



Antimicrobial Interventions for Blade Tenderized Whole Muscle Non-Intact Beef Boneless Strip Loins: Evaluation of Shelf-life and Sensory Characteristics

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Introduction

- During blade tenderization, blades can translocate surface bacteria into the inherently sterile interior of meat.
- This translocation of bacteria causes a potential health concern for consumers who are usually unaware of the tenderization of the product.
- Internal temperatures corresponding to some consumers preferred cooking method & degree of doneness, such as rare (57°C) or medium rare (62°C), are not lethal to *E.coli* O157:H7 and other serotypes.

Objective

- Evaluate two novel antimicrobials compared to two industry standard antimicrobial interventions for shelf-life and sensory characteristics of steaks from blade tenderized beef strip loins.



Method & Materials

- Twenty boneless strip loins (15 D postmortem) were assigned 1 of 5 treatments
 - LVA+SDS = 0.2% Levulinic acid + 0.02% Sodium dodecyl sulfate
 - EOW = Electrolyzed Oxidizing Water (pH 6.2-6.5, FCC = 50 ppm, ORP = +850 mV)
 - PAA = 200 ppm peroxyacetic Acid
 - LA = 4.5% lactic acid
 - CON = No antimicrobial
- Treatments applied with Chad Co. spray cabinet before making 1 pass through Ross Blade Tenderizer
- Subprimals were vacuum packaged & held 4 D in cold storage
- Subprimals were cut into 2.54 cm steaks and randomly assigned 0, 1, 3, 5, or 7 D aerobic shelf-life display
- Two steaks were selected for WBSF and sensory analysis (VP and Frozen)
- PVC overwrapped steaks were placed in lighted (1600–2100 lux; 24 h) retail cases
- On respective day, steaks were collected for aerobic plate counts and lipid oxidation (TBARS)
- Trained subjective color & objective color CIE L* a* b*, hue, chroma, 630/580 nm were recorded on d 7 steaks (D 0, 1, 3, 5, 7)
- Experiment was replicated 3X and each treatment was repeated 4x within each rep
- Data was analyzed using Proc Mixed function of SAS (V. 9.3)
- Significance determined at $\alpha \leq 0.05$

Results

Subjective Shelf-life Color

Table 1. Objective color main effects by day for PVC overwrapped steaks from beef loin subprimals

	Day of Display					SEM ¹
	0	1	3	5	7	
L* ²	38.30 ^b	40.28 ^b	49.90 ^a	36.93 ^b	35.29 ^b	2.13
a* ²	29.07 ^a	27.99 ^a	25.72 ^b	14.21 ^d	19.67 ^c	0.67
b* ²	23.35 ^a	23.39 ^a	24.03 ^a	17.94 ^b	15.59 ^c	0.44
Hue ²	38.82 ^c	40.25 ^c	43.85 ^b	42.89 ^b	48.89 ^a	0.73
Chroma ²	37.34 ^{ab}	35.55 ^a	35.32 ^b	26.76 ^c	21.26 ^d	0.72
630/580 ²	7.99 ^a	6.73 ^b	5.44 ^c	3.84 ^d	2.05 ^e	0.20
ΔE^2	-	19.72 ^b	17.35 ^b	18.79 ^b	25.37 ^a	1.45

^{abde} Means within a row with different superscripts are different $P < 0.05$.

¹SEM= standard error of means.

²L* = 0 = black to 100 = white; a* - high values indicate more red; b* - higher values indicate more yellow; Hue = lower values indicate redder color; Chroma = higher value indicates more red saturation; 630/580 = larger ratio indicates more redness; ΔE = total color change over a period of time.

