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The Effect of Dipping in Organic Acids for Short or Extended Times on Quality Attributes of Ground Beef from Sections of Beef Shoulder Clods

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Objectives

The objective of this study was to evaluate the effect of short or extended antimicrobial dip times on various shelf life and quality characteristics of ground beef from beef shoulder clod sections.

Materials and Methods

Beef clod slices (5.44 kg) were treated with 1 of 4 antimicrobial treatments or a negative control in 6 replications. Pieces of beef shoulder clod were dipped in 4.5% lactic acid or 380 ppm peroxyacetic acid for 15 s (s) or 3 min (m) at 22.2°C. Samples were then ground and formed into 454 g blocks before being overwrapped in oxygen permeable film and placed in retail display at 2.7°C for 7 d (d). On d 0, 1, 3, 5, and 7, samples (25 g) were taken for Total Plate Count (TPC) and 150 g for lipid oxidation and pH analysis. Percent discoloration and L*a*b* were measured daily. Data were analyzed using GLIMMIX 9.2 of SAS (SAS Inst. Inc., Cary, NC) with model including treatment, day of retail display, and the interaction. LS means were calculated and separated ($P < 0.05$) using Tukey's adjustment.

Results

TPC, lipid oxidation, pH, and discoloration % all had a significant interaction of treatment by day of display ($P < 0.0001$). For TPC, lactic acid 3m had lower ($P < 0.05$) Colony Forming Units (3.4 CFU/g) than control (4.2 CFU/g) on d 3 of display. Also, d 5 and 7 of display showed lower ($P < 0.05$) CFU/g for lactic acid 3m than control. Lipid oxidation was lower ($P < 0.05$) on d 3 for peroxyacetic acid 3m and 15s (1.5, 1.8 mg malonaldehyde/kg tissue, respectively) than lactic acid 15s, 3m, and control (2.7, 3.6, 2.0 mg malonaldehyde/kg tissue). On d 5, lipid oxidation values were higher ($P < 0.05$) for lactic acid 3m (4.8 mg malonaldehyde/kg tissue) than control (2.7 mg malonaldehyde/kg tissue). Analysis of pH on d 1 and 3 showed lactic acid 3m was lower ($P < 0.05$) than all other treatments, including control. In general, % discoloration scores increased rapidly from d 3 to 5. On d 3, lactic acid 3m % discoloration scores were higher ($P < 0.05$) than peroxyacetic acid 3m (32.2, and 8.5%, respectively). Additionally, on d 4, lactic acid 3m was no different than control and higher ($P < 0.05$) than peroxyacetic acid 3m. This continued on d 5 when lactic acid 3m (90.9%) was higher ($P < 0.05$) than peroxyacetic acid 3m (68.3%) but not different than control. L* values were higher ($P < 0.05$) for lactic acid 3m (51.38) than control (49.7) and peroxyacetic acid 15s (49.55). In a* values, peroxyacetic acid 3m and 15s were more red ($P < 0.05$) than control. Lactic acid 3m and 15s had higher ($P < 0.05$) b* values when compared to peroxyacetic acid 3m, 15s, and control.

Conclusion

While lactic acid 3m reduced TPC, quality characteristics such as discoloration, pH, and lipid oxidation all showed negative impacts that could lead to reduced shelf life. In addition, peroxyacetic acid showed an increase in redness, but remained similar to control in TPC, lipid oxidation, and pH analysis. When processors use an organic dip for control of Shiga Toxin-producing *E. coli* (STEC), both the organic acid type and length of exposure can influence ground beef quality and shelf life.

