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Effectiveness of 1,3-Dibromo-5,5-Dimethylhydantoin Applied in a Pre-Evisceration Wash Cabinet for Reducing Microbial Contamination on Beef Carcasses

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Objectives

The objective of this study was to evaluate the effect of a bromine-based antimicrobial (1,3-dibromo-5,5-dimethylhydantoin; DBDMH), for use in a pre-evisceration carcass wash cabinet, against naturally occurring beef carcass associated microflora.

Materials and Methods

The study was conducted in a commercial beef harvest facility. Carcasses were randomly selected prior to the pre-evisceration wash cabinet for treatment application, which included 2 concentrations of DBDMH: low (280 to 350 ppm) and high (550 to 630 ppm). Prior to treatment application, carcasses were swabbed (10 × 10 cm^2) on the ventral midline region with a sampling sponge hydrated with 10 mL Dey/Engley neutralizing broth, to serve as the initial counts (untreated control). After DBDMH was applied to the carcasses, a second sample was taken, to provide remaining bacterial populations after treatment. The 2 DBDMH treatments were replicated over 2 production days per treatment (N = 80; n = 40). All sponge samples were analyzed for aerobic plate counts (APC) and *Enterobacteriaceae* counts (EB) using Petrifilm Aerobic Count Plates and Petrifilm *Enterobacteriaceae* Count Plates, respectively. Bacterial populations for all samples were converted and expressed as log CFU/cm^2. The study was designed as a paired comparison conducted on 2 different test days per treatment (4 total production days), for 2 DBDMH concentration levels. Day was treated as a fixed effect due to the unpredictable variation of the microbial conditions of carcasses on each production day. Data were analyzed using the Mixed Procedure of SAS (SAS Inst. Inc., Cary, NC) and expressed as least squares means for log CFU/cm^2. Differences were reported with a significance level of a = 0.05.

Results

There were significant main effects of treatment and day for APC populations recovered from carcasses treated with DBDMH at 280 to 350 ppm (treatment: $P < 0.0001$; day $P = 0.0181$). Due to these main effects, APC results were separated by each production test day to evaluate efficacy of the treatment. The APC populations recovered from beef carcasses before treatment with the low concentration of DBDMH (280 to 350 ppm) were 3.4 and 2.8 log CFU/cm^2, from d 1 and 2, respectively (Table 1). Following DBDMH application, APC were 1.4 and 1.0 log CFU/cm^2 for d 1 and 2, respectively (Table 1). The EB populations obtained before and after treatment with the low DBDMH concentration were < 0.1 and < –0.6 log CFU/cm^2; respectively (Table 1). For carcasses treated with DBDMH at 550 to 630 ppm, a significant interaction between treatment and day ($P = 0.0028$) was observed for the APC data; therefore, APC results were separated by each production test day. Prior to DBDMH application at 550 to 630 ppm, the APC were 2.7 and 2.8 log CFU/cm^2 for d 1 and 2, respectively (Table 1). The APC declined ($P < 0.05$) after DBDMH was applied, and APC of 1.1 and 2.2 log CFU/cm^2 for d 1 and 2, respectively, were obtained (Table 1). Corresponding EB populations before and after the high concentration treatment were < –0.1 and < –0.6 log CFU/cm^2, respectively (Table 1).

Conclusion

In conclusion 1,3-dibromo-5,5-dimethylhydantoin was effective against naturally occurring microflora present on beef carcasses when applied in a pre-evisceration wash cabinet.

Table 1. Adjusted least squares (LS) mean aerobic plate counts (APC) and *Enterobacteriaceae* counts (EB) (log CFU/cm^2; [confidence limits]) of beef carcasses before (untreated control) and after treatment with 1,3-dibromo-5,5-dimethylhydantoin (DBDMH) in a pre-evisceration wash cabinet.

Bacteria Count	DBDMH Treatment Concentration	Test Day	Untreated Control		After DBDMH Pre-evisceration Wash	
			log CFU/cm^2	% BDL	log CFU/cm^2	% BDL
APC[1]	280-350 ppm	Day 1	3.4[a] (3.0, 3.7)	0.0	1.4[b] (1.0, 1.7)	0.0
		Day 2	2.8[a] (2.4, 3.1)	0.0	1.0[b] (0.6, 1.4)	0.0
	550-630 ppm	Day 1	2.7[a] (2.4, 3.1)	0.0	1.1[b] (0.7, 1.5)	0.0
		Day 2	2.8[a] (2.4, 3.2)	0.0	2.2[b] (1.8, 2.6)	0.0
EB[2]	280-350 ppm	N/A	< 0.1[a] (-0.6, 0.7)	40.0	< -0.6[b] (-0.6, -0.3)	90
	550-630 ppm	N/A	< -0.1[a] (-0.2, 0.0)	45.0	< -0.6[b] (-0.6, -0.3)	92.5

[1]Main effects of treatment and day were observed for APC data of the 280-350 ppm treatment (treatment $P < 0.0001$; day $P = 0.0181$), as well as a significant interaction between treatment and day for the APC data of the 550-630 ppm treatment ($P = 0.0028$); therefore, APC results are separated by day to evaluate the effect of treatment within each test day.

[2]Regardless of DBDMH concentration, a main effect of day was not ($P \geq 0.05$) observed for the EB data.

[a,b]LSMeans bearing different superscript letters within the same row are different ($P < 0.05$).

LSMeans with a less than symbol (<) indicates at least one sample within the treatment had counts that were below the microbial analysis detection limit (< -0.6 log CFU/cm^2).

% BDL: percentage of samples below the analysis detection limit.