The microbiological examination and grading of ice creams manufactured in Ghana

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SUMMARY

Over 200 samples representing four brands of ice cream manufactured in Ghana have been examined microbiologically. It has been shown that various parameters, such as the level of mesophilic flora, coliforms, coagulase-positive staphylococci, yeasts, moulds and acidity can be used as a basis for grading and assessing the microbiological quality of the ice cream. Two of the four brands were grouped under Grade I and the other two under Grade II.

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RÉSUMÉ

DE GRAFT-JOHNSON, CHARLOTTE: *Examen microbiologique et degré de qualité de différentes crèmes glacées fabriquées au Ghana.* Plus de 200 échantillons représentant 4 marques commerciales de crèmes glacées fabriquées au Ghana, ont été examinés au point de vue microbiologique. L'auteur a montré que divers paramètres tels que l'abondance de la flore mesophile, les coliformes aérobies, les staphylocoques coagulants positifs, les levures, les moisissures et l'acidité pouvaient être utilisés comme indications pour l'estimation de la qualité et la détermination de la condition microbiologique des crèmes glacées. Deux des quatre marques examinées se rangeaient dans la classe I et les deux autres dans la classe II.

Introduction

Very little information is available on the microbiological quality of locally manufactured ice creams. The food value of some of these ice creams had previously been evaluated by comparing the chemical composition with draft F.A.O. standards (Ankrah, 1971). Ice cream is nutritious food, yet it is also an excellent medium for the growth of many micro-organisms, some of which can be pathogenic to man. Therefore, in addition to parameters such as flavour, texture, melting range, colour and packaging, which determine the edible quality, a knowledge of the microbial load can also play an important role in grading ice creams (Frazier, 1968).

It is the purpose of this paper to examine the microbiological quality of the various ice creams manufactured in Ghana, and to use this as a basis of advising industry on the need for technological improvement in the local ice cream manufacture.

Materials and methods

Samples of four different brands of ice creams manufactured in Accra were obtained and labelled A, B, C and D respectively. There were 58 samples for each of the brands A, B and C and 32 only for brand D. The samples were obtained between April and November 1971 from various retail outlets. The sampling procedures followed were those recommended by the British Standards (1963) and the Public Health Laboratory Service Reports (1948, 1949). Samples were kept frozen in insulated boxes containing *freezells* (Insulex Ltd., British Patent No. 876779) and examined within 6 h of sampling in the laboratory at the Food Research Institute, Accra.

The main method used in grading the samples was the methylene blue dye reduction test, as described in the Public Health Laboratory Service Report (1948).

Cultural examination was carried out on gravimetric basis according to Patton (1950), and the number of particular groups of micro-organisms was determined by the use of the appropriate selective media as follows:

(a) General mesophilic flora was determined by the plate count method on glucose-peptone agar incubated at 30°C for 3 days.

(b) Coli-aerogene organisms were estimated by the inoculation of 1·0cm^3 of 10^{-1} and 10^{-2} dilutions of 1·0g of the ice cream into 5·0cm^3 of single strength MacConkey broth. They were confirmed by subculturing into peptone water and brilliant green bile broth at 44°C and incubated at 22°C for 3–5 days.

(c) Yeasts and moulds were identified from growths on potato-dextrose agar (*p*H 3·5) incubated at 22°C for 3–5 days.

(d) *Staphylococcus* spp. were determined in mannitol-salt agar as described by Chapman (1948). 0·1cm^3 of 10^{-1} dilution of the ice cream in 0·25% Ringer solution was spread over the surface of well-dried plates and incubated at 37°C for 24–48 h.

Results and discussion

The result of the methylene blue dye reduction test of all the samples of the four brands are summarized in Table 1. The results show that ice cream samples A and C can be grouped in Grade I whilst those labelled B and D can be categorised into Grade II.

