JOURNAL OF PURE AND APPLIED MICROBIOLOGY, June 2016. Vol. **10**(2), p. 1633-1636

Evaluation of the Bacteriological Quality of Indian Cheese (*Paneer*) Sold in Some Locations Within Varanasi City

Sudhir Kumar[1], Dilip Kumar[2] and Reeta[1]

[1]Centre of Food Science and Technology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi - 221 005, India.
[2]Department of Animal Husbandry and Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi - 221 005, India.

(Received: 14 March 2016; accepted: 10 April 2016)

Paneer **is nutritive dairy product which is a regular dietary preferred among the Indians. So the present study was aimed to review the microbiological quality of *paneer* sold in Varanasi city. A total of 15 samples were collected from five locations of Varanasi city. All samples were analysed for the standard plate count, yeast and mould count, *Salmonella* count, and *Vibrio* count bio load were determined using routine techniques. The mean standard plate count, yeast and mould count, *Salmonella* count, and *Vibrio* count observed for *paneer* samples ranged from 8.082 to 8.135 logCFU/g, 6.009 to 6.477 logCFU/g, 4.592 to 4.944 logCFU/g, and 3.935 to 4.566 logCFU/g respectively. The intense contamination of bacterial and fungal seen in all samples predominantly. The presence of *Salmonella spp*. and *Vibrio spp*. in *paneer* samples can be recognized to poor hygienic conditions during *paneer* preparation, handling and storage. This study advocate the need for more strict preventive and control measures to avoid pre and post process contamination in the preparation of milk products.**

Keywords: *Paneer*, standard plate count, yeast and mould, *Salmonella*, *Vibrio*.

Paneer is a popular Indian dairy product sometimes called as soft Indian cheese, which is usually prepared from buffalo milk and widely used for preparation of various culinary dishes in India. The Indian cheese (*paneer*) is a regular dietary favourite among the Indians. Due to its high protein content, it is an excellent substitute for meat in the diet in a vegetarian cuisine. There are many steps in the manufacture, handling and storage of *paneer* in which it can get contaminated with microorganisms. The quality of shelf life of goat milk *paneer* in refrigerated storage was reported earlier (Agnihotri *et al*., 1996), and it was observed that even during storage at refrigerated conditions, the products are found to be contaminated. In another study the microbiological quality of dairy product Pedha was reported and the quality could be improved by gamma radiation (Bandekar *et al*., 2007) A work on bacteriological study of *paneer* sold in Chandigarh city had also shown the samples to be highly contaminated (Vaishnnavi *et al*., 2001) and similar study on evaluation of bacteriological quality of Indian cheese (*paneer*) sold in nagpur city had also shown the samples to be highly contaminated (Godbole *et al*. 2013).

In tropical countries like India, dairy products are responsible for many outbreaks of gastro intestinal infection. The product prepared under unhygienic conditions affects the health of the consumers. A study was conducted to assess microbiological quality of *paneer* samples sold in Varanasi city with a view to analyze the situation locally.

* To whom all correspondence should be addressed.
E-mail: dilip.bhu@live.in

MATERIALS AND METHODS

Sample collection

A total of 15 samples of *paneer* were collected from different shops in various locations of the Varanasi city. The samples were collected in pre-sterilized containers and transported to the lab in ice bucket.

Microbial analysis

All the samples were processed as follows under sterile conditions. The sample was crushed finely in pestle and mortar. 1g of sample was mixed thoroughly in 10ml autoclaved saline and mixed thoroughly by vortexing. Serial dilutions from the above suspension were prepared up to 10^{-6}. 1 ml serially diluted sample was plated by pour plate technique on Total Plate Count (for total viable count), Potato Dextrose Agar (for yeast and mould count), Salmonella HiVegTM agar for *Salmonella* spp., and Vibrio HiVegTM Agar for *Vibrio* spp. All plates were incubated at 37°C for 24-48 hrs.

