

Short Communication

Bacterial Analysis of Different Types of Ice Creams from Dhaka City

Sabrina Akter and Sangita Ahmed*

Department of Microbiology, University of Dhaka, Dhaka 1000, Bangladesh

Different types of ice creams available in Dhaka were analyzed for their bacteriological quality. A total number of 24 ice cream samples from two different brands (Brand 1 and 2) were collected from street vendors and local shops of different parts of Dhaka city. Average total viable count in the Brand 1 samples ranged from 9.5×10^2 to 4.72×10^4 cfu/ml, while total coliform count and fecal coliform counts were 2.3×10^1 to 2.43×10^3 cfu/ml and zero to 100 cfu/ml, respectively. In case of Brand 2, average total viable count, total coliform count and fecal coliform count were 9.5×10^3 to 4.43×10^4 cfu/ml; 10 to 2.49×10^3 cfu/ml and zero to 200 cfu/ml, respectively. Bacteria isolated from the ice cream samples included *Staphylococcus* sp. (96%), *Bacillus* sp (50%), *Listeria* sp. (41.66%), *Micrococcus* sp. (12.5%), *Escherichia coli* (8.33%) and *Klebsiella* sp (8.33%). Presence of these bacteria in the ice cream indicates the lack of good manufacturing practice in the production of ice cream, which imposes great risk to the consumers.

Key words: Ice cream, Bacteria, Food borne disease

Ice cream is a popular dairy product and consumed by people of all ages. It is mainly composed of milk, sweetening and stabilizing agents, together with colorings and flavoring in some. This composition renders ice cream a nutritious food, as well as an excellent media for microbial growth, including the human pathogens¹. Some of these pathogens can survive pasteurization, therefore leaving the ice cream unsuitable for human consumption. Several outbreaks of food borne diseases like cholera, typhoid, diarrhea, listeriosis have been linked to the consumption of bacterially contaminated ice creams^{2, 3}.

In Bangladesh, there are several well known and large scale manufacturers which produce different types of ice creams. Being a tropical country, consumption of ice cream increases during summer when several outbreaks of food borne diseases are reported each year. However, not much data is available on the bacteriological quality of ice creams available in Bangladesh. This study was designed to study the bacteriological quality of different types of ice creams commonly consumed in Dhaka.

This study was carried out in Dhaka city during the period of January to August 2011. Four different types (mentioned as A, B, C, D) of ice creams manufactured by two ice cream companies (Brand 1 and Brand 2) were collected in triplicates. In total, 24 samples were collected from street vendors and from different departmental shops.

Samples were collected in autoclaved conical flask and were left to melt at room temperature for one hour. For bacterial enumeration ice cream samples were diluted upto 10000 fold by serial dilution and were inoculated by spread plate method on nutrient agar media for total viable counting, on MacConkey

agar media for total coliform count and on mFC agar media for fecal coliform count. Different selective media were used for isolation of different bacterial species, which were *Listeria* selective Agar for *Listeria* species, Mossel's Agar for *Bacillus* species, Mannitol Salt Agar (MSA) for *Staphylococcus* species and *Micrococcus* species and Eosine Methylene Blue Agar (EMB) for *Escherichia coli*. All plates were incubated at 37°C for 24 hours, except for mFC agar which was incubated at $44(\pm 0.5)$ °C for 24 to 48 hours. Standard bacteriological tests were performed to identify the bacteria isolated from the ice cream samples⁴.

The average range of the total viable count obtained from four different types of Brand 1 ice cream samples ranged between 9.5×10^2 to 4.72×10^4 cfu/ml (Table 1). Average total coliform count was between 2.3×10^1 cfu/ml to 2.43×10^3 cfu/ml, while the average total fecal coliform count ranged between zero to 1.0×10^2 cfu/ml (Table 1). Type A samples showed the highest total count and coliform count, whilst the lowest counts were obtained from type D samples. Fecal coliforms were isolated only from Type A samples and were absent in the others.

In case of Brand 2, the average range of the total viable count from four types of ice cream was between 9.5×10^3 cfu/ml and 4.7×10^4 cfu/ml, average total coliform count was between 1.0×10^1 cfu/ml and 2.49×10^3 cfu/ml, average total fecal coliform count was between <1 and 2.0×10^2 cfu/ml (Table 2). The highest total count was obtained from type C sample while type A samples had highest coliform and fecal coliform counts. Fecal coliform were found in type A and B samples.

