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EFFECT OF LACTIC ACID SPRAYS ON SURFACE MICROFLORA OF GOAT CARCASSES

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INTRODUCTION: Microbial invasion of meat occurring during slaughter and subsequent handling and processing presents a challenge to the meat industry. The shelf-life of meat is highly dependant on the initial microbial load(2) and proper sanitary measures can significantly improve the quality of meat.

Of the various methods of decontaminating carcasses, lactic acid sprays either singly or in combination with other agents has been reported to be quite effective for beef carcass(4,7).

Lactic acid is a proven bactericidal agent and is generally safe. However, it is reported to cause bleaching and production of sour flavour in meat at higher concentrations. Hence, this study was undertaken to assess the bactericidal effect of lactic acid sprays at varied concentrations and to determine the optimal level for sanitising goat carcass in regular slaughter line without affecting their meat qualities.

MATERIALS AND METHODS: A total of 70 goat carcasses utilised in this study were divided into 7 equal groups. Lactic acid solutions(0.5,0.75,1.0,1.5,2.0 and 3.0%, v/v) were prepared from a 90% lactic acid solution (E.Merck India Ltd., Bombay) and 300ml of these solutions were sprayed on the respective group of carcasses with an ordinary sprayer immediately after washing them with tap water. Controlled carcasses were sprayed with equal volume of water in similar manner.

Aerobic colony counts and colour were determined on all these 7 groups of carcasses while the effect on meat flavour was assessed on carcasses sprayed with 1.0 and 3.0%solutions. Changes in pH, Enterobacteriaceae and Lactobacillaceae counts were determined on carcasses sprayed with 1.0% solution only.

The surface pH of the meat was determined using a pH-meter equipped with a combination type probe electrode.

Colour was assessed subjectively by a 5-membered semi-trained panelists from samples of breast meat using a 6-point hedonic scale(7).

Bacteriological examinations were performed on samples collected aseptically from both sides of the carcass from the breast and perineal regions at 1,3 and 24h post-mortem. Samples were analysed for aerobic colony counts, Enterobacteriaceae and Lactobacillaceae counts(7) after resuscitation of the stressed microorganisms at room temperature(3). Spread plate method was followed.

Statistical analysis of the data was performed as per standard method(5).

RESULTS AND DISCUSSION: Better decontamination effect was achieved with increasing the concentration of lactic acid(Table 1). However, there was greater discolouration of the carcass with increasing the concentration of lactic acid beyond 0.75%. Significant reduction in bacterial load was observedat 0.75% concentration of lactic acid without causing unacceptable discolouration of the carcass. These findings are in agreement with the results of other researchers (6,7) who also recommended lesser concentrations of lactic acid to avoid bleaching of beef carcasses.

Table 1. Aerobic colony count(log_{10}cfu/cm^2) and colour score of goat carcasses sprayed with lactic acid *

Lactic acid conc(%,v/v)	Sampling site	Aerobic colony count			Colour score			
		1h	3h	24h	2h	24h	48h	72h
0(control)	Breast	7.13±0.05	9.40±0.15	10.38±0.17	1.0±0.00	1.45±0.06	2.0±0.15	2.8±0.17
	Perineum	7.19±0.07	10.04±0.05	11.05±0.14	-	-	-	-
0.5	Breast	6.23±0.05	1.10±0.05	1.16±0.02	1.5±0.07	1.00±0.00	1.5±0.15	2.1±0.10
	Perineum	6.38±0.05	1.05±0.04	1.18±0.02	-	-	-	-
0.75	Breast	6.24±0.02	1.11±0.04	1.12±0.04	1.5±0.07	1.00±0.00	2.5±0.18	3.1±0.18
	Perineum	6.21±0.03	1.13±0.04	1.16±0.01	-	-	-	-
1.0	Breast	6.19±0.03	1.12±0.04	1.17±0.03	3.0±0.07	2.00±0.03	3.5±0.15	3.9±0.10
	Perineum	6.13±0.02	1.15±0.02	1.15±0.02	-	-	-	-
1.5	Breast	5.98±0.04	1.17±0.07	1.20±0.03	3.5±0.15	2.00±0.00	3.5±0.13	4.0±0.17
	Perineum	6.01±0.04	1.27±0.03	1.27±0.03	-	-	-	-
2.0	Breast	6.16±0.02	1.14±0.05	1.23±0.02	4.0±0.13	3.50±0.14	4.5±0.21	4.7±0.23
	Perineum	6.09±0.06	1.19±0.05	1.30±0.04	-	-	-	-
3.0	Breast	6.03±0.04	1.17±0.03	1.33±0.02	4.5±0.13	4.50±0.16	4.0±0.18	4.9±0.24
	Perineum	6.00±0.04	1.18±0.05	1.36±0.02	-	-	-	-

