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Comparison of Electrostatic Spray, Spray, or Dip Using Lactic Acid, Peroxyacetic Acid, or Beefxid on the Effects of Color and Aerobic Plate Counts

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Objectives

Small meat processing facilities often purchase beef sub-primals for ground beef production that have not previously been tested for shiga toxin producing *E. coli* (STEC). The use of antimicrobial interventions may offer a method to minimize the risk of STEC but may result in a change of quality attributes. Three types of antimicrobials using three application techniques were tested to evaluate aerobic plate counts and surface color on ground beef.

Materials and Methods

Beef shoulder clods were treated with 4.5% lactic acid (LA), 380 ppm peroxyacetic acid (PAA), or 2.5% Beefxide (BX; lactic acid + citric acid) using spray (11 s/side, 20 psi), dip (15 s), or electrostatic spray (10 s/side) applications. Clods were then ground and 1 pound portions formed using a Colosimo press were placed onto trays overwrapped with oxygen permeable film. The ground beef was then placed in simulated retail display where a subjective color panel (8 to 10 panelists) evaluated discoloration daily. L*a*b* values were collected using a Minolta colorimeter. Delta E values were calculated from the L*a*b* values using d 0 from each sample to compare the rate of discoloration. Samples (25 g) were then collected (d 0, 1, 3, 5, 7) for microbial analysis of aerobic counts using ACP Petrifilm. Six independent replicates were conducted. Data was analyzed by using the glimmix procedure of SAS 9.4 (SAS Inst. Inc, Cary, NC) and LS-means (LSM) were evaluated.

Results

Application method and acid treatments did not impact L*, a*, or b* scores. However, there was a significant acid by application interaction ($P = 0.001$) for L* values. This interaction indicated that PAA spray (LSM = 48.23) resulted in darker surface color than LA spray (LSM = 49.88), BX spray (LSM = 49.91) and PAA dip (LSM = 49.96). Additionally, when treatments were compared to the control, PAA spray was darker ($P = 0.009$) than the control (LSM = 49.84). All L*, a*, and b* color values decreased ($P < 0.05$) with increasing days of display. Delta E scores showed a greater change in delta E ($P < 0.001$) with increased days of display. Discoloration showed higher percentage ($P < 0.001$) of discolored surface area with increased days of display. Aerobic counts resulted in a significantly higher microbial counts with increase in days ($P < 0.001$) with d 0 at LSM = 2.033 log CFU/g and d 7 at LSM = 4.144 log CFU/g. There was a tendency for a treatment effect ($P = 0.094$), however the only two treatments that were different from each other were LA electrostatic spray (LSM = 3.508 log CFU/g) and PAA dip (LSM = 2.541 log CFU/g).

Conclusion

The use of antimicrobials to minimize the risk of STECs may be applied to beef sub-primals by small meat processors without impacting the color characteristics of ground beef in retail display.