Bacterial Analysis of Different Types of Ice Creams from Dhaka City

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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 $9.5 \times 10^2$ to $4.72 \times 10^4$ cfu/ml, while total coliform count and fecal coliform counts were $2.3 \times 10^1$ to $2.43 \times 10^3$ 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 $9.5 \times 10^3$ to $4.43 \times 10^4$ cfu/ml; 10 to $2.49 \times 10^3$ 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 up to 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(±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 $9.5 \times 10^2$ to $4.72 \times 10^4$ cfu/ml (Table 1). Average total coliform count was between $2.3 \times 10^1$ cfu/ml to $2.43 \times 10^3$ cfu/ml, while the average total fecal coliform count ranged between zero to $1.0 \times 10^2$ 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 $9.5 \times 10^3$ cfu/ml and $4.7 \times 10^4$ cfu/ml, average total coliform count was between $1.0 \times 10^1$ cfu/ml and $2.49 \times 10^3$ cfu/ml, average total fecal coliform count was between <1 and $2.0 \times 10^2$ 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

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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/ml. 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/g. 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, Nigeria. 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. 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. This is of great concern for pregnant women, children and immunocompromised individuals where listeriosis has serious consequences. 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. 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,

### Table 1. Bacterial count in different types of ice creams

<table>
<thead>
<tr>
<th>Bacteria isolated</th>
<th>Brand 1 (n=12)</th>
<th>Brand 2 (n=12)</th>
<th>Total (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A (n=3)</td>
<td>B (n=3)</td>
<td>C (n=3)</td>
</tr>
<tr>
<td>Average total viable count (cfu/ml)</td>
<td>4.72×10⁴</td>
<td>3.4×10³</td>
<td>3.4×10⁴</td>
</tr>
<tr>
<td>Average total coliform count (cfu/ml)</td>
<td>2.43×10³</td>
<td>5.17×10²</td>
<td>1.06×10²</td>
</tr>
<tr>
<td>Average total fecal coliform count (cfu/ml)</td>
<td>1.0×10²</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bacteria isolated</th>
<th>Brand 1 (n=12)</th>
<th>Brand 2 (n=12)</th>
<th>Total (n=24)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A (n=3)</td>
<td>B (n=3)</td>
<td>C (n=3)</td>
</tr>
<tr>
<td>Staphylococcus Sp.</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Bacillus sp.</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Listeria sp.</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Micrococcus sp.</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Klebsiella sp.</td>
<td>1</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>
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:
3. Emerging Infectious Diseases Outbreak of Salmonella enteritidis Associated with Nationally Distributed Ice Cream Products — Minnesota, South Dakota, and Wisconsin. 1994. CDC.