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Microbial Quality of Frozen Dairy Foods Available in Retail Outlets of Salem, Tamil Nadu, India

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ABSTRACT: The study aimed to assess the microbiological quality of frozen desserts sourced from branded and local manufacturers to ensure consumer safety. One hundred samples (25 ice cream, 25 Kulfi, 25 softy ice cream and 25 milk lollies) were subjected to total plate count, coliform count and presence of pathogens viz., salmonella and *Staphylococcus aureus*. The mean total plate count for ice cream, kulfi, softy and milk lollies, were 2.52±0.11, 5.32±0.13, 5.51±0.12 and 5.58±1.51 respectively. The coliform and salmonella were negative in branded ice cream samples. Seventeen samples of kulfi, softy ice cream and milk lollies, tested positive for *Staphylococcus aureus*. Due to the substandard microbiological quality of frozen dairy products in the research area, it is imperative to implement preventive measures during both the production and post-production phases till consumption to avert foodborne illness. This research emphasizes how important it is to maintain ongoing oversight and adherence to food safety regulations in order to protect the health and safety of consumers. To maintain the standards in frozen desers and safeguard the public's health, constant monitoring and compliance with food safety laws are crucial.

Keywords: ice cream, kulfi, milk lollies, softy ice cream, total plate count, salmonella, *Staphylococcus aureus*, coliform.

INTRODUCTION

In Indian cuisine, frozen dairy foods remain consistently preferred. They are a nutrient-rich source that is susceptible to microbial contamination during the addition of ingredients and at various phases of processing. Kulfi is a favored South Asian ice cream that is typically prepared with boiled milk obtained from water buffaloes. Kulfi is distinguished from western ice cream by its creamier texture and richer flavor. Because of their high nutrient value, extended storage duration, and nearly neutral pH value, milk-based products are effective media for microbial growth. Water and fresh milk are the primary sources of microbial contamination in ice cream, while flavoring agents, utensils, and handling are the secondary sources. Although the majority of microbial hazards can be estimated through pasteurization and chilling processes during production, a number of health hazards remain persistent as a result of a variety of conditions. The product may also be contaminated with potential pathogenic organisms as a result of the handling by operators who are carriers of specific diseases. Hennessy *et al*. (1996) reported that, consuming ice cream contaminated with enteropathogenic bacteria, such as Salmonella, has led to serious disease outbreaks.

The frozen dessert must be free of pathogens and have a bacteriological quality that is as high as feasible to guarantee its safety. Due to the high consumption of frozen products, including ice cream, among young children, strict microbiological safety standards must be maintained (Champagne *et al*., 1994). Ice cream quality is vulnerable to a range of psychrophilic and psychrotolerant microorganisms, including *Listeria monocytogenes*, *Staphylococcus aureus*, *Bacillus* spp., *Salmonella* spp., *Shigella* spp., *Streptococcus* spp., *Pseudomonas* spp., *Campylobacter* spp., Brucella spp., and coliform bacteria (Jay, 1992; Warke *et al*., 2000) Psychrotrophic bacteria, including *Listeria monocytogenes*, *Staphylococcus aureus*, *Bacillus* spp., *Salmonella* spp., *Shigella*, *Streptococcus* spp., and *Pseudomonas* spp., have been isolated from dairy food

products (Das *et al.*, 2020). In light of this, the objective of this study is to ascertain the microbiological integrity of commercially available frozen dairy foods, including kulfi, ice cream, softy ice cream, and milk lollies, in the Salem district of Tamil Nadu, India.

MATERIALS AND METHODS

One hundred samples, which included 20 ice cream, 25 kulfi, 25 softy ice cream, and 25 milk lollies, were acquired from various retail outlets in the Salem district. The frozen dessert that was collected was regarded as a single representative sample. This sample was thoroughly mixed, and an exact quantity of 1 ml was pipetted out aseptically and transferred to a sterile, empty test tube. The tube was then sealed with cotton. 9 ml of dilution was added to this sample to achieve a 1:10 v/v dilution rate. Furthermore, the standard method outlined by APHA (1960) was employed to produce the decimal dilution that was necessary.

