The production and chemical composition of some varieties of edible ices in Ghana

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SUMMARY

Information is given on the raw materials and the processing techniques employed in the manufacture of edible ices in Ghana. The volume of ice cream produced annually has increased from 199×10^3 l in 1964 to 451×10^3 l in 1969, that of milk ice from 49×10^3 l in 1967 to 81×10^3 l in 1969, but the production figure for water ice has remained constant at about 81×10^3 l. The chemical composition of some varieties of ice cream analysed nearly conformed to the FAO draft standards, whilst that of all the milk ices fell below these standards. Suggestions concerning the labelling of the edible ices are given.

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RÉSUMÉ

K. E. ANKRAH: *La production et la composition chimique de quelques sortes de glaces comestibles du Ghana.* Ce travail donne des informations sur les matières premières et les procédés techniques employés dans la fabrication de glaces comestibles au Ghana. Le volume de crèmes glacées produites annuellement a augmenté de 199×10^3 litres en 1964 jusqu'à 451×10^3 litres en 1969, celui du lait glacé est passé de 49×10^3 litres en 1967 à 81×10^3 litres en 1969, mais le chiffre de production de glace pure est resté constant aux environs de 81×10^3 litres. La composition chimique de quelques sortes de crème glacée qui ont été analysées est conforme au schéma standard de l'Organisation des nations unies pour l'alimentation et l'agriculture, tandis que celle de tous les laits glacés se place au dessous du niveau de ce même standard. L'auteur donne des suggestions sur l'étiquetage des glaces comestibles.

Introduction

The draft standard of the Codex Alimentarius Commission defines edible ices as preparations the solid or pasty state of which has been obtained by freezing, and which are intended to be consumed in that state (FAO/WHO, 1970). The products which fall under this definition are ice cream, milk ice and water ice. The Codex Alimentarius Commission also defines ice cream and milk ice as edible ices produced from milk and milk products which contain only milk fat as fat. In Ghana, however, the commodities termed ice cream and milk ice with one exception are made from skimmed milk powder with added fat as vegetable fat. For this reason they may be more appropriately described as mellorine types of edible ices (Arbuckle, 1966).

This paper discusses the raw materials, the processing techniques and the annual production figures of some varieties of edible ices manufactured in Accra by Fan Milk Company Limited, Accra Ice Company, K_2 Italian Ice Cream, and Rocket Ice Cream. The quality of the edible ices has been evaluated on the basis of the chemical composition. Suggestions are also given on the labelling requirements of the edible ices.

Raw materials and processing

The information about the raw materials and the production figures were obtained through direct communication with the managements of the factories, but that relating to processing was obtained through observation in the factories.

The annual production figures of ice cream, milk ice and water ice are presented in Table 1. The annual production of ice cream and milk ice has shown steady increases while that for water ice has remained nearly constant over the periods for which data are available.

TABLE 1

Annual Production Figures for Ice Cream, Milk Ice and Water Ice in Ghana

Year	*Ice cream* ($\times 10^3$ l)	*Milk ice* ($\times 10^3$ l)	*Water ice* ($\times 10^3$ l)
1964	199	—	—
1965	214	—	—
1966	234	—	—
1967	318	49	80
1968	366	69	81
1969	451	81	82

Ice cream

The fats used for making ice cream are hydrogenated coconut oil and deodorized palm kernel oil. Only one producer uses milk fat derived from evaporated milk. The milk solids constituents come mostly from skimmed milk powder. Palm kernel monoesterate glycerin, glyceryl monoesterate, lecithin and cremodan SE 33 are employed as emulsifiers. Locust bean gum and sodium alginate are used as stabilizers. The colours employed are yellow edible colour, brown colour, egg yellow, red colour and strawberry colour. Flavours such as vanilla, banana, strawberry, chocolate, lemon, raspberry and buttabelle are utilized. Sugar (sucrose) is used as a sweetener.

