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PREVALENCE OF ENTERIC BACTERIA IN ICE-CREAM IN GIZA GOVERNORATE

(With 3 Tables)

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(Received at 15/3/2009)

تحديد مدى تواجد الميكروبات المعوية فى الايس كريم فى محافظة الجيزة

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يعتبر الأيس كريم من منتجات الألبان الواسعة الانتشار، السهلة الهضم، ذات القيمة الغذائية العالية، وينتشر تداوله بين فئات كثيرة وأعمار مختلفة من المستهلكين، وهو مصدر للفيتامينات والأملاح المعدنية. وتحت ظروف الإنتاج المختلفة وكذلك التصنيع والتوزيع، قد يتعرض الأيس كريم للتلوث الميكروبي بمختلف الأنواع الممرضة والتي تشكل خطورة لا يستهان بها على صحة المستهلك، لذلك كانت هذه الدراسة لتحديد مدى تواجد الميكروبات المعوية فى الأيس كريم فى محافظة الجيزة، وقد تم تجميع عدد 50 عينة من الأيس كريم من المحلات التي بها ماكينة تصنيع الأيس كريم ونقلت للمعمل وتم إجراء الفحوصات البكتريولوجية على العينات. وكان متوسط العدد الكلي لبكتيريا المجموعة القولونية $1.98 \times 10^3 \pm 0.5 \times 10^3$ و $1.5 \times 10^4 \pm 0.34 \times 10^4$ ، على التوالي. وتم عزل ميكروب الايشريشيا كولاي من 4% من العينات وميكروب السالمونيلا من 2% من العينات وأيضا تم عزل الميكروبات المعوية بنسب وأنواع مختلفة. وقد تم اقتراح التوصيات المختلفة للحد من تلوث الأيس كريم وزيادة جودة المنتج.

SUMMARY

A total of 50 samples of ice-cream were collected from different shops which have ice-cream machine at Giza governorate and subjected to bacteriological examination, the mean values of the Coliform (MPN/g) and Enterobacteriaceae count were $1.98 \times 10^3 \pm 0.5 \times 10^3$ and $1.5 \times 10^4 \pm 0.34 \times 10^4$, respectively, *E. coli* could be isolated and identified as EPEC 2% of O55: K59 (B5) and EIEC 2% of O124: K 72 (B17), While, *Salmonella* isolated from 2% of samples and identified as *S.typhimurum*, and the incidence of the Enterobacteriaceae members

isolated from examined ice-cream were *E. coli* 4%, *Klebsiella pneumoniae* 6%, *Klebsiella ozonae* 16%, *Enterobacter aerogenes* 14%, *Enterobacter agglomerans* 4%, *Citrobacter freundii* 18%, *Proteus vulgaris* 14% and *Proteus mirabilis* 22%. The public health importance of the isolated microorganisms were discussed, the sources of contamination of ice-cream and the measures which should be applied to minimize the bacterial load and safe guard the consumer are mentioned.

Key words: *Milk products, ice-cream, Enterobacteriaceae*

INTRODUCTION

Milk and milk products are good sources of protein, minerals and vitamins for human especially for children and there is no need to state that ice-cream is the most palatable, nutritious and healthful inexpensive dairy product. Ice-cream is highly appreciable by all ages because it is considered a safe, enjoyable, energy giving and refreshing food because levels of water soluble vitamins and minerals are two to three times higher than those of full cream milk. Also, it is a valuable source of vitamin B, and contains twice vitamin A content as that of milk (Arbuckle, 1986 and Varnam and Sutherland, 1994).

The manufacture of ice-cream is a relatively complex operation, with a serious of steps which, in both compositional and microbiological terms, contribute to the overall quality of the ice-cream. It is not possible to give details here but several authors discuss this issue (Arbuckle, 1972 and Hyde and Rothwell, 1973). Ice-cream is often stored for few hours or even over night; so there is opportunity for bacterial growth and multiplication, rendering the product to be of public health hazard. Because ice-cream is consumed without any treatment that might reduce its microbial load, it is necessary to maintain a high level of microbial quality, for this purpose many countries have adopted mandatory manufacturing practices and standards to ensure an adequate and wholesome supply of such product.

This study was planned to evaluate the microbiological hygiene of the shops of ice-cream in Giza governorate through some indicator microorganisms as Coliform, *E. coli* and Salmonella as well as a trials for identification of some Enterobacteriaceae organisms.

Materials and methods:

A total of 50 samples of ice-cream were collected from different shops which have ice-cream machine at Giza governorate.

Samples were transferred in an ice box without delay to the laboratory and subjected to the following examinations:

- 1- Determination of Enterobacteriaceae: according to FDA 2002.
- 2- Determination of Coliforms (MPN/g): according to FAO 1992.
- 3- Isolation and identification of *E. coli* according to APHA 1992.
- 4- Isolation and identification of Salmonellae APHA 1992.
- 5- Identification of Enterobacteriaceae according to Elmer *et al.* 1997.

RESULTS

Table 1: Statistical analysis of Enterobacteriaceae and Coliform (MPN/g) counts of examined ice-cream samples.

