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ABSTRACT #: 124

ANTIMICROBIAL INTERVENTIONS TO REDUCE SHIGA TOXIN-PRODUCING *ESCHERICHIA COLI* (STEC) SURROGATE POPULATIONS ON BEEF STRIPLOINS INTENDED FOR BLADE TENDERIZATION

TAP TO RETURN TO KIOSK MENU

Chevise L. Thomas*[1], Harshavardhan Thippareddi[2], Macc Rigdon[1], Sanjay Kumar[2], Robert W. McKee[1], William M. Sims[1], Alexander M. Stelzleni[1]
[1]Animal and Dairy Science, [2]Poultry Science, University of Georgia, Athens, United States

Meat Science and Technology Center
College of Agricultural & Environmental Sciences
UNIVERSITY OF GEORGIA

Introduction:

- 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

Objectives:

- The objectives of this research were to:

1. Evaluate the efficacy of antimicrobial interventions applied to inoculated (surrogate *Escherichia coli*) beef striploins prior to blade tenderization
2. Examine the transfer of *E. coli* from inoculated striploins to subsequent non-inoculated subprimals

Methods:

- The anterior portion of whole muscle beef striploins (30.48 cm) were inoculated (lean side) across a 10 cm band with a ca. 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 (i) levulinic acid (5.0%) + sodium dodecyl sulfate (0.50%) (LVA+SDS), (ii) peroxyacetic acid (2,000 ppm; PAA), (iii) acidified sodium chlorite (1,200 ppm; ASC), or (iv) 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 (Figure 1)
- 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
- Sponge samples were also collected from the blade tenderizer (plate of the blade unit and blades) after each treatment group

Statistical Analysis:

- 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 sub-surface compared to other treatments, followed by LVA+SDS (1.00 log CFU/g)
- *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)

Table 1. Least squares means (± SE) of surrogate *E. coli* recovered from surface and sub-surface of inoculated beef striploin.

	Recovered surrogate *E. coli* (log CFU/g)	
Treatment	Surface	Sub-surface
CON	4.54 ± 0.18^{a}	3.36 ± 0.15^{a}
LA	4.14 ± 0.18^{ab}	3.04 ± 0.15^{ab}
ASC	3.96 ± 0.18^{bc}	2.77 ± 0.15^{b}
LVA+SDS	3.56 ± 0.18^{c}	2.90 ± 0.15^{ab}
PAA	2.75 ± 0.18^{d}	1.80 ± 0.15^{c}

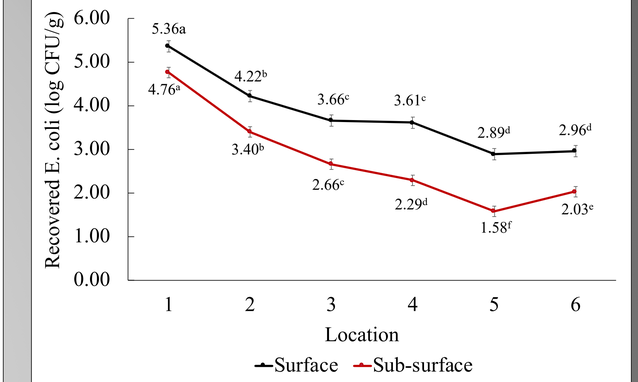

Figure 2. Least squares means (± SE) of the surrogate *E. coli* populations recovered from surface and sub-surface samples from beef striploins that were subjected to antimicrobial treatment and blade tenderization. Means among surface and subsurface sample that do not share a common letter are different ($P \leq 0.05$). Antimicrobial intervention: CON = control; blade tenderization only; LA = 4.5% lactic acid; ASC = acidified sodium chlorite (1200 ppm); LVA+SDS = 5% levulinic acid plus 0.5% sodium dodecyl sulfate; PAA= peroxyacetic acid (2000 ppm).

Table 2. Least squares means (± SE) of recovered rifampicin resistant surrogate *E. coli* from the blade tenderizer after each treatment.

