



Microbiological Quality Analysis of Ice Creams Sold by Street Hawkers: A Case Study of Jalandhar City, India

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Abstract

Ice cream is a food commonly consumed during summer season. It is an excellent medium for the growth of many microorganisms and thus, its bacteriological quality has always been crucially important to public health. This study aims to access the bacteriological quality of local made open scoop ice cream sold in different areas of Jalandhar city, Punjab, India. Randomly collected 45 open scoop ice cream samples were collected from street hawkers and studied to determine the colony forming units per gram of the ice cream samples. For aerobic colony counts samples were classified as satisfactory, acceptable and unsatisfactory categories according to PHLS (Public Health Laboratory Services, UK) guidelines. For total coliform counts, BIS guidelines were followed. In aerobic colony counts, all the samples of the nine areas that were selected for the study, showed heavy contamination of bacteria ranging from 0.1×10^9 CFU/g to 10.2×10^9 CFU/g. A total of 7 zones out of 9, showed the presence of coliforms. The results of the study indicate that, all the local made open scoop ice cream samples studied in Jalandhar city were heavily contaminated, indicating the non-enforcement of inspection act and lack of maintenance of standard relation to hygienic quality of ice creams.

Key words: open scoop ice cream, contamination, Jalandhar city, colony forming unit

Introduction

Ice cream is a nutritionally enriched congealed dairy product consumed by all, age groups particularly children, during summer (Sharif et al. 2005). As a result, its production and consumption are rapidly increasing. Undoubtedly it is the one of the most popular and favourite food product in Jalandhar city.

Ice cream is also an excellent medium for the growth of many microorganisms some of which cause diseases in human beings e.g. Cholera, typhoid, bacillary dysentery (Ahmed et al. 2009). Historically, it has been responsible for a number of outbreaks of food-borne illness (Nichols et al. 1995). Possible source of contamination are the processing methods that are used in preparation,

inappropriate holding temperature, poor personal hygiene (Chukuezi 2010; Barro et al. 2006). In addition, the use of unhygienic water, unhygienic surroundings often with swarming houseflies and air borne dust can also act as source of contamination (Anonymous 2010; Mensah et al. 2002).

Microbial quality of ice cream is determined by significant aerobic colony counts and total coliform counts. Microbial quality determination is used to indicate hygienic quality in production (Joshi et al. 2004). Increasing varieties of ice cream flavours are available and manufacturers are attempting to extend its consumption beyond the normal summer season. This investigation presents situational analysis of microbial quality of local made commercially sold open scoop ice cream in Jalandhar city and their potential risk to public health.

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Material and Methods

Collection of Samples: For collection of local made open scoop ice cream samples (ice cream which was directly poured into the cone or cup with the help of scoop from bulk container), the whole of Jalandhar city, India, was divided into 9 zones. 45 samples were collected in the mid of March to the mid of April 2011 from the street hawkers randomly without concern to their flavor from each of the 9 zones. Moreover, branded ice creams and ice cream parlors were not included in this study. While collecting the samples, the investigator also considered the serving practice of the hawkers, like, use of apron, covering of hair, handling of money and usage of gloves while serving. The samples were collected in the sterile sampling bottles that were kept in a cold box and were immediately shifted to the laboratory of Microbiology, Department of Biotechnology, Lovely Professional University, India.

Aerobic colony counts: Aerobic colony counts (ACC) were performed using spread plate method (Gilbert et al. 2000; Cappuccino and Sherman 2002). Nutrient agar plates (CDH Pvt. Ltd, India) were inoculated with 100 μ l of 10⁻⁷ times diluted open scoop ice cream samples and incubated at 37°C. After 24 h of incubation, the total numbers of colonies that appear were counted with the help of digital colony counter (LABFITTM, Ambala, India). PHLS (Public Health Laboratory Services, UK) guidelines were used to classify the samples in satisfactory, acceptable and unsatisfactory categories (Gilbert et al. 2000).

