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# Antimicrobial Interventions to Reduce Shiga Toxin-Producing *Escherichia coli* (STEC) Surrogate Populations on Beef Striploins Intended for Blade Tenderization

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## Objectives

Blade tenderization (BT) is used in the beef industry to improve tenderness of steaks prepared from subprimals but can translocate surface pathogens to the interior of meat. Application of antimicrobial solutions on the surface of subprimals prior to blade tenderization can reduce the risk of translocation of surface microorganisms. The objectives of this research were: 1) evaluate the efficacy of antimicrobial interventions applied to inoculated (surrogate *Escherichia coli*) beef striploins prior to blade tenderization; and 2) examine the transfer of *E. coli* from inoculated striploins to subsequent non-inoculated subprimals.

## Materials and Methods

The anterior portion of whole muscle beef striploins (30.48 cm) were inoculated (lean side) across a 10 cm band with an approximately 8.00 log CFU/mL cocktail containing non-pathogenic, rifampicin-resistant surrogate STEC strains (BAA-1427, BAA-1428, BAA-1429, BAA-1430, and BAA-1431). The inoculated striploins were sprayed with (1) levulinic acid (5.0%) + sodium dodecyl sulfate (0.50%) (LVA+SDS), (2) peroxyacetic acid (2000 ppm; PAA; FCN 1666), (3) acidified sodium chlorite (1200 ppm; ASC), or (4) lactic acid (4.5%; LA) by passing through a spray cabinet and blade tenderized, along with an inoculated, non-sprayed control (CON). To evaluate the potential for cross-contamination of subsequent subprimals, an inoculated striploin (for each treatment) was blade tenderized followed by a non-inoculated beef striploin. For each striploin, surface and subsurface samples (2.54 cm wide) were collected from three different locations including the anterior, middle, and posterior end of each striploin. A total of 30 striploins across three replications were randomly assigned to treatment stratification. Sponge samples were also collected from the blade tenderizer (plate of the blade unit and blades) after each treatment group. Data were analyzed using Proc Mixed (SAS Inst., v.9.4; Cary, NC) as a completely randomized split-plot design. Microbial counts for all samples were log transformed and then analyzed for the main effects of antimicrobial treatment, location (anterior to posterior and surface or interior), and their interaction. Differences were considered significant at $\alpha \leq 0.05$.

## Results:

PAA was more effective in reducing *E. coli* populations (1.80 log CFU/g; $P \leq 0.05$) and had lowest recovery of the microorganism from the striploin subsurface compared to other treatments, followed by LVA+SDS (1.00 log CFU/g). *E. coli* populations gradually decreased ($P \leq 0.05$) on the surface and subsurface as sampling moved anterior to posterior. However, *E. coli* populations were similar ($P > 0.05$) on the posterior end of inoculated striploins and the anterior end of the subsequent, non-inoculated striploins, indicating transfer of microorganisms from one striploin to the following striploin. *E. coli* populations of 3.03 log CFU/cm$^2$ and 2.47 log CFU/cm$^2$ were recovered from the plate of the blade unit and the blades of the blade tenderizer. *E. coli* populations recovered from the plastic plate (3.46 log CFU/cm$^2$) and blades (2.87 log CFU/cm$^2$) of the blade tenderizer were the similar ($P > 0.05$) for all treatment groups except for PAA (1.41 log CFU/cm$^2$ and 0.97 log CFU/cm$^2$, respectively).

## Conclusion

These results showed that PAA and LVA+SDS can be used to improve the safety of blade tenderized beef.