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A Survey of the Hygienic Quality of Market Foods in Kandy

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Abstract: A total of 183 samples of consumable items of food and drink exposed for sale in the Kandy Municipal area were subjected to bacteriological examination with regard to its hygienic quality. Only 19 per cent of the samples of ice cream examined were within the limits of the bacteriological standards laid down by the Sri Lanka Bureau of Standards. Other desserts (Fruit salad, Wood-apple cream) show lower mean bacterial densities (*Escherichia coli* 1, faecal streptococci and total viable count) than ice cream. The levels of faecal contamination of the fruit drinks did not vary with the place of preparation. This was due to the low pH. The faecal streptococci appears to be better indicator of faecal contamination than *E. coli* type 1 under freezing and at low pH.

1. Introduction

Diarrhoeal disease due to consumption of unhygienic food is a common feature among the population of Sri Lanka. The enteric disease agent once it enters food, uses it as a medium for dissemination.

The control of the food borne diseases could be effected on application of correct control measures at the most appropriate link in the epidemiological chain of events leading to disease. A knowledge of the critical control points in the food processing and distribution system is required for such a control.

A previous study on the bacteriological quality of ice cream in the city of Colombo has shown the hygienic quality to be very poor.⁴

The present study was carried out within the limits of the Kandy Municipal Council to determine the hygienic quality of food served to the public within this area.

2. Experimental

2.1 Sampling and Preparation of Samples

A total of 183 samples of food were examined. The food under investigation included products such as ice cream (42), other desserts such as fruit salad, watalappan, etc (26), diluted fruit drinks (34), pastries (37) and fermented milk products (44). The samples

of ice cream investigated were from large and small scale producers. The small scale producer exposed their own ice cream for consumption within the premises. Samples of diluted fruit drinks included those prepared and sold in reputed establishments and on the pavement.

Collection of all products were done with the assistance of the Food Inspector, Kandy Municipal Council. Sterile precautions were taken during the opening of the packages and collection of samples. Representative samples of the food under investigation were obtained and examined within one hour of collection. Data pertaining to the manufacturer, date of manufacture were recorded.

Solid food were minced and 10 grams of the sample were shaken with 90 ml of sterile normal saline. Decimal dilutions of liquid food were directly prepared in sterile normal saline down to 10^{-8} .

2.2 Bacteriological Analysis

In the enumeration of *Escherichia coli* I and coliforms, Violet Red Bile Agar (BBL 11807) was used. One ml of the sample and dilutions respectively were inoculated using the standard pour plate method. Incubation of the inoculated plate at 37°C was carried out to determine the number of coliforms. Similarly at 44°C to determine the number of *E. coli* I. The spread plate method using Slanetz and Bartley medium (MERCK 5262) at 37°C was employed to enumerate faecal streptococci. Plate count agar (Oxoid CM 325) was used to determine the total viable count at 30°C . The pour plate method was employed using 1 ml amounts of the samples and the decimal dilutions.

To determine the presence of *Salmonella*, approximately 10 ml or 10 grams of the sample was incubated in a selective enrichment broth (PREUSS Potassium tetrathionate broth, Merck No. 5173) at 37°C for 16 hours followed by cultivation on solid selective media, Brilliant green lactose saccharose agar (Merck No. 7237) at 37°C . Suspicious colonies were confirmed by biochemical and serological tests.

3. Results

Results show that there are marked differences in the three indicator densities, the coliforms, *E. coli* I and faecal streptococci in the different types of food.

Of the 42 samples of ice cream examined, only 19 per cent were free of *E. coli* I. These were from reputed large scale manufacturers. The balance 81 per cent of the samples were mainly from the small scale producers where the consumption was within the place of manufacture.

The results in Table 1 indicates the number of samples and the percentage of the same, that belong to each category of indicator densities tested, namely <10, 11-100, 101-1000 and >1000 per ml of ice cream.

