BACTERIAL QUALITY OF BEEF CARCASSES IN A MEAT PROCESSING PLANT

The safety and hygienic quality of the carcasses are largely determined by the presence of microorganisms, which are ubiquitous in nature. During slaughter and dressing of animals, the carcass gets contaminated with microorganisms from various sources such as hide, hair and intestinal contents and from the environment in which they are handled. Thus knowledge of the overall bacterial load on the carcasses and slaughtering areas will help to develop a beef carcass monitoring system to evaluate the bacterial quality of the carcass in a processing plant.

During the investigation, a total of 40 beef carcasses were randomly selected from a meat processing plant located at Kochi in Kerala during a period from April to June 2002. The factory procures the carcasses from two sources (A and B) located at Tamil Nadu for fabrication and production of meat and its products. From each randomly selected carcass surface, 500 cm^2 area was swabbed, which consisted of 100 cm^2 each from neck, brisket, loin, flank and outer round .The samples were collected and brought to the laboratory in thermo cool containers and processed immediately to evaluate the bacterial quality by estimating total viable count (TVC), coliform count (CC), *E. coli* count (ECC) and faecal streptococcal count (FSC) according to the procedures described by Swansson *et al*. (2001); Anon (1968), Anon (1973) and BIS (1980), respectively. The samples were identified by the cultural, morphological and biochemical characteristics described by Barrow and Feltham (1993). Samples such as pond water, tap water, ice and processing equipments were collected and processed for estimation of bacterial counts. Hand wash of personals were taken at end of processing hours on each of six visits. The count obtained was expressed as $\log_{10}$ cfu/ml. The examination of water samples and ice samples was repeated during six visits.

Swab contact method described by Evancho *et al.* (2001) was followed to collect samples from the meat cutting board, meat cutting tables, knife and steel for the estimation of bacterial count. The bacterial count of the cutting board, and cutting table was expressed as colony forming units (cfu) per cm^2 and knife and steel was expressed as cfu/ml. Hand wash of the personnel was mixed and further ten fold serial dilutions of samples were made as prescribed in the ISI (1978). The bacterial count of the samples was estimated as described in the carcass swab sample examination and the count was expressed as cfu/ml. The data obtained in the study were subjected to statistical analysis as per the procedure described by Rangaswamy (1995).

Table 1. Mean bacterial counts of the samples

Source of samples	TVC Mean ± SE ($\log_{10}$cfu/cm^2)	CC Mean±SE ($\log_{10}$cfu/cm^2)	ECC Mean±SE ($\log_{10}$cfu/cm^2)	FSC Mean±SE ($\log_{10}$cfu/cm^2)
A	$7.32^{a*} \pm 0.17$	$3.61^{a*} \pm 0.13$	$2.53^{a*} \pm 0.19$	$3.55^{a*} \pm 0.11$
B	7.47 ± 0.18	$3.21^{a} \pm 0.13$	$1.13^{a} \pm 0.25$	$3.00^{a} \pm 0.10$
Overall mean	7.40 ± 0.17	3.41 ± 0.13	1.83 ± 0.22	3.27 ± 0.10

N=40, 20 each from source A and B
Figures bearing the same superscript differ significantly
*P<0.05

J. Vet. Anim.Sci. 2009. 40 : 52-55

Table 2. The mean bacterial load of processing equipment, ice, water and hand washings

Sl. No.	Source	Mean bacterial count ± SE (log_{10} cfu/cm² or per ml)			
		TVC	CC	ECC	FSC
1.	Cutting board	4.94 ± 0.87	1.24 ± 0.94	-	1.38 ± 0.86
2.	Cutting table	4.28 ± 0.87	1.26 ± 0.83	-	1.29 ± 0.79
3.	High density polyethylene bags	1.18 ± 0.76	-	-	-
4.	Knife	2.36 ± 0.76	1.11 ± 0.73	-	1.13 ± 0.70
5.	Steel	3.08 ± 0.75	1.57 ± 0.74	-	-
6.	Pond water	5.10 ± 0.74	1.39 ± 0.77	-	-
7.	Tap water	3.24 ± 0.09	0.50 ± 0.21	-	-
8.	Ice	3.20 ± 0.11	2.30 ± 0.08	-	-
9.	Hand wash	4.96 ± 0.82	1.26 ± 0.78	0.80 ± 0.24	1.48 ± 0.77

The mean total viable count, coliform count, *Escherichia coli* count and faecal streptococcal count of carcasses belonging to the sources A and B are given in Table.1

Statistical analysis of the data using paired t-test revealed a significant and positive association between the mean total viable count and faecal streptococcal count ($P<0.05$). The high TVC and CC observed in the present study could be suggestive of lack of hygienic practices followed during slaughter and dressing of cattle and subsequent transportation. This also confirms the observation of Lasta *et al.* (1992), who reported that carcasses produced from very good abattoirs had coliform count lower than one cfu/cm². *Escherichia coli* is a mesophilic, gram-negative organism found in the intestinal tract of man and animals. The organism is associated with spoilage of meat and their presence on the carcasses indicates that the contamination might have occurred from the intestinal contents of the animal and from the contaminated water used for various activities during slaughter and dressing of carcasses. All samples revealed the presence of faecal streptococcal organisms in large numbers which could be attributed to direct or indirect faecal contamination, as these organisms are true commensals of the alimentary tract of man and animals. At times, the organisms are associated with "sours" or "bone taint" on the carcasses (Jay, 1996).