Table 2. Objective color main effects of treatment for PVC overwrapped steaks from beef loin subprimals

	Treatment					SEM ¹
	CON	EOW	PAA	LA	LVA+SDS	
L* ²	40.92	40.55	40.29	40.76	38.21	2.64
a* ²	24.13	23.17	22.96	23.16	23.23	0.75
b* ²	21.29	20.91	20.83	20.72	20.55	0.56
Hue ²	38.82	40.25	43.85	42.89	48.24	0.73
Chroma ²	32.34	31.33	31.20	31.21	31.15	0.86
630/580 ²	5.57	4.99	4.99	5.36	5.12	0.34
ΔE^2	18.91	20.33	20.74	22.37	19.18	1.90

¹SEM= standard error of means.

²L* = 0 = black to 100 = white; a* - high values indicate more red; b* - higher values indicate more yellow; Hue = lower values indicate redder color; Chroma = higher value indicates more red saturation 630/580 = larger ratio indicates more redness; ΔE = total color change over a period of time.

Figure 1. Subjective color: Overall Color

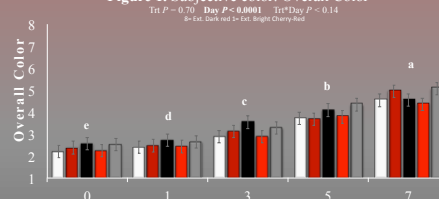


Figure 2. Subjective color: Surface Discoloration

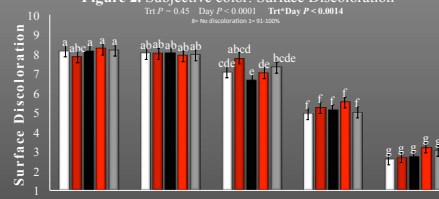


Figure 3. Subjective color: Worst Point Color

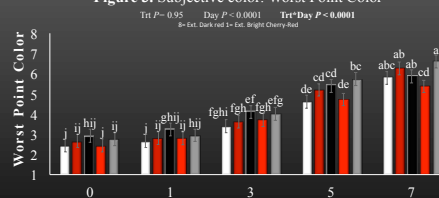


Table 3. Psychrotrophic growth main effects by treatment for PVC overwrapped steaks from beef loin subprimals

	Treatment					SEM ¹
	CON	EOW	PAA	LA	LVA+SDS	
² Aerobic Plate Count	4.19 ^a	4.20 ^a	3.65 ^b	3.64 ^b	4.07 ^a	0.11
³ Lipid Oxidation	0.43	0.47	0.52	0.47	0.54	0.07

^{ab} Means within row with different superscripts are different $P < 0.05$.

¹SEM= standard error of means.

²Values are reported as CFU/g.

³Values are reported in mg MDA/kg meat.

Table 4. Main effect of sensory values for steaks from beef loin subprimals

	Treatments					SEM ¹
	CON	EOW	PAA	LA	LVA+SDS	
Initial Tenderness ²	5.82	5.64	5.04	5.17	5.96	0.39
Sustained Tenderness ²	5.62	5.47	4.84	5.02	5.64	0.40
Beef Flavor Intensity ³	5.12	5.00	5.26	5.19	5.29	0.25
Juiciness ⁴	4.77	4.67	4.35	4.62	4.77	0.37
Off-Flavor ⁵	1.09	1.12	1.12	1.10	1.10	0.07
WBSF, kgf	2.85 ^b	3.28 ^{ab}	3.15 ^b	3.93 ^a	2.98 ^b	0.27

^{ab} Means within a row with different superscripts are different $P < 0.05$.

¹SEM= standard error of means.

²8 = extremely tender, 1 = extremely tough.

³8 = extremely intense, 1 = extremely bland.

⁴8 = extremely juicy, 1 = extremely dry.

⁵6 = extreme off-flavor, 1 = none detected.

Conclusion

Results suggest that the two novel antimicrobial interventions would be acceptable to use on beef subprimals subjected to blade tenderization without detrimental effects to quality and shelf-life.

This project was supported by AFRI Grant no. 2011-68003-30012: Food Processing Technologies to Destroy Food-borne Pathogens Program - (A4131)

