DECONTAMINATION OF BACTERIAL LOAD ON THE SURFACE OF CAMEL CARCASSES USING 2% LACTIC ACID

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SUMMARY

The surface contamination of camel carcasses was studied, where 10cm^2 area from the surface of twenty camel's carcasses were swabbed before & after skinning, after preparation and after showering followed by spraying with 2% lactic acid solution . The mesophilic, Enterobacteriaceae, S. aureus, coliforms (MPN), fecal coliforms (MPN), E. coli (MPN) counts were determined as well as isolation and identification of Salmonellae. The recorded mean values of mesophilic count was 9.4x10^7, 5x10^3 and 8.2x10^6/cm^2, while that for Enterobacteriaceae was 7.6x10^5, 6.2x10^2 and 8.2x10^4/cm^2. Moreover, coliforms (MPN) was 4.3x10^5, 3.1x10^2 and 6.8x10^4/cm2, while fecal coliforms and E. coli (MPN)/cm^2 were 3.6x10^3, 83 and 7.1x10^2 & 93, <3 and 2.3x10^2/cm^2 respectively, whereas S. aureus count was 8.2x10^5, 8.2x10^2 and 5.6x10^4/cm^2 on the surface of camel carcasses during the first three steps. Enterobacter aerogenes, E. cloacae, E. sakazak, E. coli, Klebsiella pneumoniae, Proteus mirabilis, P. vulgaris, Morganella morganii and Salmonella typhimurium could be isolated from examined camel carcasses. The application of showering followed by spraying with 2% lactic acid solution is an effective method in reduction of bacterial population on surface of the such carcasses.
The public health significance of bacterial contamination of camel carcasses as well as the suggestive measures for improving their bacterial quality was discussed.

INTRODUCTION

The external contamination of meat constitutes a constant problem in most developing countries in the abattoir itself where there are a large numbers of potential sources of contamination by microorganisms (Davis et al., 2000).

Camels are considered one of the most important groups of livestock in Egypt, one of the cheapest sources of animal protein and consumed by different classes of people.

Microbial contamination of raw meat has always been an important issue for food safety. One measure to ensure good meat quality is to rely an effective washing of carcasses in order to decrease bacterial population on the surface of meat. Although many methods and devices have been developed to clean carcass surfaces, complete sterilization of carcass surfaces is difficult achieve. Microbial spoilage of meat is influenced not only by their initial bacteria attached to the surface but also by subsequent proliferation after attachment (Addo and Diallo, 1981 and Hamdy, 1991).

The contamination of carcasses could be minimized by strict hygienic measures, but the total elimination of foodborne pathogens is very difficult, variety of methods had been developed to reduce the levels of contaminating bacteria on carcasses as current washing and sanitizing procedures (Castillo et al., 1999).

Organic acids as antimicrobial for surface treatment of fresh meat have been used to prevent the growth of bacteria during chill storage (ICMSF, 1980). Lactic acid is listed as generally recognized as safe (GRAS) in the United States FDA (1981). Similarly, in Europe it is considered a harmless constituent (Lueck, 1980). This widely acknowledged absence of acute and chronic toxicity has led to the choice of lactic acid as decontaminating agent in food industry. Data are available on the potency of lactic acid sprays as carcass decontaminants for lamb and beef carcasses (Smulders, 1987; Visser et al., 1988 and Fatema-Ali, 2001).

The main objects of this study was planned to throw the light on the surface contamination of camel carcasses in a small abattoir in El-Kalyobia governorate and try to apply 2% lactic acid solution as decontaminant.

MATERIAL AND METHODS

Eighty swabs form the surface of the fore quarters of twenty camel carcasses slaughtered in a small slaughterhouse at Kalyobia governorate were taken from the shoulder surface before & after skinning, after preparation and after showering followed by spraying and washing by lactic acid (88% L- lactic acid ,Pura Inc.,Arlington Heights,Ill.) diluted with distilled water (w/v) to make a concentration of 2% solution were used according to the technique recommended by Castillo et al. (1999); Ariyapitipun et al. (1999) and Fatma-Ali (2001).

Ten cm^2 were swabbed by using sterile cotton tampon and a metal template and 0.1% sterile peptone water used as rinsing and diluent fluid (Patterson, 1971) to determine the following:

1-Mesophilic count using the drop technique recommended by ICMSF (1978).
2-Enterobacteriaceae count using violet red bile glucose count (Gork, 1976).
3-Identification of Enterobacteriaceae using API 20 Bio Merieux sa 69280 Marcy Etoile, France.
4-Coliforms (MPN), fecal coliforms (MPN) and E. coli (MPN) were applied according technique recommended by (ICMSF, 1978).
5-Enumeration of coagulase positive Stapylococcus aureus using Baird Parker

medium (ICMSF, 1978).
6-Isolation of Salmonellae according to the technique recommended by Flowers et al. (1992).

