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## Microbiological Examination of Ice Cream Sold in Akure

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**Abstract:** Studies on the microbiological quality of ice cream obtained from vendors in Akure was carried out. The samples were screened for total viable counts which ranged  $1.8 \times 10^3$  cfu/g –  $2.0 \times 10^4$  cfu/g. Ten (10) genera of microflora were isolated, characterized and identified. The isolates were seven (7) bacteria and three (3) moulds. *Staphylococcus* species, *Klebsiella* species and *Aspergillus* species recorded maximum percentage occurrence of 100% while the least value of 10% occurrence was for *Streptococcus* species isolated from one (1) sample. The isolation of probable potential pathogens from ice cream samples analyzed is of public health significance.

**Key words:** Ice cream, Akure, *Staphylococcus* species, *Aspergillus*

### Introduction

Ice cream is a product of a mix consisting milk, sweetening and stabilizing agents together with flavouring and colouring matter (Graff - Johnson, 1974). Although ice cream is eaten as dessert, its significance in human nutrition is unquestionable, both in the positive as well as negative senses. The protein and vitamin contents of ice cream is fairly low, but as a source of calcium it is as valuable as milk. The unfrozen ice cream mix is an oil - in - water emulsion. The aqueous phase in which the fat globules are dispersed also serve as a dispersion medium for proteins in colloidal dispersion, sugars and salts in true solution. Frozen ice cream is a very complex mixture of fat globules, solution of milk, non - fat milk solids, sugar, flavourings and colour, frozen water (ice crystals) and air bubbles.

Presently, today ice cream is one of the triumphs of food technology and is noteworthy in that air is a major ingredient and accounts for about half of the volume of the final product. Without air ice cream would simply be a frozen milk ice (Brain and Allan, 1982).

A typical ice cream contains 12% fat, 11% non - fat milk solids, 15% sugar and about 1% minor ingredients, the rest being water (Brain and Allan, 1982). Ice cream are usually named by the dominant additive added to the basal plain or vanilla type ice cream. Thus chocolate ice cream requires the addition of a considerable quantity of cocoa or chocolate to the vanilla type so also the banana ice cream. Based on its constituent, ice cream is a nutritious food for man and also an excellent medium for the growth of many micro organisms including some which may be pathogenic to man. Possible sources of these micro organisms in ice cream have been reported to include raw materials used for the composition of ice cream mix such as separated milk and milk powder, cream, flavouring and colouring substances and stabilizers (Verma, 1972; Bathla and Rao, 1973) and from air during processing (Gomez, 1969). The

presence of these organisms in pasteurized ice cream could be due to their ability to survive the pasteurization process as the case with spore formers (Alexander and Rothwel, 1970) and they may persist in ice cream product there after and similarly yeasts moulds (Verma, 1974) for ice cream.

Some of these contaminant organisms can affect human health by causing diseases in them e.g. cholera, typhoid, bacillary dysentery, guinea worm and hook worm infection (Richard *et al.*, 1989). Microbiological quality of some local ice cream sold in Akure is investigated and reported upon.

### Materials and Methods

**Five brand of ice cream:** Fan Lolly (A), Banana (B), Chocolate (C), Yoghurt (D) and Ice Lolly (E) obtained from vendors in Akure town, Nigeria were allowed to melt at  $28.0 \pm 2.0^\circ\text{C}$  for 6 hours in sterile covered beakers.

**Microbial analysis:** The total aerobic cell counts was carried out using Nutrient agar (Oxoid Ltd., Basing Stoke Hants England). Enumeration of fungi was on potato dextrose agar (PDA) to which antibacterial agents (Chloramphenicol) was incorporated.

In serial dilution preparation, 10.0g of sample was aseptically transferred into 90.0ml of distilled water and homogenized by vortex. Subsequents serial dilutions up to  $10^5$  were made. The enumeration of micro organisms in the samples was by the pour plate technique. At the end of the incubation, resultant microbial colonies (bacteria and fungi) were counted.

Discrete bacterial colonies on NA were subcultured onto freshly prepared nutrient agar plate by streaking. Fresh PDA plates were used to subculture fungi. Stock culture of the isolates were developed on slants and stored at  $10^\circ\text{C}$  with transfers at intervals of 14 days. Isolates were identified by cultural and morphological characteristics

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Table 1: Total viable counts (cfu/g) of various microorganisms isolated from ice cream samples

Samples	Bacteria count	Fungi count
Fan lolly	1.28 X 10 <sup>4</sup>	1.8 X 10 <sup>3</sup>
Banana	6.8 X 10 <sup>3</sup>	2.0 X 10 <sup>4</sup>
Chocolate	8.0 X 10 <sup>3</sup>	4.0 X 10 <sup>3</sup>
Banana yoghurt	1.0 X 10 <sup>4</sup>	2.6 X 10 <sup>3</sup>
Ice lolly	9.8 X 10 <sup>3</sup>	1.9 X 10 <sup>3</sup>

Table 2: Micro organisms isolated from different brands of ice cream

Brand	Bacteria	Fungi
Fan lolly	<i>Klebsiella</i> sp. <i>Salmonella</i> sp. <i>Bacillus</i> sp. <i>Staphylococcus</i> sp.	<i>Aspergillus</i> sp. <i>Neurospora</i> sp. <i>Rhizopus</i> sp.
Banana	<i>Salmonella</i> sp. <i>Shigella</i> sp. <i>Klebsiella</i> sp. <i>Staphylococcus</i> sp.	<i>Aspergillus</i> sp. <i>Rhizopus</i> sp.
Chocolate	<i>Salmonella</i> sp. <i>Klebsiella</i> sp. <i>Escherichia coli</i> <i>Shigella</i> sp. <i>Staphylococcus</i> sp.	<i>Aspergillus</i> sp.
Banana yoghurt	<i>Klebsiella</i> sp. <i>Streptococcus</i> sp. <i>Shigella</i> sp. <i>Staphylococcus</i> sp.	<i>Aspergillus</i> sp. <i>Rhizopus</i> sp.
Ice lolly	<i>Klebsiella</i> sp. <i>Bacillus</i> sp. <i>Escherichia coli</i> <i>Staphylococcus</i> sp.	<i>Aspergillus</i> sp. <i>Neurospora</i> sp.