After 24-48 hours of incubation the plates were observed for typical colonies of each microorganism and colonies were counted with the help of colony counter. The results were recorded as CFU/g. Biochemical test performed were gram staining, catalase test, urease test, oxidase test and sugar fermentation tests

Statistical analysis

Analysis of variance (ANOVA) of the respective mean bacterial counts obtained for the *paneer* samples were determined using SPSS version 16. Also Duncan Multiple Range (DMR) test was used to locate the source of significant differences in the mean counts.

RESULTS AND DISCUSSION

The sampling locations of *paneer* samples from various zones of Varanasi city are shown in Table 1.

The samples were collected randomly from various shops from different zones of Varanasi city. In present study the finding indicate that all samples of *paneer* collected from different parts of the city were highly contaminated with bacteria as well as fungi. All the 15 samples studied had bacteriological counts ranging from 8.082 to 8.135 logCFU/g) and fungal counts ranging from 6.009 to 6.477 logCFU/g. The samples were found to be contaminated with Salmonella and Vibrio in 75.18%, and 24.82% of the samples respectively. Figure 1 and Table 2 shows the results of the microbiological analysis of *paneer* samples.

In the present study a high degree of bacterial and fungal contamination has been seen. The occurrence of *Salmonella* spp. and *Vibrio* spp. in almost all the *paneer* samples collected may be attributed to the practice of preparing large bulks far too in advance of requirement which are being held for long periods at room temperature. Studies carried out on microbial quality of *paneer* have indicated that it is often contaminated with *Staphylococcus aureus* and *coliforms* (Kumar *et al*., 1889 and Rajorhia *et al*., 1984). It also indicates poor hygienic conditions and faults in manufacturing/handling during the process of preparation. It is observed that most of the times the vendors in various sectors of the city and workers in the shop have no knowledge of the practices and probable dangers if a food safety is not followed. The application of HACCP to identify the critical control points for *Salmonella* spp. and *Vibrio* spp. has indicated that the contamination is due to food handlers using naked hands to remove excess water in *paneer* (Bhat *et al*., 2000)

In India quality control with regard to food products is being enforced through various regulatory mechanisms like Food Safety and Standards Authority of India (FSSAI), Agricultural grading and marketing (AGMARK). The Bureau of Indian standards (BIS) has launched a HACCP program of certification for the food industry (Vaishnnavi *et al*., 2001), while efforts are being made to implement HACCP in the organized sector of the food industry, there is a need to implement HACCP in the unorganized sector also, as it accounts for 70-80% of food produced and processed in India. Thus in the context of globalization and post WTO era, the codex

Table 1. Sampling locations of *paneer* samples from various zones of Varanasi city

Sample Number	Locations
P1 to P3	Zone I
P4 to P6	Zone II
P7 to P9	Zone III
P10 to P12	Zone IV
P13 to P15	Zone V

Table 2. Enumeration of Standard Plate Count, Yeast & Mould Count, *Salmonella* and *Vibrio* in *paneer* samples from Varanasi city

Paneer samples		TPC (LogCFU/g)	PDA (LogCFU/g)	Salmonella HiVegTM agar (LogCFU/g)	Vibrio HiVegTM agar (LogCFU/g)
Zone I	P1	8.096 ± 0.001	6.094 ± 0.010	4.944 ± 0.002	4.566 ± 0.003
	P2	8.086 ± 0.001	6.146 ± 0.002	4.926 ± 0.003	4.533 ± 0.002
	P3	8.070 ± 0.043	6.113 ± 0.004	4.939 ± 0.002	4.545 ± 0.001
Zone II	P4	8.096 ± 0.001	6.472 ± 0.002	4.742 ± 0.001	4.285 ± 0.002
	P5	8.093 ± 0.001	6.477 ± 0.006	4.733 ± 0.002	4.231 ± 0.002
	P6	8.089 ± 0.002	6.445 ± 0.003	4.707 ± 0.005	4.176 ± 0.002
Zone III	P7	8.091 ± 0.002	6.416 ± 0.002	4.626 ± 0.002	4.155 ± 0.002
	P8	8.086 ± 0.001	6.360 ± 0.006	4.634 ± 0.001	4.077 ± 0.002
	P9	8.082 ± 0.001	6.397 ± 0.002	4.614 ± 0.002	4.113 ± 0.002
Zone IV	P10	8.132 ± 0.001	6.099 ± 0.003	4.612 ± 0.001	3.935 ± 0.001
	P11	8.113 ± 0.002	6.009 ± 0.007	4.592 ± 0.001	4.175 ± 0.002
	P12	8.122 ± 0.002	6.036 ± 0.011	4.603 ± 0.001	4.322 ± 0.001
Zone V	P13	8.135 ± 0.001	6.364 ± 0.005	4.674 ± 0.001	4.040 ± 0.002
	P14	8.119 ± 0.002	6.274 ± 0.003	4.654 ± 0.002	4.277 ± 0.002
	P15	8.127 ± 0.001	6.322 ± 0.002	4.661 ± 0.001	3.955 ± 0.002