Bacterial load in different processing equipments, ice, water and hand washings of personnel are given in table 2.

Highest mean total viable count was observed in pond water. The observation of the study indicates that the ice, pond water and tap water contributed significantly in the contamination of beef carcasses. The mean TVC in the tap water was much higher than the reported 10 cfu/ml (Rao and Ramesh, 1992) and 2.07 log_{10} cfu/ml (Tarwate *et al.*, 1993). Coliform count was observed in all samples except in packaging material. The highest count of the organisms was observed in ice samples. Cutting board, cutting table and knife showed presence of faecal streptococci. *Escherichia coli* count was present only in hand wash samples. Hand wash also showed the presence of coliform and faecal streptococcal count. Therefore the personals engaged in various operations during the processing of carcasses played a significant role in the contamination of carcasses.

Table 3. The mean bacterial load of air samples in processing plant.

Sampling site	Mean counts ± SE (cfu /min)
Slaughter hall	100.7 ± 8.17
Chilling room	8.75 ± 1.19

The mean bacterial load of air samples in the slaughter hall and chilling room are shown in table 3

Mean bacterial load in the slaughter hall and chilling room obtained indicate that the air in these rooms play a significant role in the bacterial contamination of the carcass surface.

Summary

Bacteriological quality of 40 beef carcasses selected from a meat processing plant and the environmental samples surrounding the plant were assessed during the present investigation. The samples from each carcass were examined for the bacterial quality by estimating the total viable count (TVC), coliform count (CC), *Escherichia coli* count (ECC) and faecal streptococcal count (FSC). Statistical analysis of the data using paired t-test revealed a significant and positive association between the mean total viable count and faecal streptococcal count ($P<0.05$) of the samples. The samples of air, water, equipment and hand wash of personnel were also collected and the various bacterial loads of these samples were estimated. Highest mean total viable count was observed in pond water. The ice, pond water and tap water had contributed significantly in the contamination of beef carcasses. Only hand wash samples showed the presence of *Escherichia coli* count whereas coliform and faecal streptococcal count was also detected in samples collected from hand washes. Ice samples had a mean TVC of 3.20 ± 0.11 log_{10} cfu/ml. The coliform count in ice, pond, and tap water were 2.30 ± 0.08, 1. 39 ± 0.77 and 0.50 ± 0.21 log_{10} cfu/ml, respectively. Thus, it may be inferred that, hygienic quality of equipments and processing plant environment plays a key role in the production of good quality meat. The study points out that the equipment, environment and personnels contribute to the low quality of meat in the processing plant.

References

[Anonymus]. 1968. *Determination of faecal streptococci in foods*. Nordic Committee on Food Analysis 68. Universal Decimal Classification. 576, 851, 21, Finland

[Anonymus]. 1973. *Determination of number of coliform bacteria in foods*. Nordic Committee on Food Analysis 68. Universal Decimal Classification. 576, 851, 48, Finland.

BIS [Bureau of Indian Standards]. 1980. SP:18. *Handbook of food analysis. Part 1. General Methods.* Indian standards institution. Manak Bhavan, New Delhi.FAO. 1985. FAOSTAT, FAO Statistics Division, Rome

Barrow, C.J. and Feltham, R.K.A. 1993. *Cowan and Steel's manual for the identification of medical bacteria* 3rd ed., Cambridge Press, London. 238 p

Evancho, G. M., Sveum, W. H., Moberg, L. J. and Frank, J. F. 2001. Microbiological monitoring of the food-processing environment. In : Downes, F.P. and Ito, K.(Eds). *Compendium of methods for the microbiological examination of foods*. 4th ed., American public health association. Washington DC., pp. 25-35

IS: 1622 [Indian Standard].1978. *Method of sampling and test for microbiological examination of water used in industry*. Indian standards institution.

Jay, J. M. 1996. *Modern food microbial.,*5th ed. International Thomson Publishing, NewYork. 622 p.

Lasta, A. J., Rodriguez, R., Zanelli, M. and Margaria, C.A.1992. Bacterial count from bovine carcasses as an indicator of hygiene at slaughtering places: A proposal for sampling. *J. Fd. Prot.*, **54**: 271-278

Rangaswamy, R. 1995. *A text book of Agricultural Statistics.* New Age International publishers Ltd., New Delhi. 495 p.

Rao, D. N. and Ramesh, B. S. 1992. The microbiology of sheep carcasses processed in a modern Indian abattoir. *Meat Sci.* **32**: 425-436

Swansson, K. M. J., Petran, R. L. and Hankin, J. H. 2001. Culture methods for enumeration of microorganism. In: Downes, F.P. and Ito, K (Eds.) *Compendium of methods for the microbiological examination of foods.* 4th ed., American public health association .Washington DC. pp. 53-62

Tarwate, B. G., Sherikar, A. T. and Murugkar, H.V. 1993. Microbiological analysis of environmental sources of contamination in Deonar abattoir. *J. Fd. Sci. Technol.,* **30:** 127-129.

C. Sethulekshmi[1] and E. Nanu[2]
Department of Veterinary Public Health
College of Veterinary and Animal Sciences
Mannuthy - 680 651, Thrissur, Kerala

❑

1. Assistant Professor
2. Dean (Retd.)