RESULTS AND DISCUSSION

From the data given in table (1) it was evident that the mean mesophilic counts on the surface of camel carcasses were $9.4x10^7$, $5x10^3$, $8.2x10^6$ and $8.2x10^3/cm^2$ before & after skinning, after preparation and after showering followed by spraying with 2% lactic acid solution .Nearly similar findings were recorded by Yassien (1997) and Fatma-Ali (2001). Meanwhile, the mesophilic counts have been used as indicator to the hygienic conditions inside the slaughter halls (Elnawawi et al., 1976). The mesophilic count is of great significance in judging the hygienic conditions under which the meat was produced. It gives good idea about the keeping quality of meat (Miskimin et al., 1976). The mesophilic count significantly reduced ($p<0.01$) after application of showering of carcasses with water followed by spraying with 2% lactic acid solution to $8.2x10^3$.

Reduction of bacterial load on carcass surface by showering may be attributed to physically removing of bacteria remained on the surface of carcass by pressed water which carries dirties including microorganisms.

Concerning the Enterobacteriaceae count, the mean value on the surface of camel carcass were $7.6x10^5$, $6.2x10^2$, $8.2x10^4$ and $7x10^2/cm^2$ before & after skinning, after preparation and after showering followed by spraying with 2% lactic acid solution .Similar results were recorded by Hamdy (1991) and Yassien (1997), while lower results were obtained by El-mossalami (1988) and Samaha and Draz (1993). The presence of Enterobacteriaceae may constitute microbiological and toxigenic hazards (ICMSF, 1978).

From the results achieved in the same table it was evident that the mean values of coliforms, fecal coliforms and E. coli (MPN) were $4.3x10^5$, $3.6x10^3$ and $93/cm^2$ before skinning, $3.1x10^2$, 83 & $<3/cm^2$ after skinning and $6.8x10^4$, $7.1x10^2$ and $2.3x10^2/cm^2$ after preparation of camel carcasses. Lower figures were recorded by Samaha and Draz, 1993 and Sofos et al. 1999 for cattle. Such counts were significantly reduced at $p<0.01$ after application of showering followed by spraying of carcasses with 2% lactic acid solution to $<3/cm^2$.

Washing of carcasses followed by spraying with 2% lactic acid solution is effective in lowering bacterial population including E. coli and coliforms count (Prasai et al., 1995).In the examination of food, the presence of intestinal inhabitants should be taken as indicator of cleanliness and not safety. E. coli is so uniformly outside the intestine may be regarded as due to contamination with fecal discharges of man or animals (Gracey, 1997).

Tables (2 & 3) showed the different isolates of Enterobacteriaceae from examined swabs of camel carcass surfaces during the four steps. Enterobacter aerogenes, Enterobacter cloacae, Enterobacter sakazaki, E. coli {O_{26}: K_{60} (B_6), O_{55}: K_{59} (B_5), O_{111}: K_{58} (B_4), O_{119}: K_{69} (B_{14}), Klebsiellae pneumoniae, Proteus mirablis, Proteus vulgaris, Morganella morganii and Salmonella typhimurium were isolated at

varying rates. Most of these organisms were isolated by many authors with different percentages from surface of camel carcasses (Hamdy, 1991 and Yassien, 1997).

The hygienic significance of Enteropathogenic E. coli has been emphasized by many authors as it has been implicated in cases of gastroenteritis, cystitis, pyelonephritis, appendicitis and peritonitis in man, epidemic summer diarrhea in children (Krieg and Holt, 1984 and Eley, 1992).

One strain of salmonella namely Salmonella typhimurium was isolated in this study after preparation of the carcass and before shower or lactic acid (2%) application which might originate from handling or from intestinal content of camels. Salmonella Typhimurium is the commonest Salmonellae isolated from food poisoning in man and 50-60% of the cases of food poisoning in man were attributed to this serotype (WHO, 1967).