Abbreviations: TPC - Total plate count, PDA - Potato Dextrose Agar, P1 to P15 - *paneer* sample 1 to 15.

Table 3. The Indian standards specifications for *paneer* (IS : 10484-1983)

S.No.	Characteristics	Requirement	Method
1.	Bacterial count per gram max.	5×10^5	Is : 5402-1969
2.	Fungal count per gram max	90	Is:5401-1969
3.	Coliform count per gram max	250	Is:5403-1969

Alimentarius commission guidelines on food safety issues such as HACCP should be implemented in India. Table 3 shows the Indian standards specifications for *paneer* (IS : 10484-1983).

The code of conduct laid down by FSSAI should be strictly followed by the *paneer* manufacturers. Government agencies and NGOs could take initiative in spreading awareness and measures to educate the workers about the manufacturing handling and selling of such products which have a very high risk of getting contaminated during the entire process, and basic training of handling and hygienic practices can be given to the manufacturers and handlers, so that the health of the consumer is not at risk.

a)Vibrio *b) Salmonella*

Fig. 1. Typical colonies of *Vibrio* and *Salmonella* isolated from *paneer* sample

CONCLUSION

This study concluded that the presence of *Salmonella* spp. and *Vibrio* spp. can be recognized to poor hygienic conditions during *paneer* preparation, handling and storage as per standards. Consumption of lower quality of *paneer* may lead to serious human health problems. This study suggested to strictly preventive and control measures of pre and post process contamination in *paneer* preparation.

REFERENCES

1. Agnihotri, M.K. and Pal U.K. Quality and shelf life of goat milk *paneer* in refrigerated storage, *J .small ruminant research*., 1996; **20**(1): 75-81.
2. Bandekar, J. and Thomas A. R. Microbiological quality of the dairy product pedha and its improvement using gamma radiation. *J. food safety*, 2007; **18**(3): 221-230.
3. Bhat, R.V., Rao, V.S. and Lingerkar K. Application of hazard analysis and critical control point for improvement of quality of processed foods. ICMR bulletin. 2000; **30**(5).
4. Kumar, V. and Sinha R.N. Incidence of *coliforms* in indigenous milk products. *Ind J. Dairy Sci*., 1989; **42**: 579.
5. Rajorhia, G.S., Dharmpal and Arora, K.L. Quality of *paneer* marketed in Karnal and Delhi., *Ind J. Dairy Sci*. 1984; **37**: 274.
6. Sudarshan, R.V., Rao, P. and Kalpagam, P. Food safety research in India - A Review, *Asian J. food and Agri Ind*. 2009; **2**(03): 412-433.
7. Vaishnnavi, C., Singh, S., Grover, R. and Singh, K, Bacteriological study of Indian cheese (*paneer*) sold in Chandigarh. *Ind J. Med. Microbiol*., 2001; **19**: 224-226.
8. Godbole, S., Dabholkar, P. and Pachbudhe, A. Evaluation of bacteriological quality of Indian cheese (*paneer*) sold in Nagpur city. *J. Glob Biosci*. 2013; **2**(2): 53-56.