

Evaluation of the bacteriological quality of ice cream sold at San Jose, Costa Rica

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SUMMARY. The presence of total and fecal coliforms, *E.coli*, *Listeria sp* and *Salmonella sp.* was evaluated in 65 samples of both commercial and homemade ice cream. 37,1% of homemade ice cream and 20% of commercial ice cream did not fulfill the international standard for total coliforms. At the same time 82,9% of home made samples and 56,7% of commercial ones presented fecal coliforms. *E. coli* was found in 51,4% of home made samples and 26,7% of commercial ones. Sixteen *Listeria sp.* isolates were obtained, 50% corresponded to *Listeria monocytogenes* and 50% to *L. innocua*. The overall presence of *L. monocytogenes* in ice cream samples was of 12,3% and it was isolated in all cases, from homemade ice cream samples. *Salmonella* was not isolated from the samples analyzed. Although the results obtained show an important improvement in the quality of ice cream, compared with a previous work done also in Costa Rica, further efforts shall be done, in order to offer safe products to consumers.

Key words: Ice cream, *Listeria sp*, *Salmonella*, *Escherichia coli*, coliforms.

RESUMEN. Evaluación de la calidad bacteriológica de helados expendidos en San José, Costa Rica. Se evaluó la presencia de coliformes totales y fecales, *E. coli*, *Listeria sp* y *Salmonella sp* en 65 muestras de helados caseros o de origen comercial. 37,1% de los helados caseros y 20% de los comerciales no cumplieron la norma internacional para coliformes totales. A la vez 82,9% de los helados caseros y 56,7% de los comerciales presentaron coliformes fecales. *E. coli* fue aislada a partir del 51,4% de los helados caseros y el 26,7% de los comerciales. Se realizaron 16 aislamientos de *Listeria sp.*, 50% correspondió a *L. monocytogenes* y 50% a *L. innocua*. La presencia total de *L. monocytogenes* en las muestras de helado fue de 12,3%, y en todos los casos fue aislada a partir de helados caseros. No se aisló *Salmonella* de las muestras analizadas. Aun cuando los resultados obtenidos demuestran una importante mejoría en la calidad bacteriológica de los helados, comparado con un trabajo previo también de Costa Rica, se necesita un mayor esfuerzo para poder ofrecer un producto seguro a los consumidores.

Palabras claves: Helados, *Listeria sp*, *monocytogenes*, *Escherichia coli*, coliformes.

INTRODUCTION

Ice cream is a product both loved and feared by tourists in a tropical country like Costa Rica. Although there is no growth in frozen dairy products, many types of bacteria, including pathogens, may survive. Different authors report the isolation of *Listeria monocytogenes* from ice cream (1) as well as outbreaks associated to *Salmonella* or Staphylococcal intoxication (2,3).

Tourism is one of the most important and complex industries created by human beings. In the last years, it has grown to huge proportions and spreaded worldwide, including important economic, cultural and social repercussions over the visited country as well as the tourists themselves (4).

In Costa Rica, and other Latin-American countries, the tourist industry has grown to important levels, constituting one of the most important foreign currency for the countries (4).

Tourists are basically exposed to different sanitary risks in their journeys, including the exposition to non-common infectious diseases, and food may represent an important source of infectious microorganisms for them. Different authors have related about 200 different diseases to food. The causing

agents include bacteria, virus, parasites, fungi, toxins and chemical products (3,5).

The aim of this work was to determine the bacteriological quality of commercial and homemade ice creams distributed in San José, Costa Rica in order to determine the risk they represent to public health.

MATERIAL AND METHODS

A total of 65 samples of both, commercial and homemade ice cream were analyzed during the months of May and June, 1999 at the Food Microbiology Laboratory, University of Costa Rica. Samples were randomly acquired at 13 ice cream shops distributed in the metropolitan area of San José, Costa Rica.

Total and fecal coliforms and *Escherichia coli* enumeration were done by the Most Probable Number (MPN) technique using three tube series (5). *Salmonella* spp. was isolated according to the methodology described by the Association of Official Analytical Chemists (6) and the presence of *Listeria* was determined according to the methodology recommended by International Dairy Federation (IDF) (7). For the identification of *Listeria* species, Api *Listeria* (BioMérieux®) was used.

RESULTS

Table 1 presents the results obtained for the bacteriological analysis of commercial and homemade ice cream.

From the samples analyzed, 37,1% of homemade ice cream and 20% of commercial ice cream did not fulfill the international standard for total coliforms in this product (8). For fecal coliforms, 17,1% of homemade ice creams and 43,3% of commercial based ice creams were negative (<3NMP/g) for their presence. 48,6% of homemade ice creams and 73,3% of commercial based ones accomplish the standard for absence of *E. coli*/g.