as well as biochemical tests such as the oxidative/fermentative (O/F) utilization of sugars and carbohydrates, catalase, coagulase amongst others in accordance with the methods of Buchanan and Gibbons (1974).

Characterization method employed for fungal isolates was by an examination of the culture and morphological features after Barnett and Hunter (1972) and Alexopoulos and Nims (1979).

### Results

The total viable counts in sample of the five brands of ice cream investigated are presented in Table 1. The counts for *Escherichia coli*, *Salmonella* sp. and *Shigella* sp. were generally low relative to coliform and *Staphylococcus* sp. The minimum counts obtained from the five brands was 1.8 X 10<sup>3</sup>cfu/g while the maximum was 2.0 X 10<sup>4</sup> cfu/g. Bacteria genera isolated were four each for fan lolly, ice lolly and banana brands while chocolate had five genera listed in Table 2. *Staphylococcus* sp. and *Klebsiella* sp. were isolated from each of the five brands, *Shigella* sp. was isolated from banana, chocolate and banana yoghurt brands, *Bacillus* sp. was isolated from fan lolly and ice lolly brands, *Escherichia coli* was isolated from ice lolly and chocolate brands while *Streptococcus* sp. was isolated

only from Banana yoghurt brand.

The genera of fungi isolated were three. They were *Aspergillus* sp., *Rhizopus* sp. and *Neurospora* sp. *Aspergillus* sp. was recovered in each of the brands analyzed. *Rhizopus* sp. was isolated from fan lolly, banana and banana yoghurt brands while *Neurospora* sp. was isolated from fan lolly and ice lolly brands.

The occurrence of different types of micro organisms in the ice cream samples analyzed indicated 100% for both *Staphylococcus*, *Klebsiella* and *Aspergillus* species as shown in Table 3. *Streptococcus* sp. has the least present occurrence having been isolated from one sample with a 10%.

### Discussion

The total viable counts from the five ice cream brands fell within the range observed by Ikenebomeh and Ogaguvi (1993) 10<sup>0</sup> - 10<sup>4</sup> cfu/g. When compared to 1.8 X 10<sup>3</sup> - 2.0 X 10<sup>4</sup> cfu/g reported in the present study. The microbial counts in some samples 10<sup>4</sup> may have resulted from inadequate processing, such as initial improper cooling of the hot ice cream mix, which may lead to multiplication of microorganisms present in ice cream immediately after pasteurization. Beck (1973) indicated that high microbial count occurrence in virtually sterile mix may occur when cooled slowly at a temperature conducive to spore germination.

*Staphylococcus* sp was present in all the samples. Similar findings were reported by Ikenebomeh and Ogaguvi (1993). The possible source(s) of this organism in ice cream could be from nose where it is commonly found; hands, skin, and clothing of handlers (Hobbs and Golbert, 1982). Coughing, talking and sneezing produce droplets which could settle on ice cream during transportation, storage and retailing.

*Escherichia coli*, *Salmonella* sp., *Shigella* sp., and *Klebsiella* sp. all coliforms were isolated from the samples. Coliforms being non-spore formers should be susceptible to pasteurization. Their post pasteurization presence in ice cream may be due to faulty heat process or to post pasteurization contamination by handlers with poor sanitary practices. The level of presence of these organisms in food has been described as index of food hygiene (Frazier and Westhoff, 1978; Jay 1978). Other species of bacteria isolated were *Bacillus* sp. and *Streptococcus* sp. Their isolation indicate favourable environment within the ice cream capable of promoting growth of these organisms. The presence of the organisms is of health significance as some of them may be capable of causing various ailments of man which may be fatal. *Aspergillus* sp. was obtained from all the samples analyzed while *Rhizopus* sp. was isolated from three samples and *Neurospora* sp. from two samples. Yeasts and Moulds in ice cream cause a yeasty flavour together with foamy development (Judkins and Keener, 1960).

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Table 3: Types of microorganisms and their percentage (%) occurrence in ice cream samples

Organisms	Percentage Occurrence
<i>Staphylococcus</i> sp.	100
<i>Salmonella</i> sp.	60
<i>Bacillus</i> sp.	20
<i>Klebsiella</i> sp.	100
<i>Streptococcus</i> sp.	10
<i>Escherichia coli</i>	20
<i>Shigella</i> sp.	60
<i>Aspergillus</i> sp.	100
<i>Neurospora</i> sp.	20
<i>Rhizopus</i> sp.	60

The presence of possible pathogenic organisms in the analyzed five brands of ice cream should be viewed with concern by the consumers, producing company and the Government since food poisoning by *Bacillus*, *Shigella* and *Salmonella* species is possible through consumption of contaminated ice cream. It should also be noted that some species of *Aspergillus* are known to produce powerful mycotoxins which are harmful to man, thus their occurrence in ice cream is undesirable.

There is need for continuous monitoring of this nutritious product by educating producers, distributors and retailers on good sanitary practices during processing and sale of the product and the possible danger of contaminated product.

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