	Blade tenderizer location (log CFU/cm^2)	
Treatment	Plastic plate	Blades
CON	4.01 ± 0.34^{a}	3.32 ± 0.35^{a}
LA	3.31 ± 0.41^{a}	2.76 ± 0.42^{a}
ASC	3.08 ± 0.34^{a}	2.50 ± 0.35^{a}
LVA+SDS	3.42 ± 0.34^{a}	2.90 ± 0.35^{a}
PAA	1.40 ± 0.34^{b}	0.97 ± 0.35^{b}

Conclusions:

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

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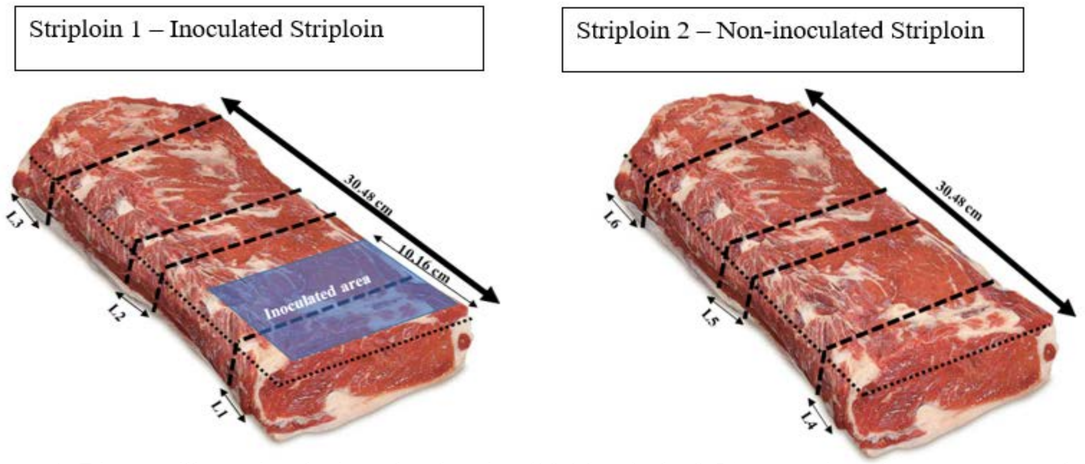

Figure 1. Diagram illustrating the inoculated region (10.16 cm), the 2.54 cm sections that were removed from the anterior (L1), middle (L2), and posterior (L3) ends of striploin 1, and the anterior (L4), middle (L5), and posterior (L6) ends of striploin 2. Beef striploin (NAMP #180) used with permission from Canada beef (Available at: http://elearn.canadabeef.ca/carcass/loin).

Table 1. Least squares means (± SE) of surrogate *E. coli* recovered from surface and sub-surface of inoculated beef striploin.

Treatment Group[1]	Recovered surrogate *E. coli* (log CFU/g)	
	Surface	Sub-surface
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LA	4.14 ± 0.18^{ab}	3.04 ± 0.15^{ab}
ASC	3.96 ± 0.18^{bc}	2.77 ± 0.15^{b}
LVA+SDS	3.56 ± 0.18^{c}	2.90 ± 0.15^{ab}
PAA	2.75 ± 0.18^{d}	1.80 ± 0.15^{c}

[a-d] Least squares means within columns that do not share a common letter are different ($P \leq 0.05$).
1 Antimicrobial intervention: CON = control, blade tenderization only; LA = 4.5% lactic acid; ASC = acidified sodium chlorite (1200 ppm); LVA+SDS = 5% levulinic acid plus 0.5% sodium dodecyl sulfate; PAA= peroxyacetic acid (2000 ppm).