The standard plate count and coliform count were determined according to the standard methods for the examination of dairy products (I.S. No. 1479, Part III, 1977). Staphylococcus agar No. 110 was utilized for the enumeration of Staphylococcus species. Salmonella detection involves initial enrichment utilizing Selenite F broth, followed by plating on Brilliant Green Agar. Selected colonies were subjected to confirmation through biochemical reactions (Barrow and Feltham 1993).

RESULTS AND DISCUSSION

The microbial quality of the ice, cream, kulfi softy ice cream and milk lollies samples are presented in Table 1. The mean total plate count for Ice cream, kulfi, softy and milk lollies, were 2.52±0.11, 5.32±0.13, 5.51±0.12 and 5.58±1.51 log cfu/g respectively. All analyzed frozen dessert samples (n=100) showed positive growth on plate count agar indicating the presence of psychrophilic microorganisms. Yan *et al.* (2022) revealed that microbial quality of ice cream from various regions of China, that 6.10 per cent of the samples had total viable count of more than 10^5 cfu/g. There was a significant amount of contamination in the ice cream that was purchased from street shops in Jalandar city, Punjab, as reported by Kumar *et al.* (2011). The bacterial count ranged from 0.1×10^9 CFU/g to 10.2×10^9 CFU/g.

Mean total coliform count in kulfi, softy ice creams and ice milk were 1.57±0.13, 2.85±0.13 and 3.51±0.12 cfu/gm respectively and no coliform was found in branded ice cream samples. According to FSSAI regulations, the permissible limit for coliform bacteria in ice cream is a maximum of 100 per gram. In our study, samples of kulfi, softy ice cream and lollies had a higher coliform count than the prescribed limit. Salmonella was not detected in any of the branded ice cream and kulfi samples. Only five samples from softy ice cream and milk lollies showed positive for salmonella. It should be absent in 25 g as per the standards. This result indicates that consumption of softy ice cream and milk lollies is totally unsafe and needs to be handled with appropriate measures to avoid contamination. Guclu *et al.* (2022) reported negative results in search of Salmonella detection in ice cream samples. Paul *et al.* (2018) revealed that 15.15 percent of the ice cream samples showed Salmonella spp. from street vendors of Dhaka city

Staphylococcus aureus was identified from 17 samples of kulfi, softy ice cream and milk lollies. In a recent study Sirisha *et al.* (2020), it is reported that incidence of pathogenic staphylococcus in branded and non branded ice cream samples of Hyderabad city were 53 and 100 percent respectively. Badr (2018), reported that four out of 25 isolates were staphylococcus obtained from 10 ice cream samples in Hyderabad, India. One or more of the possible origins of this organism in ice cream could include the nose, which is a popular location for it, as well as the hands, skin, and clothing of those who handle it. Droplets are produced when people cough, talk, or sneeze, and these droplets have the potential for settling on ice cream when it is being transported, stored, or handled.

Table 1: Microbial quality of frozen dairy foods.

Sr. No.	Count	Ice Cream	Kulfi	Softy ice cream	Milk lollies
1.	Standard plate count (SPC) (log CFU/g)	2.52±0.11	5.32±0.13	5.51±0.12	5.58±1.51
2.	Coliforms (log CFU/g)	0	1.57±0.13	2.85±0.13	3.51±0.12
3.	Salmonella (number of positive samples)	0	0	2	3
4.	*Staphylococcus aureus* (number of positive samples)	0	4	6	7

The existence of coagulase positive Staphylococcus, predominantly *S. aureus* when transmitted from humans and animals, can cause staphylococcal food poisoning due to the organism's growth and the subsequent release of enterotoxin in food. Enterotoxin production and secretion is particularly prevalent when ice cream products are inadequately prepared and stored. Starch and proteins promote the production of enterotoxins by microorganisms (Jay, 1992).

The dietary richness of ice cream is widely acknowledged; however, the complexities involved in its production and handling offer numerous challenges. Significant challenges exist concerning the quality of ice cream, particularly in relation to its microbiological standards, which are currently inadequate. Throughout various stages, including production, transportation, storage, and preparation, milk intended for consumption may become contaminated with biological agents. Pathogens contaminating food are linked to ingredients introduced after pasteurization and environmental factors, including air quality, storage tank defects, structural cracks in the processing plant, and packaging materials.