Table 2 summarizes the results of the total bacteria count experiment. The number of counts/g ice cream was about 100 000. Samples A, B, C and D were grouped into Grades I, II, III and IV, respectively. The plate count, however, could not be used as a standard measure because of:

(a) the large experimental error encountered even with skilled workers (Public Health Laboratory Service Reports, 1948); and

TABLE 1

The Grading of Ice Creams Based on the Reduction of Methylene Blue

Ice cream sample	*Percentage of ice cream graded as:*			
	Group 1: Fails to reduce methylene blue after 4 h	*Group 2: Takes 2½–4 h to reduce methylene blue*	*Group 3: Takes ½–2 h to reduce methylene blue*	*Group 4: Reduces methylene blue instantly*
A	79·3	17·3	1·7	1·7
B	41·5	50·0	5·1	3·4
C	72·6	25·7	1·7	Nil
D	15·6	81·3	3·1	Nil

TABLE 2

The Grading of Ice Cream by Total Bacteria Count on Glucose-Peptone Agar (10^3/g)

Ice cream sample	*Percentage total sample with count*				*Grade assigned on total count basis*
	Below 10^3	*$10^3 - 10^4$*	*$10^4 - 10^5$*	*Over 10^5*	
A	3·4	53·4	32·8	10·2	Grade I
B	10·2	41·4	25·7	22·3	Grade II
C	Nil	6·8	34·3	58·8	Grade III
D	Nil	Nil	6·2	93·8	Grade IV

TABLE 3

The Incidence of Yeasts and Moulds in Four Brands of Ice Cream Determined by Plate Count on Potato-Dextrose Agar (10^3/g)

Ice cream sample	*Percentage of total sample with count*							
	Below 10		*10 – 10^2*		*10^2 – 10^3*		*Over 10^3*	
	Yeast	*Mould*	*Yeast*	*Mould*	*Yeast*	*Mould*	*Yeast*	*Mould*
A	22·4	67·0	37·7	27·5	30·4	3·4	Nil	1·7
B	30·9	91·3	41·4	8·5	27·7	Nil	1·7	Nil
C	3·4	51·6	20·7	39·4	63·9	8·6	15·8	Nil
D	Nil	71·7	Nil	28·1	61·3	Nil	40·4	Nil

(b) the pathogenicity of the organisms encountered not being reflected in the total bacteria count.

The results obtained, therefore, could only serve as a guide to improving the general handling procedures in the manufacture of ice creams so as to minimize the potential of proliferation of the micro-organisms.

Table 3 shows the incidence of yeasts and moulds, in the brands of ice cream. 50% of all the ice cream samples had total mould count below 10 and only 8% exceeding a total mould count above 100. Yeasts counts were generally high, probably due to the fact that the local brands of ice cream were manufactured from dehydrated products which tended to be high in yeasts (Caurie, 1970).

Table 4 shows the incidence of coliforms (e.g. *Escherichia coli*) and *Staphylococcus aureus*, in samples of the four brands. Sample C had neither faecal type coliforms nor *S. aureus*, which is an indication of the maintenance of a high bacteriological standard. B and D were graded as sub-standard because of the high incidence of *S. aureus* in D and a great number of faecal coliforms in B.

In Ghana, there are, at present, no legal bacteriological standards for ice cream. Davis (1963) has suggested that ice cream should have a total viable bacilli count of not more than 10 000 per gram, a count of coagulase-positive staphylococci of not more than 10 per gram and a coli-aerogene count of not more than 1·0 per gram.

On the basis of the results obtained, ice cream samples A and C fall into the general accepted standards of quality. Samples B and D, which showed higher levels of pathogenic types of organisms could be graded as sub-standard. The problem, however, is the post-processing and pre-packaging handling, the stage at which most bacteria find their way into the products.

TABLE 4

Incidence of Coliforms and aureus *in Ice Cream Samples*

Ice cream sample	% *Presumptive coliform present 1/10cm*	% *Faecal* E. coli *1/10cm³*	% S. aureus *present in 1·0g*
A	87·9	20·6	Nil
B	96·4	31·0	Nil
C	86·4	Nil	Nil
D	93·6	18·7	6·2

Conclusion

Ice creams manufactured in Ghana can be grouped into Grades I and II based on bacteriological standards. The sanitary precautions during

the preparation are inadequate with the result that the presumptive coliform counts are generally high. There is the need, therefore, to improve on the sanitary aspects of post-processing and pre-packaging handling.

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