American Journal of Food Technology

ISSN 1557-4571

Academic Journals Inc.

www.academicjournals.com

American Journal of Food Technology 2 (1): 55-59, 2007
ISSN 1557-4571

Microbial Quality of Retail Meat Products Available in Chennai City

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Abstract: A study on microbial quality of commercially available beef, pork, mutton and chicken products in Chennai city was conducted. A total of 36 samples were analyzed for Total Viable Count (TVC), psychrotrophs, anaerobes, staphylococci, streptococci, coliforms and *Salmonella*. The mean total viable count was significantly greater in mutton products than all other products studied. The mean psychrotrophic count was significantly lesser in pork products than other products studied. The mean anaerobic and coliform counts of beef and mutton products did not differ significantly. However, the mean anaerobic counts of both mutton and beef products were significantly higher than that of both pork and chicken products. The mean staphylococcal count of pork products was significantly lesser than beef and mutton products. The mean streptococcal count of pork products was significantly lesser than mutton and chicken products. Mutton products showed the highest microbial counts in all the microbial quality parameters except total viable count and anaerobic count. Chicken products recorded the lowest total viable count and anaerobic count. Based on the microbial quality assessment, pork products were found to be better in comparison with other meat products.

Key words: Microbial quality, commercial meat products, beef, mutton, pork, chicken products

Introduction

Food habits of society have substantially changed due to rapid urbanization and hurried way of living, resulting in increased demand for ready to cook and ready to eat meat products. Consumers have become more selective, conscious of quality, concerned about value for money, freshness and health aspects of meat food products. Technological developments in food processing, preservation and handling have given consumers much greater choice over the food they can buy.

Meat is not only highly susceptible to spoilage, but also frequently implicated to the spread of food-borne illnesses. During slaughter and processing, all potentially edible tissues are subjected to contamination from a variety of sources within and outside the animal (Ayres, 1955). In living animals, those surfaces communicating with environment, harbor variety of microorganisms. When tissues are removed from the carcass and exposed to the environment, the sterile surfaces will become contaminated with microorganisms. The contaminating organisms are derived mainly from the hide of the animal and also comprise organisms that originate from both faeces and soil. In addition, processed meat foods are more prone to contamination with pathogenic microorganisms during the various stages of processing.

In general, the microbiological quality of meat products as purchased by the consumer is dependent on a number of factors, such as the quality of the raw materials, other materials used or

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added during processing operations to the products as extraneous contaminants, efficacy of cooking process, sanitation during processing and packaging, maintenance of adequate refrigeration from the processor to the retail level and to the consumer and finally, sanitation during handling at the retail stores. Heredia *et al.* (2001) reported that the microbial quality of ground meat analyzed was unsatisfactory, and the product was important cause of food poisoning. Similarly, Duffy *et al.* (2001) reported that the mean log APC and TCC were highest in store-ground pork and pork sausages. Astorga *et al.* (2002) also reported that chicken products (especially those made with ground meat) represented notable hazards to humans and were a cause of public health concern.

Keeping all these in view, the present study was undertaken to assess the microbiological quality of various commercially available meat products sold in Chennai city to evaluate the hygienic standards from public health point of view.

Materials and Methods

A study on the microbial quality of retail meat products was carried out in the Department of Meat Science and Technology, Madras Veterinary College, Chennai during the period from November 2000 to August 2001.

Collection of Samples

Six samples of beef products (beef mince and beef sausages), eighteen samples of pork products (ham, bacon and cocktail sausages), 6 samples of mutton products (mutton mince) and six samples of chicken products (chicken kabab, chicken keema, chicken sausages and chicken nuggets) were collected at random at different times from different sources through out the course of a year to determine the microbial quality. The collected samples were immediately transported in insulated, iced containers to the meat microbiology laboratory for microbial analysis.

Microbial Analysis

Mean counts of total viable organisms, psychrotrophs, anaerobes, coliforms, staphylococcus, streptococcus organisms and also the detection of *Salmonella* were determined in the collected samples by the method described by APHA (1976, 1984). Readymade media (Hi-media) were utilized for the assessment of microbial quality.

The data were analysed statistically, using the standard procedures given by Snedecor and Cochran (1994).

Results and Discussion

The mean±SE values of bacterial counts ($\log_{10}$ cfu g^{-1}) for beef, pork, mutton and chicken product samples are presented in Table 1.

Table 1: Mean (±SE) and analysis of variance of microbial counts (log value/g) of different meat products

	Kind of meat products				
Type of organisms	Beef products (n = 6)	Pork products (n = 18)	Mutton products (n = 6)	Chicken products (n = 6)	F-value
TVC	4.78±0.19^{a}	4.60±0.09^{a}	5.35±0.03^{b}	4.52±0.12^{a}	6.14**
Psychotropic count	3.33±0.01^{a}	2.70±0.64^{b}	3.29±0.03^{a}	3.13±0.01^{a}	21.65**
Anaerobic count	3.20±0.02^{a}	3.13±0.01^{b}	3.25±0.01^{a}	3.10±0.02^{b}	8.91**
Streptococcal count	3.68±0.19^{ab}	3.39±0.17^{a}	4.22±0.02^{b}	4.09±0.02^{b}	4.21*
Staphylococcal count	5.16±0.02^{a}	3.97±0.29^{b}	5.23±0.03^{a}	4.88±0.21^{ab}	4.08*
Coliforms count	2.07±0.38^{a}	0.66±0.12^{b}	2.46±0.07^{a}	1.13±0.46^{b}	11.73