The result recorded in table (1) declared that the mean values of S. aureus count were $8.2x10^5$, $8.2x10^2$ and $5.6x10^4/cm^2$ before and after skinning and after preparation. Higher values were recorded by Hamdy (1991) who reported that coagulase positive staphylococci reached up to 10^5/gm on the surface of camel carcasses, it is sufficient to cause toxicosis to consumer. At the same time the presence of S. aureus on food article indicate their contamination from the skin, mouth, nose of workers handling the food. The inadequately cleaned equipment may be a source of contamination (Fliss et al., 1991).

S. aureus count was significantly reduced at $p<0.01$ after application of showering followed by spraying of carcasses by 2% lactic acid solution to $<10^2$ organism/cm^2.

For the production of fresh meat of good microbiological quality, the recommended international codex of hygienic practice for fresh meat and for ante- and post-mortem inspection of slaughtered animals (Codex, 1976) should be followed. The most important practice that should be taken in consideration in slaughtering process are cleaning of dirty camels before slaughtering, skinning of camels while being on the rail not in the ground, separation of carcasses from each other and avoid contact between the outer surface of the hide and the carcass. A decontamination step, in the form of showering and sanitizing (spraying by 2% lactic acid solution) after preparation can improve the bacterial safety and shelf life of the meat. Hygienic measures must be adequate to prevent spread of contamination via hands, knives, saws, equipment and clothes. Aerial contamination must be minimized by avoiding excessive transportation of hides.

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Table (1): Statistical analytical results of bacterial load on camel carcasses/cm^2

Counts	Step	Min.	Max.	Mean	S.E. ±
Mesophilic	I	$2x10^5$	$5x10^9$	$9.4x10^7$	$6.3x10^7$
	II	<20	$7x10^4$	$5x10^3$	$1.1x10^3$
	III	$6x10^4$	$3x10^7$	$8.2x10^6$	$2.1x10^6$
	IV	$2x10^2$	$5x10^4$	$8.2x10^3$	$5x10^3$
Enterobacteriaceae	I	$2x10^2$	$3x10^6$	$7.6x10^5$	$11.2x10^5$
	II	<20	$5x10^3$	$6.2x10^2$	$3.3x10^2$
	III	$2x10^2$	$6x10^5$	$8.2x10^4$	$2.1x10^4$
	IV	<20	$6.9x10^3$	$7x10^2$	$3.2x10^2$
Coliforms (MPN)	I	90	$1.1x10^6$	$4.3x10^5$	$8.2x10^4$
	II	<3	$5x10^2$	$3.1x10^2$	$1.1x10^2$
	III	$1.5x10^2$	$1.1x10^5$	$6.8x10^4$	$2.3x10^4$
	IV	<3	<3	<3	
Fecal coliforms (MPN)	I	40	$1.1x10^4$	$3.6x10^3$	$1.2x10^2$
	II	<3	$2x10^2$	83	52
	III	40	$1.1x10^3$	$7.1x10^2$	$5.3x10^2$
	IV	<3	<3	<3	
E. coli (MPN)	I	<3	$1.1x10^3$	93	61
	II	<3	<3	<3	
	III	<3	$1.1x10^3$	$2.3x10^2$	$1.3x10^2$
	IV	<3	<3	<3	
S. aureus	I	$6x10^2$	$2x10^2$	$8.2x10^5$	$2x10^5$
	II	<10	$6x10^3$	$8.2x10^2$	$3.1x10^2$
	III	$2x10^2$	$5x10^5$	$5.6x10^4$	$1.3x10^4$
	IV	<10	<10	<10	

I Before skinning II After skinning

III After preparation IV After showering followed by spraying with lactic acid 2%

Table (2): Enterobacteriaceae isolated from examined swabs

Isolates	I		II		III		IV	
	No.	%	No.	%	No.	%	No.	%
Enterobacter aerogenes	3	15	-	-	4	20	-	-
Enterobacter clocae	2	10	-	-	3	15	-	-
Enterobacter sakazaki	1	5	-	-	-	0	-	-
E. coli	1	5	-	-	7	35	-	-
Klebsiella pneumoniae	2	10	1	5	4	20	-	-
Proteus mirabilis	4	20	1	5	2	10	1	5
Proteus vulgaris	3	15	-	-	2	10	-	-
Morganella morganii	4	20	-	-	2	10	-	-
Salmonella typhimurium	-	-	-	-	1	5	-	-

Table (3): Serotypes of isolated E. coli

Serotype	I		II	
	No.	%	No.	%
O_{26}: K_{60} (B_6),	1	5	2	10
O_{55}: K_{59} (B_5),	-	-	2	10
O_{111}: K_{58} (B_4),	-	-	1	5
O_{119}: K_{69} (B_{14})	-	-	2	10