Table 1. Numbers of samples of different foods containing the indicators of contamination in the 4 categories

Food	Total No. of samples	Type of Indicator	Number of samples in the 4 categories							
			1 <10 (per gm or ml)		2 11-1000 (per gm or ml)		3 101-1000 (per gm or ml)		4 >1000	
			No. of samples	%	No. of samples	%	No. of samples	%	No. of samples	%
Ice cream	42	Coliforms	3	7.14	4	9.5	15	35.7	20	47.6
		E coli I	9	21.4	6	14.2	13	30.9	14	33.3
		Faecal Streptococci	11	26.19	2	4.7	9	21.4	20	47.6
Other Desserts Fruit salad Woodapple cream	26	Coliforms	3	11.5	7	26.9	14	53.8	2	7.6
		E coli I	9	34.6	11	42.3	6	23	0	0
		Faecal Streptococci	16	61.5	2	7.6	7	26.9	1	3.8
Pastries	37	Coliforms	32	86.4	3	8.1	1	2.7	1	2.7
		E coli I	35	94.5	0	0	1	2.7	1	2.7
		Faecal Streptococci	36	97.2	0	0	1	2.7	0	0
Fruit drinks	34	Coliforms	29	85.2	4	11.76	1	2.9	0	0
		E coli I	34	100	0	0	0	0	0	0
		Faecal Streptococci	32	86.4	1	2.9	1	2.9	0	0
Fermented milk products	44	Coliforms	20	45.4	12	27.2	8	18.1	4	9
		E coli I	44	100	0	0	0	0	0	0
		Faecal Streptococci	20	45.4	8	18.1	8	18.1	8	18.1

A < 10 B 11 - 100 C 101 - 1000 D >1000 Coliforms E Colitype I Faecal Streptococci

The faecal indicator densities of the second group of food such as fruit salads, woodapple cream, etc are lower compared to ice cream. With this group of food (fruit salad etc) none of the samples showed *E. coli I* densities exceeding 1000/gram.

In the third group of food that were investigated, which were pastries (rolls, patties, cutlets, etc), around 95 per cent of the samples indicated faecal streptococci and *E. coli I* densities < 10/gram.

The results of the 34 samples of fruit drinks show that 85 per cent of the samples belong to the 1st category (Table 1) where the indicator density is less than 10 with regard to coliforms and faecal streptococci. None of the fruit drink samples were positive for *E. coli I*. The *E. coli I* densities of all the samples of fermented milk products are below 10/gram.

The distribution of the per centages of samples of the different types of food in the four categories A, B, C and D representing indicator densities < 10, 11-100, 101-1000 and > 1000/gram is illustrated in Figure 1.

A greater percentage of the samples of ice cream fall into category D with indicator densities > 1000/gram. A greater percentage of pastries and fermented milk products fall into category A. In other types of desserts the samples are distributed in categories A, B and C.

The mean total viable count, the mean counts of the indicators *E. coli I*, coliforms and faecal streptococci and the pH range of the different types of food are shown in Table 2.

Table 2. Mean total viable count, mean counts of *E. coli I*, coliforms and faecal streptococci and the pH range of the different types of foods examined.

Type of Food	Mean total viable count at 30°C (per gm or ml)	Mean density <i>E. coli I</i> (per gm or ml)	Mean density Coliforms (per gm or ml)	Mean density Faecal streptococci (per gm or ml)	pH range
Ice cream	32×10^4	726	1436	1425	5.5 - 6.5
Fruit salad & Woodapple cream etc.	651×10^2	173	423	258	3.1 - 3.7
Pastries	115×10^2	36	55	12	—
Fruit drinks	280	0	8	10	2.1 - 2.7
Fermented milk products	342×10^7	112	202	439	3.2 - 3.8

Ice cream shows the highest mean bacterial densities among the non-fermented food.

The pH ranges from 5.5 to 6.5 in ice cream.