Different bacteria were isolated from the ice cream samples tested in the study (Table 3). Among these organisms, *Staphylococcus* sp. were the most prevalent and were isolated

*Corresponding author:

Dr Sangita Ahmed, Department of Microbiology, University of Dhaka, Dhaka-1000, Bangladesh, Telephone: 9661900-59; Ext: 7754, Fax: 880-2-8615583, Email: sangitaahmed@yahoo.com

Table 1. Bacterial count in different types of ice creams

Bacteria isolated	Brand 1(n=12)				Brand 2(n=12)			
	A(n=3)	B(n=3)	C (n=3)	D (n=3)	A(n=3)	B(n=3)	C (n=3)	D (n=3)
Average total viable count (cfu/ml)	4.72×10 ⁴	3.4×10 ³	3.4×10 ⁴	9.5×10 ²	1.25×10 ⁴	9.5×10 ³	4.43×10 ⁴	4.43×10 ⁴
Average total coliform count (cfu/ml)	2.43×10 ³	5.17×10 ²	1.06×10 ²	2.3×10 ¹	2.49×10 ³	4.92×10 ²	1.0×10 ¹	2.0×10 ²
Average total fecal coliform count (cfu/ml)	1.0×10 ²	Nil	Nil	Nil	2.0×10 ²	5	Nil	Nil

Table 2. Different types of bacteria isolated from the ice cream samples

Bacteria isolated	Brand 1(n=12)					Brand 2(n=12)					Total (n=24)
	A(n=3)	B(n=3)	C (n=3)	D (n=3)	Total(n=12)	A(n=3)	B(n=3)	C (n=3)	D (n=3)	Total (n=12)	
<i>Staphylococcus. Sp.</i>	3	3	2	3	11(91.66%)	3	3	3	3	12(100%)	23(96%)
<i>Bacillus sp.</i>	1	3	3	1	8(66.66%)	1	1	1	1	4(33.33%)	12(50%)
<i>Listeria sp.</i>	1	1	2	1	5(41.66%)	0	3	2	0	5(41.66%)	10(41.66%)
<i>Micrococcus sp.</i>	1	0	1	1	3(25%)	0	0	0	0	0	3(12.5%)
<i>Escherichia coli</i>	0	0	0	0	0	1	1	0	0	2(16.67%)	2(8.33%)
<i>Klebsiella sp.</i>	1	0	0	1	2(16.67%)	0	0	0	0	0	2(8.33%)

in 96% samples. The other organisms isolated in higher prevalence were *Bacillus sp.* (50%) and *Listeria sp.* (41.66%). *Micrococcus sp.*, was found in Brand 1 ice cream samples, but was absent from the Brand 2 ice creams. Among enteric bacteria, *E. coli* was found in two Brand 2 samples, while *Klebsiella sp* was detected in two Brand 1 samples (Table 2).

According to Manual on Milk and Milk products testing procedure, Bangladesh, ice cream should be free from fecal coliforms, the total coliform count should be less than 10 cfu/ml and the total bacterial count should not exceed 100 cfu/ml⁵. All the ice cream samples tested in this study had a total bacterial count that exceeded the standard and most had coliform count above than the standard. Only one sample from each brand contained fecal coliforms. Hossain and Kober (2008) investigated the bacterial quality of three different brands Kwality, Igloo and Sub Zero in Chittagong and found total heterotrophic count ranging from 2 x 10³ to 4 x 10³ cfu/g and average coliform count ranging from 12 to 42 cfu/g⁶. Ojokoh (2006) also reported high total viable count ranging from 1.8 X 10³ to 2.0X 10⁴ cfu/g in ice cream samples tested in Akure, Nigeria⁷.

In the current study, *Staphylococcus sp* was found to be the predominant organism, which might have introduced from nose, hands, skin and clothing of handlers during transportation, storage and retailing. Presence of this pathogen in ice cream is of great concern as it can lead to fatal staphylococcal food poisoning. Similar high prevalence of *Staphylococcus aureus* was reported by Warke *et al.*, (2000) who isolated this pathogen in all 30 ice cream samples sold in some retail outlets in Mumbai, India⁸.

The other organisms isolated in the current study were *Micrococcus sp.*, *Listeria sp.*, *Bacillus sp.*, *E. coli* and *Klebsiella sp.* Ojokoh (2006) also reported similar bacteriology of ice

cream and isolated *Staphylococcus sp.*, *Bacillus sp.*, *Streptococcus sp.*, *Klebsiella spp.*, *E. coli* and *Salmonella sp.*, from different types of ice cream in Akure, Nigeria⁷. In Turkey, Yaman *et al.*, (2006) showed similar bacteriology in ice creams samples and isolated *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia*, *Salmonella spp.* and *Yersinia spp.*⁹. As all these organisms are susceptible to pasteurization, their presence in the ice cream samples indicates to faulty pasteurization process or post-pasteurization contamination during transportation, storage and retailing.