*n=10

The analysis of variance of the data on the effects of lactic acid sprays on the flavour score of meat showed that at 3% level detectable sour flavour was evident, whereas, 1% lactic acid did not alter the flavour score significantly from that of the controls(Table2). The data on the effects of lactic acid sprays on meat colour and flavour suggested that upto a level of 1% might be successfully used in sanitising goat carcasses. In beef carcasses however, concen-

tration upto a level of 2% was reported to be optimal(7).

Results on the changes in the pH values indicated that at 3h post-mortem, there was a significant reduction in the pH values of the treated samples(3.52±0.14) from that of the controls (6.85±0.05) which gradually increased from 12th through 72nd h post-mortem (Table3).

Table 2. Analysis of variance of flavour score of Longissimus dorsi muscle sprayed with lactic acid

Sources of variation	df	SS	MSS	F
1. Between treatment	2	4.73	2.36	
2. Within treatment	27	0.66	0.024	98.33*
Total	29	5.39	2.384	

* $P < 0.01$

Table 3. Surface pH values of goat carcasses sprayed with lactic acid

Hour	Control sample	Treated sample
1	6.89 ± 0.06^a	6.87 ± 0.05^a
3	6.85 ± 0.05^a	3.52 ± 0.14^b
12	6.66 ± 0.06^a	4.66 ± 0.13^b
24	6.76 ± 0.04^a	5.37 ± 0.12^b
48	6.87 ± 0.03^a	6.29 ± 0.06^b
72	7.00 ± 0.04^a	6.92 ± 0.06^a

Means with common superscript row-wise do not differ significantly($P > 0.05$).

This sudden reduction in pH values might have caused strong inhibitory effect on the bacterial load(1).

The data on bacteriological status of goat carcasses treated with 1% solution of lactic acid showed significant lower aerobic colony count at 3h in the breast and perineum region (Table4). On subsequent storage upto 24h, treated breast meat samples showed a tendency for slight increase in aerobic colony count but their values remained static for treated perineum samples.

At 1h post-mortem only a small number of treated breast and perineum samples were positive for Enterobacteriaceae, after which both the treated samples were negative for this group of bacteria. None of the treated samples were positive for Lactobacillaceae at all the 3 different periods of sampling.

CONCLUSIONS: Spraying of lactic acid exerts an immediate decontamination effect on goat carcasses. The optimal level is found to be 0.75% for the purpose; however, upto a level of 1% may be used safely for obtaining desirable decontamination effect without affecting the normal colour and flavour of the meat.

Table 4. Bacteriological status of goat carcasses sprayed with lactic acid (1%,v/v)

Test	Time post-mortem (h)	Breast				Perineum			
		Control		Treated		Control		Treated	
		%	Mean ± SE	%	Mean ± SE	%	Mean ± SE	%	Mean ± SE
Aerobic colony count	1	100	7.13 ± 0.05^a	100	6.19 ± 0.03^b	100	7.19 ± 0.07^a	100	6.13 ± 0.02^b
	3	100	9.40 ± 0.15^a	100	1.12 ± 0.04^b	100	10.04 ± 0.05^c	100	1.15 ± 0.02^b
	24	100	10.38 ± 0.17^a	100	1.17 ± 0.03^b	100	11.05 ± 0.14^c	100	1.15 ± 0.02^b
Enterobacteriaceae	1	69	2.50 ± 0.11^a	44	2.30 ± 0.10^a	23	2.40 ± 0.11^a	20	2.00 ± 0.03^a
	3	35	2.10 ± 0.09^a	0	-	30	2.40 ± 0.13^a	0	-
	24	26	2.00 ± 0.06^a	0	-	18	2.00 ± 0.08^a	0	-
Lactobacillaceae	1	10	3.10 ± 0.11^a	0	-	16	2.80 ± 0.09^a	0	-
	3	13	3.40 ± 0.12^a	0	-	10	3.05 ± 0.14^a	0	-
	24	8	3.90 ± 0.08^a	0	-	7	3.32 ± 0.11^a	0	-

Means with common superscript row-wise do not differ significantly ($P > 0.05$);
- => 1.01 $\log_{10}$cfu/cm^2

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