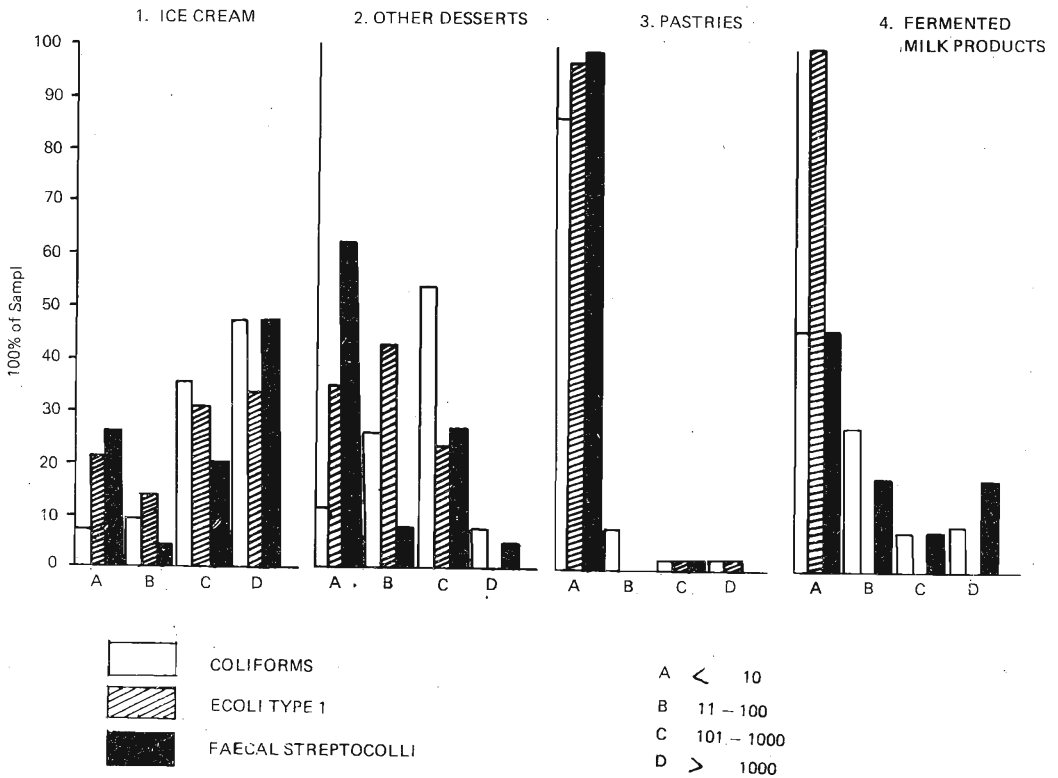


Figure 1. Distribution of the % of samples in the 4 categories (A, B, C & D) of Bacterial Indicator (Coliforms, E.coli type 1, and Faecal Streptococci) densities of the four different types of foods examined.

All food, except pastries show a significant difference between the mean *E. coli I* count and the mean faecal streptococci count. The faecal streptococci count is higher than the *E. coli I* count in these samples. None of the food samples examined were positive for salmonella species.

4. Discussion

The results of this survey indicate the risk involved in the consumption of a variety of food and beverage served to the public within the limits of the Kandy Municipal Council.

Ice cream is the most contaminated product of the five types of food under study. The hygienic quality of pastries and fruit drinks were found to be higher when compared to ice cream. The average bacterial counts in these food products serve as a basis of a general evaluation of the food.

In ice cream the average *E. coli* I count was found to be 726 per ml. This reflects the poor hygienic standards of the majority of the food manufacturers. 33 per cent of the samples showed *E. coli* I densities higher than the above mentioned average. According to the Bureau of Standards, ice cream should be free of *E. coli* I⁶. With the methodology used in the present study only 19 per cent of the samples of ice cream examined conformed to the standard laid down by the Bureau of Standards. The balance 81 per cent of the manufacturers need vast improvements in their hygienic standards.

The observed mean total viable count of ice cream at 30°C is slightly higher than the permissible total count.⁶ A high viable count at 30°C indicate contaminated raw materials, unsatisfactory sanitation, improper storage. This excludes food prepared by means of fermentation activity of living organisms.

The present study reveals that faecal bacterial indicator densities are highly dependent on the pH of a particular food. A pH of 6-7 as in ice cream affords the environment for survival of a majority of bacteria. The survival of faecal bacteria are checked as the pH approaches 2-3. The pH of fruit drinks are in the range 2-3. Thus there was no difference in the bacterial densities of fruit drinks whether prepared on the pavement or inside reputable eating establishments.

The significance of micro-organisms used as indicators of faecal contamination of prepared food deserve some comment. The two species of intestinal bacteria which are of particular interest in food hygiene are *E. coli* I, and faecal streptococci.¹ The numbers of faecal streptococci in faeces are usually lower than the number of *E. coli* I³ but they differ in their sensitivity to various physiochemical actions. Due to the significant difference that was observed between faecal streptococci and *E. coli* I counts in ice cream and fermented milk products, it can be said that faecal streptococci survive better than *E. coli* I in an acid environment and during freezing. In addition to the value of faecal streptococci as an indicator of faecal contamination in treated food, it has been shown that faecal streptococci has a food poisoning potential^{2,5}

In conclusion, it should be stated that production hygiene of food such as ice cream and fruit salads should be improved.

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