Two methods are employed in the processing of ice cream. The first method involves mixing skimmed milk powder with the rest of the ingredients. The mixture is heated at a fixed temperature (either at 74 °C or at 39 °C) whilst being stirred. The mix is pasteurized (either at 94 °C for a few seconds or at 71–77 °C for 20 min), and then homogenized to ensure uniform dispersion of fat globules. The second method involves reconstitution of ice cream powder with water.

Both methods then undergo the following heat treatments: The mix is cooled (either at 2 °C for about an hour or at 4·4 °C for about an hour) until aging is effected, after which some flavouring material is added. The mix is frozen (either at 0 °C for 15 min or at −26·2 °C for 15 min) and at the same time whipped to obtain the desirable overrun. The finished product is filled into cups and stored in the cold room until ready for sale.

Milk ice

The ingredients for milk ice are similar to those already mentioned for ice cream, but in addition, synthetic kola, pineapple flavour, saccharin and alginates are used.

There are two methods of processing: the first method follows exactly the same procedure as already described for ice cream up to the stage of pasteurization, after which the mixture is filled into cartons and allowed to solidify in the cold room. In the second method, fixed proportions of water ice mix and ice cream mix are combined and then processed as described for water ice.

Water ice

The raw materials for water ice are sucrose, alginate, citric acid, saccharin, soluble carbonate and any of the colouring substances previously mentioned.

The weighed ingredients are mixed thoroughly in a vat which is externally cooled. The mix is transferred into moulds and allowed to freeze in brine. After solidification they are demoulded, packaged and stored at −20 °C.

Chemical composition

Materials and methods

Most of the samples analysed were purchased from retail stores in Accra, but a few samples were obtained from the manufacturers. In all, 15 varieties of edible ices were analysed. Each sample was melted at 45 °C in a water bath before being analysed.

Ash. About 5 g of sample was ashed at 550 °C.

Fat. Fat was determined according to Roese-Gottlieb method (FAO/WHO, 1968) on 5 g of sample.

Protein. Protein was determined by macro-Kjeldhal method. The percentage protein was calculated as N$\times$6·38.

Total solids. 5 g of sample were placed on sand and heated on water bath for about 1 h. It was then transferred into an oven and dried at 105 °C for about 4 h.

TABLE 2

Chemical Composition of Edible Ices in Ghana

*Code system for samples**	*Type of edible Ice and flavour*	*No. analysed*	*% Fat*	*% Total solids*	*% Protein ($N \times 6 \cdot 38$)*	*% Ash*
1A	Ice Cream (noisette)	5	2·12±0·02 (2·08–2·20)	28·19±0·61 (26·91–30·00)	1·99±0·00 (1·99–2·00)	0·47±0·01 (0·42–0·50)
1B	Ice Cream (vanilla)	8	2·09±0·09 (1·66–2·47)	27·06±0·35 (25·61–28·60)	2·06±0·06 (1·85–2·40)	0·52±0·02 (0·44–0·57)
2	Ice Cream	9	8·04±0·03 (7·93–8·23)	34·53±0·43 (31·47–35·98)	3·37±0·05 (3·48–3·96)	0·85±0·01 (0·78–0·91)
3A	Ice Cream (vanilla)	9	7·73±0·36 (6·60–8·88)	31·45±0·73 (27·31–35·87)	3·42±0·16 (2·74–4·18)	0·83±0·03 (0·69–0·89)
3B	Ice Cream (chocolate)	9	8·06±0·15 (7·57–8·52)	32·29±0·43 (30·45–34·49)	3·91±0·05 (2·97–3·46)	0·73±0·02 (0·59–0·78)
3C	Ice Cream (new orange)	9	6·90±0·35 (4·75–7·79)	31·03±0·65 (28·38–33·80)	3·37±0·14 (2·92–3·99)	0·70±0·04 (0·62–0·95)
3D	Ice Cream (strawberry)	9	8·32±0·07 (7·73–8·86)	31·18±0·51 (28·38–34·19)	3·00±0·11 (2·61–4·08)	0·81±0·01 (0·74–0·91)
4A	Ice Cream (vanilla)	9	6·36±0·28 (4·48–7·83)	33·23±0·32 (33·01–33·85)	4·22±0·07 (3·83–4·66)	0·89±0·03 (0·72–0·99)
4B	Ice Cream (chocolate)	9	6·75±0·34 (5·51–8·00)	32·74±0·47 (29·62–35·00)	3·61±0·15 (3·24–4·67)	0·91±0·03 (0·67–0·99)
3E	Milk ice (strawberry)	5	2·93±0·21 (2·05–3·62)	17·87±0·47 (16·55–19·18)	2·92±0·09 (2·32–3·13)	0·70±0·00 (0·69–0·71)
3F	Milk ice (vanilla)	10	3·09±0·12 (2·22–3·48)	17·50±0·51 (14·74–19·99)	2·65±0·09 (2·18–3·00)	0·67±0·03 (0·52–0·83)
3G	Milk ice (orange)	9	2·51±0·09 (2·31–3·10)	17·52±0·58 (15·32–19·98)	1·63±0·06 (2·45–3·19)	0·61±0·01 (0·56–0·70)
4C	Milk ice (banana)	10	2·65±0·11 (1·85–3·08)	18·49±0·15 (17·49–19·25)	1·52±0·05 (1·12–1·69)	0·63±0·02 (0·59–0·75)
4D	Milk ice (pineapple)	9	2·82±0·09 (2·28–3·21)	17·87±0·16 (17·20–18·44)	1·63±0·06 (1·44–1·98)	0·61±0·01 (0·57–0·64)
4E	Water ice (orange)	8	0·04±0·01 (nil–0·07)	7·49±0·30 (5·51–8·20)	0·03±0·00 (0·02–0·04)	0·25±0·01 (0·20–0·33)

