, %R610 nm/%R525 nm), deoxymyoglobin (DMb, %R474nm/%R525nm) and metmyoglobin (MMb, %R572nm/525nm). Samples were cooked in a water bath (endpoint temperature, 70°C). The likelihood of cold shortening was determined using the following parameters: pH > 6 and temperature < 15°C. Other dependent variables included purge, pH, rebloom, Warner-Bratzler shear (WBS; 1-cm wide strips), cooking loss, and consumer sensory evaluations. Animal served as the experimental unit and data were analyzed with PROC MIXED model. Significance is reported when $P < 0.05$.

Results

The probability of cold shortening occurring was reduced the most by ESRC (down to 5%) in comparison to C (30%) and CES (14%). The pH of CES was lower than C while ESRC was lower than all other treatments at 5 h PM. An overall treatment effect showed ESRC (3 d PM) resulted in greater purge than C in the SM with no difference in the LL. However, CES had greater purge than C. A cooking loss treatment effect (3 d, 22 d, LL) showed ESRC resulted in greater loss than C and CES. Cooking loss did not differ among C, CES, RC, and RCES. No differences were detected in ultimate pH, carcass shrink and sensory evaluations. No treatment differences were found for WBS in LL (3 d, 19.5; 22 d, 13.2 N). Rebloom (22 d PM) C chops had greater estimated OMb than RC, RCES and ESRC. There was a treatment effect (3 d aged LL) for CES having greater OMb and DMb content than RCES. Additionally, CES had greater DMb than RC. Treatments were not different in CIE L* (3 d aged) on the LL. Similarly, there were no differences in treatments for CIE a* for LL or SM. RCES LL was more yellow (CIE b*) and had a greater hue angle than C and CES. The RC SM had greater values for CIE b*, hue angle, and chroma than C.

Conclusion

The application of ES followed by RC has commercial potential to reduce the likelihood of cold shortening. The order in which RC and ES are applied may also influence color.