Organisms	No / 50	%	Min.	Max.	Mean ±S.E
Enterobacteriaceae (CFU/g)	31	62	1.2×10^3	8×10^4	$1.5 \times 10^4 \pm 0.34 \times 10^4$
Coliform (MPN/g)	27	54	1.1×10^2	1.1×10^4	$1.98 \times 10^3 \pm 0.5 \times 10^3$

Table 2: Serodiagnosis of *E. coli* and Salmonella isolated from the examined ice- cream samples.

Organism	No / 50	%	Type of strain
<i>E. coli</i> O55 : K59 (B5)	1	2	EPEC
<i>E. coli</i> O124: K72 (B17)	1	2	EIEC
Salmonella	1	2	S.typhimurium

Table 3: Incidence of Enterobacteriaceae members isolated from the examined ice-cream.

Enterobacteriaceae members	No./50	%
<i>E. coli</i>	2	4
<i>Klebsiella pneumoniae</i>	3	6
<i>Klebsiella ozonae</i>	8	16
<i>Enterobacter aerogenes</i>	7	14
<i>Enterobacter agglomerans</i>	2	4
<i>Citrobacter freundii</i>	9	18
<i>Proteus vulgaris</i>	7	14
<i>Proteus mirabilis</i>	11	22
Salmonella	1	2

DISCUSSION

The results recorded in Table 1, showed that the Coliform (MPN/g) and Enterobacteriaceae counts varied from 1.1×10^2 to 1.1×10^4 and 1.2×10^3 to 8×10^4 , respectively with mean values $1.98 \times 10^3 \pm 0.5 \times 10^3$ and $1.5 \times 10^4 \pm 0.34 \times 10^4$, respectively. These results nearly agreed with those obtained by Mohamed and Al-Ashmawy (1980), Tammingo *et al.* (1980), Marin *et al.* (1985), Sharma and Joshi (1992), El-Prince and Hussein (2000) and Nawar (2001). While higher results were recorded by Hafez (1979), El-Essawy (1980) and Gad El-Rab (1983). However lower results were recorded by Delia *et al.* (1980) and El-Essawy and Riad (1990).

Coliforms group is considered as an indicator of poor sanitation and handling of the ice-cream during preparation (Finstein, 1973 and Banwart, 1981).

However, it seems to be the experience in many countries that ice-cream produced on small scale often has a poor bacteriological quality than the output of the large scale factory (Hamann and Weber, 1978), for often, these small factories have no system of quality control at all.

Table 2, showed that *E. coli* could be isolated and identified as EPEC 2% of O55: K59 (B5) and EIEC 2% of O124: K 72 (B17), While Salmonella isolated from 2% of samples and identified as *S. typhimurum*.

Nearly the same results were recorded by Sharma and Joshi (1992) and El-Prince and Hussein (2000) as they could isolate Salmonella species from ice-cream samples, while Hafez (1979), Delia *et al.* (1980) and Tammingo *et al.* (1980) failed to detect Salmonella.

Table 3, showed the incidence of the Enterobacteriaceae members isolated from examined ice-cream as *E. coli* 4%, *Klebsiella pneumoniae* 6%, *Klebsiella ozonae* 16%, *Enterobacter aerogenes* 14%, *Enterobacter agglomerans* 4%, *Citrobacter freundii* 18%, *Proteus vulgaris* 14%, *Proteus mirabilis* 22% and Salmonella 2%. These results agreed with that recorded by El-Essawy and Riad (1990), El-Prince and Hussein (2000), Nawar (2001) and Ahmed (2004).

Many opportunities exist for contamination of ice-cream from the hands of workers and other equipments. Coliforms group is considered as an indicator of both questionable and acceptable, it may indicate fecal contamination from either human or animal sources, and also its presence indicates poor sanitation and handling (Banwart, 1981).

Because the reservoir of *E. coli* is the intestinal tract of man and animals, the presence of such organism in other environments like food and water is used as an indicator of contamination from the natural reservoirs (Doyle and Padhyé, 1989), so its presence in the ice-cream indicates a general lack of cleanness during transportation, handling and processing of ice-cream. The public health importance of *E. coli* has been emphasized by many authors; these enteropathogenic serotypes have been implicated in case of gastroenteritis, epidemic diarrhea in infants, sporadic summer diarrhea in children as well as in case of food poisoning (Kornacki and Marth, 1982).

Among the requirements for any food to be of good sanitary quality it must be free from hazardous microorganisms, or those present should be at a safe low level therefore, nearly all countries now adopt standards for composition and bacterial content, so that the public may be assured of a safe healthful product.

The following measures should be adopted to ensure safety and high quality ice-cream.

- 1- High quality ingredients, properly balanced, of low microbial content and governed by standards specifications should be used.
- 2- Handling and distribution should be done under strict hygienic measures.
- 3- Standards must be applied to all aspects of production, processing and distribution. These standards must be adequate to provide an acceptable product, without imposing unrealistic requirements.
- 4- Application of good manufacturing practices in milk manufacturing units and should be regarded by the regulatory authorities as basic or compulsory requirements.

In order to obtain the best bacterial standard which is required, the utmost attention must be given to the cleaning and sanitation of all the plant and equipment used, to the personal hygiene of the entire operator, and to the general cleanliness of the factory.

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