Sixteen *Listeria* sp. isolates were done from both homemade and commercial type ice cream. *Listeria* sp. was isolated at least once from 66,7% of commercial ice cream samples and from 57,1% of homemade ice cream samples. Of the overall locals analyzed, 38,4% (5/13) never presented *Listeria* sp. in their samples, being two distributors of commercial type ice cream and three of homemade ice creams.

From the 16 *Listeria* sp isolates obtained, 50% corresponded to *Listeria monocytogenes* and 50% to *L.innocua*. The overall presence of *L. monocytogenes* in ice cream samples was of 12,3% and it was isolated, in all cases, from homemade ice cream samples.

Salmonella ssp. was not isolated from samples analyzed.

DISCUSSION

The results obtained in this study show important fecal contamination and hygiene lacks in commercial and homemade ice cream. Due to the pasteurization of ice creams, the presence of total coliforms indicates post-treatment contamination, which may come either from flavoring additives, handling or industrial and distribution environment.

The presence of fecal coliforms represents a public health risk due to the possible presence and transmission of pathogens including bacteria, virus or other enteric agents (5).

Comparing the indicator results obtained with a previous work done in 1990 in Costa Rica also in ice cream, there is an important improvement in the quality of these, although it is still not completely satisfactory.

Previous work shows that 90% of ice cream analyzed did not fulfill the international standard for total coliforms, compared with 29,2% of actual work. Also, 100% of samples presented fecal coliforms and 50% *E. coli*, compared with 70,8% and 40% positivity in the present analysis (9). This improvement has still to be greater, in order to offer safe products to consumers, which include risk populations such as children, elderly and tourists.

Traditionally, total coliforms have been the preferred hygiene indicator but actually, the European Community is using genus *Listeria* as a hygiene indicator in food processing plants, especially dairy ones, instead of total coliforms (10). Considering this parameter, 24,6% of samples would be

classified as having a deficient hygiene, similar to 29,2% defined through the use of total coliforms.

Acute foodborne disease infections and intoxications are much more of concern to governments and food industry today than a few decades ago. *Salmonella* spp. is still the most important acute agent causing foodborne disease (3). In the present analysis, although there is an important fecal contamination in the samples analyzed, *Salmonella* spp. was not isolated. Isolation of this bacteria is one of the most difficult ones, due to different factors that inhibit bacterial growth such as acidity of the product, high sugar concentration, presence of volatile acids, storage temperature and competence (11, 12).

L. monocytogenes has emerged, together with other bacteria, as a significant threat for public health. The actual increase in the number of outbreaks due to this agent has special impact over public health and food industries. This is a psychophilic microorganism, capable of growing at temperatures that range between -0,4 and 45°C, (13, 14) so ice cream represents an ideal media for its growth, especially because of the lack of competition it represents.

TABLE 1
Bacteriological analysis of commercial and homemade ice creams in San José, Costa Rica.

Type	Most Probable Number (MPN/g)			Standard*
	<3	3-999	>1000	
Homemade (n=35)	n (%)	n (%)	n (%)	
MPN**total coliforms	—	22(62,9%)	13(37,1%)	100-1000
MNP fecal coliforms	6(17,1%)	24(68,6%)	5(14,3%)	Negative
MPN <i>E.coli</i>	17(48,6%)	18(51,4%)	—	Negative
Commercial type (n=30)				
MPN total coliforms	4(13,3%)	20(66,7%)	6(20%)	100-1000
MNP fecal coliforms	13(43,3%)	16(53,3%)	1(3,3%)	Negative
MPN <i>E.coli</i>	22(73,3%)	8(26,7%)	—	Negative

* ICMSF Microorganisms in foods 2, 1987

** MPN Most probable number, three tube series

Previous work done in Costa Rica in ice creams reports a 2% of prevalence for *L. monocytogenes*, compared with 12,3% found in the present work (15). It is known that the prevalence of this bacteria in raw milk is low (16-18), so the presence of it in homemade ice cream is alarming. Possible sources of this bacteria include the processing area, freezers, raw ingredients used as flavors in ice cream production, omission of adequate manipulation techniques by vendors, hygiene of serving spoons, and even worker hands, as has been

described by Kerr et al (19).

We did not quantify the level of *L. monocytogenes* present in the samples, but the results obtained allow us to call the attention about the risk that homemade ice cream may represent in the transmission of this microorganism.

The results obtained show significant differences between the hygiene and bacteriological quality of commercial and home made ice cream. The implementation of Hazard Analysis and Critical Control Points (HACCP) programs in ice cream industries is essential for addressing food safety for resident and tourist population of Costa Rica, as well as the intervention and education of people involved in the production of house made ice creams.

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