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The Effects of Novel Antimicrobials on Quality and Shelf-Life Characteristics of Blade Tenderized Beef Strip Loins

C. L. Thomas[1]*, A. Stelzleni[1], and Y.-C. Hung[2]

[1]Animal and Dairy Science, University of Georgia, Athens, GA, USA;
[2]Food Science and Technology, University of Georgia, Griffin, GA, USA

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Objectives

Beef tenderness is an important palatability attribute relating to consumer satisfaction. To enhance tenderness, and consumer satisfaction, blade tenderization (BT) is commonly employed; however, foodborne outbreaks have been associated with BT products. Application of antimicrobial interventions prior to BT is commonly employed by the meat industry to reduce the inherent risk of BT. As new antimicrobial technologies arise, they must also be tested to ensure quality and shelf life is not compromised. The objectives of this study were to investigate the effects of pulse ultra-violet light (PUV), 5% levulinic acid + 0.5% sodium dodecyl sulfate (LVA+SDS), and electrolyzed oxidizing water (EOW; 50 ppm Cl), on beef strip loin (SL) subprimals prior to BT, and assess their effects on shelf life and sensory characteristics compared to SL treated with 4.5% lactic acid (LA), and no antimicrobial intervention (CON).

Materials and Methods

Whole USDA Choice beef SL (n = 75) of known date were assigned randomly to antimicrobial interventions across 3 replicates. Pulse UV samples were treated for 15 s at 5.754 J/cm^2 ^{6} ± 2 cm from the quartz window. All other treatments were applied to subprimals using a 6-nozzle sanitizing cabinet (0.42 L/nozzle·min^{-1} at 275.79 kPa). After treatment, all SL made a single pass, lean side up, through a mechanical tenderizer (Ross TC700MC). After BT, SL were vacuum packaged, boxed, and stored (0 ± 1°C) for 7 d. Following storage, subprimals were squared and 2 steaks (2.54 cm) were cut from the anterior face with 1 designated for Warner-Bratzler shear force and the other for trained sensory analysis. Pulse UV samples were not included in sensory analysis due to the PUV equipment being previously utilized in pathogen studies. After steak removal, roasts (5 cm) were cut for shelf life analysis, packaged in Styrofoam trays with PVC overwrap and randomly assigned to 0, 1, 2, 3, 5, or 7 d of display in open top coffin display cases (0 ± 1.5°C, 2 defrost cycle every 24 h) and 24 h lighting (1600-2100 lux; 30000K). On each day objective color was measured on d 7 roasts for L*, a*, b*, hue, chroma, and ΔE. Aerobic plate count (APC) and thiobarbituric acid reactive substance analysis (TBARS) were also quantified on d 0, 1, 2, 3, 5, and 7 roasts. Data were analyzed using Proc Mixed (V9.4, SAS Inst. Inc., Cary, NC) as a randomized split-plot where subprimal was the whole plot and steak or roast was the subplot. The PDIFF option of least squares means was utilized to test for differences ($\alpha \leq 0.05$).

Results

Antimicrobial treatment prior to BT did not ($P > 0.05$) affect objective color measures. However, as display progressed L*, a*, b*, and chroma decreased ($P < 0.05$), while hue and ΔE values increased ($P < 0.05$). As expected, APC increased ($P < 0.05$) with extended display, and, even though APC were similar ($P > 0.05$) among CON (5.64 log CFU/cm^2), PUV (5.20 log CFU/cm^2), and EOW (5.78 log CFU/cm^2), both LVA+SDS- and LA-treated roast had lower ($P < 0.05$) APC than all other treatments (3.49 and 4.33 log CFU/cm^2, respectively). However, antimicrobial treatments did not ($P > 0.05$) affect lipid oxidation, WBSF, or sensory characteristics.

Conclusion

The results from this study suggest that LVA+SDS could be used as an antimicrobial prior to SL BT without compromising quality or sensory characteristics.