Another finding from this study is the presence of *Listeria sp* in increased rate (41.66%). Although it was not possible to identify whether these *Listeria sp.* isolated were *Listeria monocytogenes*, their presence indicate to the possibility that the samples might be contaminated with this pathogen, as it is frequently isolated from ice cream samples worldwide^{10,11}. This is of great concern for pregnant women, children and immunocompromised individuals where listeriosis has serious consequences¹². This study therefore emphasizes on further study of prevalence of *Listeria monocytogenes* in food in Bangladesh.

Four samples in the present study contained the fecal coliforms *E. coli* and *Klebsiella*, which indicate fecal contamination of ice creams. Presence of these enteric bacteria in ice cream has also been reported in other countries like India, Costa Rica and Cambodia^{13, 14, 15, 16}.

This study has presented a view of the bacteriology of different types of ice creams produced by two ice cream manufacturers of Bangladesh. Presence of good numbers of bacteria, including those of fecal origin indicates that the overall standard of sanitation and hygiene practiced in these factories is very poor. To ensure food safety for the consumers in Bangladesh,

immediate actions are necessary to prevent bacterial contamination of ice cream in Bangladesh. This might be achieved by staff training, especially in relation to food safety, handling, maintaining and cleaning of machine. Adoption of a food safety management system based on the Hazard Analysis Critical Control Point (HACCP) and Good manufacturing practice (GMP) should be made mandatory in all the ice cream processing plants.

References:

1. Frazier WC and DC Westhoff. 1998. Contamination, Preservation, and Spoilage of Milk and milk Products. In *Food Microbiology*., pp 276-299. McGraw-Hill, New York.
2. Buvens G, Posse B, Schrijver KD, Zutter LD, Lauwers S and Denis P. 2011. Virulence Profiling and Quantification of Verocytotoxin-Producing *Escherichia coli* O145:H28 and O26:H11 Isolated During an Ice Cream-Related Hemolytic Uremic Syndrome Outbreak. *Foodborne Path Dis*, **8(3)**: 421-426.
3. Emerging Infectious Diseases Outbreak of *Salmonella enteritidis* Associated with Nationally Distributed Ice Cream Products — Minnesota, South Dakota, and Wisconsin. 1994. CDC.
4. Bergey's Manual of Systematic Bacteriology. 1984. Edited by Kreig NR. Williams and Wilkins, Baltimore, USA.
5. Williams ED. 1984. *Manual on Milk and Milk products testing procedures, Bangladesh*, pp 76-111. The Food and Agriculture Organization of the United Nations.
6. Hossain MT and Kober AKMH. 2008. Microbiological Quality of Ice Cream Available in Chittagong. *Bangladesh J Microbiol*. **25 (2)**: 135-136.
7. Ojokoh AO. 2006. Microbiological Examination of Ice Cream Sold in Akure. *Pakistan J Nut*. **5 (6)**: 536-538.
8. Warke R, Kamat A, Kamat M and Thomas P. 2000. Incidence of pathogenic psychrotrophs in ice creams sold in some retail outlets in Mumbai, India. *Food Cont*. **11 (2)**: 77-83.
9. Yaman H, Elmatli M, Ulukanli Z, Tuzcu M and Genctav E. 2006. Microbial quality of ice cream sold openly by retail outlets in Turkey. *Revue Med Vet*. **157(10)**: 457-462.
10. Abrahao WM, Abrahao PRS, Leise C, Monteiro B and Pontarolo R. 2008. Occurrence of *Listeria monocytogenes* in cheese and ice cream produced in the State of Paraná2, Brazil. *Brazilian Journal of Pharmaceutical Sciences*. **44 (2)**: 289-296.
11. Cordano AM and Rocourt J. 2001. Occurrence of *Listeria monocytogenes* in food in Chile. *Int J Food Microbiol*. **70(1-2)**:175-8.
12. Salyers AA and Whitt DD. 2000. *Listeria monocytogenes*. In *Bacterial pathogenesis: A Molecular Approach*, pp 182-189. Washington DC.
13. Vaishnavi C, Singh S and Singh K. 2002. Bacterial profile of dairy products sold in Chandigarh. *Trop Gastroenterol*. **23(2)**:72-5.
14. Anuranjini C, Geethu S and Dhanashree B. 2008. Bacteriological analysis of ice creams from Mangalore, south India. *Indian J Med Res*. **127(1)**: 91-92.
15. Windrantz P and Arias ML. 2000. Evaluation of the bacteriological quality of ice cream sold at San Jose, Costa Rica. *Arch Latinoam Nutr*. **50(3)**: 301-3.
16. Kruey SL, Soares JL, Ping S and Sainte-Marie FF. 2001. Microbiological quality of "ice, ice cream, sorbet" sold on the streets of Phnom Penh; April 1996-April 1997. *Bull Soc Pathol Exot*. **94(5)**:411-4.