The figures represent Mean±SE. The figures in parentheses are the range values.

* A figure represents all the edible ices produced by a particular manufacturer while the attached letters denote the varieties.

Results and discussion

Table 2 shows the percentage fat, total solids, protein and ash contents of the various types of ice cream, milk ice and water ice. A coding system (see column 1 of Table 2) has been used instead of the brand names in describing the products. Under this system a figure represents all the edible ices produced by a particular manufacturer while the attached letters denote the varieties.

The FAO draft standard for ice cream stated that ice cream should contain at least 8% milk fat and at least 30% total solids (FAO/WHO, 1970). Table 2 shows that the fat contents of Nos. 2, 3B, and 3D conformed to the FAO standard whereas those for Nos. 3A, 3C, 4A and 4B were slightly lower. The fat content of Nos. 1A and 1B did not compare well with the FAO draft standard.

The total solids content of most of the ice creams were over the FAO draft standard except for Nos. 1A and 1B which were lower. The protein content was highest in No. 4A (4·22%) and lowest in No. 1A (1·99%). No. 4B contained the highest amount of ash (0·91%) and No. 1A the lowest being 0·47%.

The FAO draft standard for milk ice stipulates that milk ice should contain at least 3% milk fat and at least 28% total solids. Table 2 shows that the fat contents of all the milk ice samples fell short of the FAO draft standard except for No. 3F containing 3·09%. The total solids content of all the milk ice samples with means ranging from 17·50 to 18·49% were far below the FAO draft standard. No. 3E was richest in protein (2·92%) while No. 4C was poorest (1·52%). Small differences were found in the ash contents of all the milk ice samples.

Table 2 shows that the total solids content of No. 4E, the only water ice sample was 7·49%. This was also found to contain small amounts of fat (0·04%) and protein (0·02%).

The results have shown that the fat contents of some of the ice creams and of all the milk ices have to be raised to the FAO requirement. Also the total solids contents of the milk ices should be increased. Because no compositional standard for water ice exists the analytical data reported will facilitate the formulation of one. Since wide variations were generally noted in the analytical results, there is the need for manufacturers to standardize all recipe formulations so as to produce commodities with uniform and constant composition.

At present the labels of the edible ices bear a statement of the trade name, the manufacturer's address and the type of flavour. This declaration is not adequate. The following additional information is suggested: The type of fat other than milk fat and the total solids content should be stated. Any food additives used in the manufacture of water ice should be declared.

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