Total coliform counts: Total coliform counts were also performed using the spread plate method. Eosin Methylene Blue agar (Titan Biotech Ltd., India) was used as a selective medium for the growth of the coliform bacteria. Plates were inoculated with 100 μ l of 10⁻⁴ times diluted open scoop ice cream sample and incubated at 37°C. After 48 h, the total numbers of colonies were counted with the help of digital colony counter (LABFITTM, Ambala, India). The values for coliform count were compared with the standards as per the BIS guidelines (Anonymous 1964).

Statistical analysis: Results were analyzed by calculating the Mean value and Standard deviation using Microsoft Excel, 2010.

Results and Discussion

It was observed that hygienic conditions in terms of usage of apron, handling of ice creams and covering of hair was not appropriately followed by any of the hawkers considered in the present investigation. The fact that they are generally unaware of food regulations in India and have no training in food related matters, need to be considered here. The aerobic colony counts in the 45 samples obtained from 9 zones of Jalandhar city are presented in Table 1. A comparison of the aerobic colony counts for the samples with the standard guidelines of PHLS is presented in Table

2. The samples of all the areas show heavy contamination of bacteria ranging from 0.1 \times 10⁹ CFU/g to 10.2 \times 10⁹ CFU/g. The mean results indicate that the highest contamination was found in Choti Baradari open scoop ice cream samples (5.5 \times 10⁹ CFU/g) followed by Rama Mandi (4.51 \times 10⁹ CFU/g), Guru Teg Bahadur Nagar (3.15 \times 10⁹ CFU/g), Jalandhar Cantonment (2.66 \times 10⁹ CFU/g), Ranjit Nagar (1.45 \times 10⁹ CFU/g), Model Town (1.42 \times 10⁹ CFU/g), Deep Nagar (1.02 \times 10⁹ CFU/g), Friends Colony (0.52 \times 10⁹ CFU/g) and Jyoti Chowk (0.43 \times 10⁹ CFU/g).

Hygienic quality of these open scoop ice cream samples on the basis of total coliform counts with their mean value is given in Table 3. It is clear from the table that 100% samples from Choti Baradari, 50% samples from Rama Mandi, 67% samples from Guru Teg Bahadur Nagar, 40% from Model Town, 43% from Deep Nagar, 50% from Friends Colony and 67% from Jyoti Chowk were heavily contaminated with coliforms. Coliform count in these samples exceeds the recommendations of BIS (> 100 coliform/g). None of the samples from the Ranjit Nagar and Jalandhar Cantonment showed the presence of coliforms.

The results suggest high negligence during the preparation and/or storage of the products, leading to poor sanitary conditions. As observed during sample collection, the handling of ice cream with bare hands, non-usage of aprons, absence of hair covering and handling of money during serving might also contribute to poor hygienic conditions. At the same time, busy road with heavy vehicular traffic and presence of garbage dumps along the roadsides might increase the air borne particles which ultimately increase the contamination. The study lacks the information on condition of people who consumed these ice creams. A recent report (Anonymous 2011) on gastrointestinal infections arising due to consumption of contaminated ice creams in Rajasthan, India also supports the view that there is an urgent requirement to implement food safety guidelines to ensure the safety and quality of ice creams.

Overall, the results of the study indicate that all the local made open scoop ice cream samples studied in Jalandhar city are heavily contaminated. This may be attributed to non- enforcement of inspection act and lack of maintenance of standard hygiene practices in relation to ice cream, thereby suggesting possible risk of infection involved in the consumption of such food. Though the guidelines for food hawkers have been published by Indian standard (Anonymous 1964) yet there is a need to implement these guidelines to ensure the safety and quality of food.

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Table 1: Aerobic Colony Count (CFU/g) for different open scoop ice cream samples