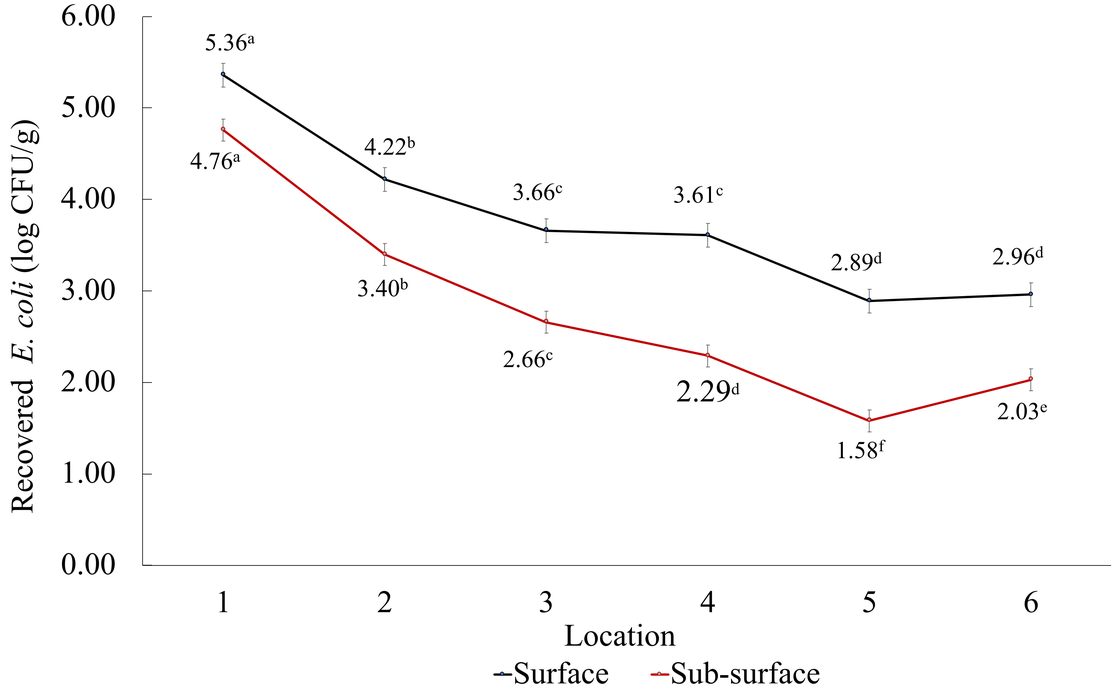

Figure 2. Least squares means (± SE) of the surrogate *E. coli* populations recovered from surface and sub-surface samples from beef striploins that were subjected to antimicrobial treatment and blade tenderization. Means among surface and subsurface sample that do not share a common letter are different ($P \leq 0.05$). Antimicrobial intervention: CON = control; blade tenderization only; LA = 4.5% lactic acid; ASC = acidified sodium chlorite (1200 ppm); LVA+SDS = 5% levulinic acid plus 0.5% sodium dodecyl sulfate; PAA= peroxyacetic acid (2000 ppm).

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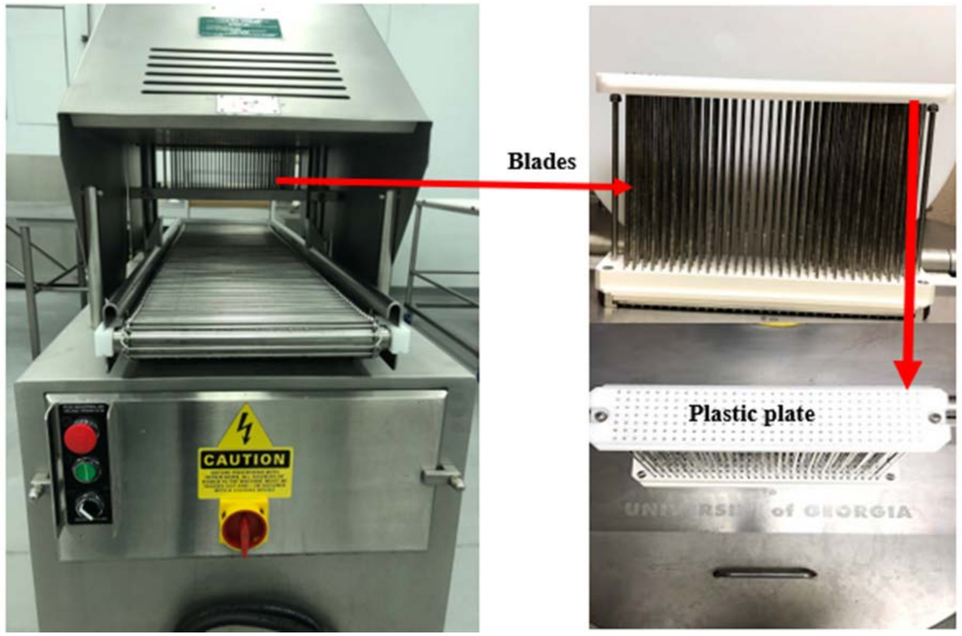

Figure 3. Pictures of the plastic plate and blades that were sampled after running the treated beef striploins through the blade tenderizer.

Table 2. Least squares means (± SE) of recovered rifampicin resistant surrogate *E. coli* recovered from the blade tenderizer after each treatment.

	Blade tenderizer location (log CFU/cm^2)	
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