*Mean bearing different superscript (a and b) between column differ significantly, * - significant ($p<0.05$), ** - Highly significant ($p<0.01$)

Total Viable Count (log cfu g^{-1})

The mean total viable counts (log cfu g^{-1}) of beef, pork, mutton and chicken products were 4.78, 4.60, 5.35 and 4.52, respectively. The mean total viable count of mutton products was significantly higher ($p<0.01$) than that of beef, pork and chicken products. However, mean total viable count of beef, pork and chicken products did not differ significantly among them. In contrast to the findings of present study, Isigidi *et al.* (1985) reported a mean total viable count of 7.47 log organisms g^{-1} in minced beef. Verma *et al.* (1987) reported similar results in pork sausages with the mean total viable count of 4.5 log organisms g^{-1}. Narashima rao and Ramesh (1988) reported a significantly higher mean total viable count in minced sheep meat. Mean total viable count of chicken products was significantly lower than the permissible level of log organisms g^{-1} for chicken sausages (IS, 1992)

Psychrotrophic Count (log cfu g^{-1})

The mean psychrotrophic counts of beef, pork, mutton and chicken products were 3.33, 2.70, 3.29 and 3.13, respectively. The mean psychrotrophic count of pork products was significantly lower ($p<0.01$) than beef, mutton and chicken products. However, mean psychrotrophic counts of beef, mutton and chicken products did not differ significantly among them. In contrast to the findings of present study, Narashima Rao and Ramesh (1988) reported significantly higher psychrotrophic count in mutton mince. The significantly low mean psychrotrophic count pork products in comparison with all the other products may be attributed to the singeing of pig carcasses during their processing.

Anaerobic Count (log cfu g^{-1})

The mean anaerobic counts of beef, pork, mutton and chicken products were 3.20, 3.13, 3.25 and 3.10, respectively. The mean anaerobic counts of beef and mutton products were significantly higher than pork and chicken products. However, there was no significant difference between beef and mutton products as well as between pork and chicken products. The significantly lower mean anaerobic counts obtained for both pork and chicken product in comparison with mutton and beef products reflect the quality of raw material used and hygienic processing.

Coliform Count (log cfu g^{-1})

The mean coliform counts of beef, pork, mutton and chicken products were 2.07, 0.66, 2.46 and 1.13, respectively. Analysis of variance revealed significantly lower ($p<0.05$) coliform counts of pork and chicken products than that of beef and mutton products. However, there was no significant difference between the mean coliform counts of beef and mutton products as well as between pork and chicken products. The mean coliform counts of all the products assessed in this study were well within the maximum permissible limit of 2.69 log organisms per gram as proposed by Goldenberg and Elliot (1973). Results of this study revealed that better sanitary measures were adopted during processing and storage of pork and chicken products than beef and mutton products.

Streptococcal Count (log cfu g^{-1})

The mean streptococcal count of beef, pork, mutton and chicken products were 3.68, 3.39, 4.22 and 4.09, respectively. Analysis of variance revealed that there was no significant difference between the mean streptococcal counts of beef, mutton and chicken products whereas mean streptococcal count of pork products did not differ significantly from that of beef products. Mean streptococcal count of pork products was significantly lower ($p<0.05$) than that of mutton and chicken products. The significantly lower streptococcal count for pork products in comparison to mutton and chicken products revealed that the personal hygiene of the personnel involved in the processing of pork products was better than those involved in the processing of other products.

Staphylococcal Count

The mean staphylococcal counts of beef, pork, mutton and chicken products were 5.16, 3.97, 5.23 and 4.88, respectively. The mean staphylococcal counts of beef and mutton products were significantly higher ($p<0.05$) than pork and chicken products. However, there was no significant difference between beef and mutton products as well as between pork and chicken products. The mean staphylococcal count of mutton products was higher than the values reported by Narashima Rao and Ramesh (1988).

Isolation and Identification of Salmonella

Among the six beef products, eighteen pork products, 6 mutton products and sixteen chicken products examined for the presence of *Salmonella*, no samples was positive for the *Salmonella*. This is in accordance with the results of Oblinger and Kennedy (1980) who did not recover *Salmonella* from samples of delicatessen meat products. The absence of *Salmonella* in the meat product samples indicates the quality of raw meat and other hygienic processing conditions including the quality of water used in processing.

Conclusions

The microbial assessment of the commercial meat products viz., beef, pork, mutton and chicken revealed the following observations.

- Mutton products showed the highest microbial counts in all the microbial quality parameters studied expect psychrotrophic count.
- Pork products recorded the lowest microbial count in all the microbial quality parameters except total viable count and anaerobic count.
- Chicken products recorded the lowest total viable count and anaerobic count.
- Microbial quality of pork products found to be better in comparison with other meat products studied.

Acknowledgments

The authors wish to thank the NATP-ICAR, New Delhi for the financial assistance offered for the NATP project on Quality Assurance and Monitoring of Food from livestock and poultry and to Tamil Nadu Veterinary and Animal Science University, Chennai-51 for the facilities made available for the research work.

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