Name of Area	Aerobic Colony Count cfu/g	Mean	Standard Deviation
	Individual		
Ranjit Nagar	1.9*10 ⁹ 0.8*10 ⁹ 1.0*10 ⁹ 2.0*10 ⁹ 0.7*10 ⁹ 0.8*10 ⁹ 3.0*10 ⁹	1.45*10 ⁹	0.86*10 ⁹
Deep Nagar	1.8*10 ⁹ 0.7*10 ⁹ 0.9*10 ⁹ 1.6*10 ⁹ 0.4*10 ⁹ 0.5*10 ⁹ 1.3*10 ⁹	1.02*10 ⁹	0.54*10 ⁹
Jalandhar Cantonment	1.7*10 ⁹ 1.1*10 ⁹ 1.7*10 ⁹ 8.3*10 ⁹ 0.5*10 ⁹	2.66*10 ⁹	3.19*10 ⁹
Rama Mandi	6.5*10 ⁹ 4.3*10 ⁹ 0.1*10 ⁹ 2.1*10 ⁹ 7.6*10 ⁹ 6.5*10 ⁹	4.51*10 ⁹	2.9*10 ⁹
GuruTeg Bahadur Nagar	4.2*10 ⁹ 4.9*10 ⁹ 3.2*10 ⁹ 0.5*10 ⁹ 4.8*10 ⁹ 1.3*10 ⁹	3.15*10 ⁹	1.86*10 ⁹
Model Town	1.8*10 ⁹ 0.1*10 ⁹ 0.3*10 ⁹ 4.8*10 ⁹ 0.1*10 ⁹	1.42*10 ⁹	2.01*10 ⁹
Friends Colony	0.7*10 ⁹ 0.2*10 ⁹ 0.7*10 ⁹ 0.5*10 ⁹	0.52*10 ⁹	0.23*10 ⁹
Jyoti Chowk	0.1*10 ⁹ 0.9*10 ⁹ 0.3*10 ⁹	0.43*10 ⁹	0.41*10 ⁹
Choti Baradari	10.2*10 ⁹ 0.9*10 ⁹	5.55*10 ⁹	6.57*10 ⁹

Table 2: Microbiological Quality (CFU/g) of open scoop ice cream samples on the basis of Aerobic Colony Count (ACC)

Name of Area	Microbiological quality (CFU/g) on the basis of ACC as per PHLS guidelines		
	Satisfactory 10^4	Acceptable $10^4 \leq 10^5$	Unsatisfactory >math>\geq 10^5</math>
Ranjit Nagar	-	-	100%
Deep Nagar	-	-	100%
Jalandhar Cantonment	-	-	100%
Rama Mandi	-	-	100%
Guru Teg Bahadur Nagar	-	-	100%
Model Town	-	-	100%
Friends Colony	-	-	100%
Jyoti Chowk	-	-	100%
Choti Baradari	-	-	100%

Table 3: Microbiological Quality (CFU/g) of open scoop ice cream samples on the basis of Total Coliform Count

Name of Area	Total Coliform Count cfu/g	Mean	Standard Deviation	Microbiological quality (CFU/g) on the basis of TCC as per BIS guidelines
				Unsatisfactory ≥ 100 cfu/g
Ranjit Nagar	All 7 samples show NG*	-	-	-
Deep Nagar	Out of 7, 3 show growth 0.1*10 ⁶ 0.7*10 ⁶ 0.5*10 ⁶	0.43*10 ⁶	0.30*10 ⁶	43%
Jalandhar Cantonment	All 5 samples show NG	-	-	-
Rama Mandi	Out of 6, 3 show growth 0.1*10 ⁶ 0.5*10 ⁶ 3.2*10 ⁶	1.26*10 ⁶	1.68*10 ⁶	50%
GuruTeg Bahadur Nagar	Out of 6, 4 show growth 1.3*10 ⁶ 0.6*10 ⁶ 2.1*10 ⁶ 0.1*10 ⁶	1.02*10 ⁶	0.86*10 ⁶	67%
Model Town	Out of 5, 2 show growth 0.1*10 ⁶ 0.3*10 ⁶	0.2*10 ⁶	0.14*10 ⁶	40%
Friends Colony	Out of 4, 2 show growth 0.6*10 ⁶ 0.5*10 ⁶	0.55*10 ⁶	0.07*10 ⁶	50%
Jyoti Chowk	Out of 3, 2 show growth 0.1*10 ⁶ 0.2*10 ⁶	0.15*10 ⁶	0.07*10 ⁶	67%
Choti Baradari	All samples show growth 0.1*10 ⁶ 0.8*10 ⁶	0.45*10 ⁶	0.49*10 ⁶	100%

*NG= No Growth