CONCLUSIONS

Based on the data presented above, it was found that all of the samples of branded ice cream were within the permissible level of public health safety. This was due to the fact that the samples did not exceed the total viable count of 2,50,000 and the coliform count of 90 per gram, both of which are specified by the Bureau of Indian Standards. Taking into account the findings as a whole, it is evident that each and every ice cream sample was risk-free. It is also clear that a small number of the kulfi, as well as the bulk of the softy ice cream and milk lollies, were not suitable for ingestion due to the presence of salmonella staphyloccocal organisms.

FUTURE SCOPE

Consumer safety will be ensured by screening more samples for the presence of harmful organisms in frozen dairy products. The HACCP principles must be rigorously adhered to for the identification and mitigation of possible risks during the various manufacturing phases. Automation and mechanization can eliminate the need for manual handling. Automation enables meticulous regulation of mixing, freezing, and other essential processes, yielding a more uniform output. It facilitates the production process in sustaining appropriate temperatures and durations, which is essential for attaining the right texture and flavor of various frozen dairy products.

Conflict of Interest. None.

REFERENCES

American Public Health Association (1960). Recommended Methods for the Examination of Dairy Products. 11th ed. APHA Inc., New York.

Badr, M. S. (2018). Isolation and Characterization of Bacteria Isolated from Ice Cream Samples in Hyderabad, *India J Pure Appl Microbiol*, *12*(4), 2275-2282.

Barrow, C. I. & Feltham, R. K. A. (1993). Cowan and Steels Manual for the identification of Medical bacteria. Third Edition, Cambridge University Press, Great Britain. pp. 128-149

Champagne, C. P., Laing, R. R., Roy, D. & Mafu, A. A. (1994). Psychrotrophs in dairy products: Their effects and their control. *Crit. Rev. Food Sci. Nutr., 34,* 130.

Das, M., Mishra, A., Dutta, P. P. & Basena, K. N. (2020). Bacteriological evaluation of few industrially produced ice creams marketed in Jorhat, Assam, India. *Int. J.Chem. Stud., 8*(2), 2946-2950.

Guclu, D., Gunes-Bayır, A., Erdogan, O. & Ozkan, B. (2022). Determination of microbiological quality of ice cream sold in Istanbul and their evaluation in terms of public health. *KASAV Int. J. Health Sci., 5*(3), 86-93.

Hennessy, T. W., Hedberg, C. W., Slutsker, L., White, K. W., Verma, G. S., Besser-Wiek, M. S., Moen, M. E., John, F. B. S., Coleman, W. W., Edmonson, L. M., MacDonald, K. L. & Osterholm, M. T. (1996). A national outbreak of *Salmonella enteritidis* infections from ice cream. *N. Engl. J. Med., 334,* 1281-1286.

ISI (1977). IS: 1479. Part III. Indian Standard methods of test for dairy industry. ISI, Manakbhavan, 9. Bahadurshah Zafair Marg, New Delhi

Jay, J. M. (1992). Modern Food Microbiology, Fourth edition, Chapman & Hall Inc. New York:

Kumar, H., Wadhwa, G., Palaha, R., Gandhi, R. & Singh, S. (2011). Microbiological Quality Analysis of Ice Creams Sold by Street Hawkers: A Case Study of Jalandhar City, India. *Internet Journal of Food Safety, 13,* 164-169

Paul, S., Hasin, F., Hossain, M. M., Khan, M. H., Akter, N. & Khairuzzaman, G. M. (2018). Assessment of the microbiological quality of ice cream offered for public consumption in Dhaka city, Bangladesh. *WJPR, 7*(3), 28-45.

Warke, R. A., Kamat, M. & Kamat, P. J. (2000). Incidence of pathogenic psychrotrophs in ice creams sold in some retail outlets in Mumbai. India. *Food Control, 11,* 77-83.

Yan, L., Pei, X., Miao, J., Li, Y., Yang, S., Peng, Z., Yang, X., Mei, L., Yang, Q., Ren, H. & Yang, D. (2022). Surveillance and examination of microbial contamination in ice cream in China. *Food Qual. Saf., 6,* 1-8.

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