MANUFACTURE OF ACIDOPHILUS AND BIOGARDE ICE MILK

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Abstract

Acidophilus and biogarde ice milks were from filled milk prepared from skim powder and coconut oil. Fructose powder and high fructose corn syrup (HFCS 42 % and 55%) were used as sweeteners. The results indicated that T.S., T.A., Ash, Calories, viscosity, specific gravity and weight per gallon were slightly lower in acidophilus ice milk mixes than in biogarde ice milk mixes.

The resulting acidophilus ice milk was lower in specific gravity, weight per galton and melting resistance, but higher in overrun when compared with biogarde ice milk. The mixes containing HFCS were higher in T.S., T.A. Ash, Calories and viscosity, while, they were lower in freezing point, specific gravity and weight per gallon when compared with using fructose. On the other hand, using of HFCS gave higher overrun, and slightly lower in specific gravity, weight per-gallon and metting resistance.

From the information obtained in this investigation regarding total scores, it might be drawn that, acidophilus ice milk with HFCS 55% could yield satisfactory technological results.

INTRODUCTION

Fermented milk products occupy an important place in the diets of many people. Acidophilus milk and biogarde as fermented products are excellent food for their nutritive and therapeutic values, due to the presence of *lactobacillus acidophilus* in the former, *L.acidophilus* and *Bifidobacterium bifidum* in the latter. Both microorganisms produce antibiotics and acetic acid which are inhibitory loard gram negative bacteria (Rasic, 1983). These organisms have a high survival potential after the consumption of fermented milk products because of their resistance to intestinal bile salts. Therefore, milk products fermented with these microorganisms could have applications as therapeutic foods (Kim and Gilliland, 1984).

The feasibility of adding *L.acidophilus* to ice cream had been studied in U.S.A.

Although the numbers of this bacteria were reduced during freezing of ice cream mix, the survival rate was still above 2 million colonies per g at 28 days (Mann, 1984). Hekmat and McMahon (1992) reported that *L. acidophilus* and *B.bifidum* could grow to high numbers in ice cream mix and remain viable during frozen storage.

The use of high fructose corn syrup (HFCS) as a sweetener agent finds increasing application in the manufacture of ice cream. This may be due to its lower cost and functional advantages over sucrose (Wittinger and Smith, 1986a, Farag *et al.*, 1993). Moreover, fructose had the lowest effect on blood glucose level in normal people and in diabetic patients (Bchmann *et al.*, 1978). On the other hand, fructose has high nutritional and energy value and could be particularly useful in the nutrition of people working under continuous mental or physical stress. (DorDevic *et al.*, 1980).

Mann (1993) reviewed and discussed the functional properties of low fat ice cream products. He reported that, a new ice cream formulation developed in Australia, contains only 4% fat in place of 10%. A high density sweetener and polydextrose were used to replace glucose and sucrose syrups. The new product had 35% reduction in energy value compared to the standard ice cream.

The objective of the present study is to manufacture acidophilus and biogarde ice milks free from cholesterol and sucrose by using fructose and high fructose corn syrup (HFCS 42% and 55%) as sweetener agents.

MATERIALS AND METHODS

Source of culture

Lactobacillus acidophilus, and ABT culture which consists of *L.acidophilus, Bifidobacterium bifidum* and *Streptococcus salivarius* spp. *thermophilus* were obtained from Chr. Hansens Laboratorium A/S, Copenhagen, Denmark.

Raw Materials

Skim milk powder (T.S. 95 %), stabilizer (palsgaard No. 5929 DK-7130 Juelsinde, Denmark, Coconut oil, vanilla and D fructose were obtained from the local market. High Fructose Corn Syrup 42% and 55% were obtained, from National Company for Maize products, Tenth of Ramadan.

Fermented milk preparation

Skim milk power and coconut oil were used in making filled milk which was divided into two equal parts. The first was heated to 95°C /10 min, cooled to 40°C, and then, inoculated with *L.acidophilus* and incubated at 37°C to prepare acidophilus milk as described by Miljkovic (1975). The second part of milk was heated to 90°C/ 30 min, and cooled to 40°C, inoculated with ABT culture and agitated for 15 min before incubation at 44°C to prepare biogarde as mentioned by Salama (1993).

Preparation of fermented ice milk

Three mixes were prepared from each of acidophilus milk and biogarde to prepare frementedice milk as follow:

1. Acidophilus milk + Fructose + palsgaard + water
2. Acidophilus milk + HFCS 55% + palsgaard + water
3. Acidophilus milk + HFCS 42% + palsgaard + water
4. Biogarde + Fructose + palsgaard + water
5. Biogarde + HFCS 55% + palsgaard + water
6. Biogarde + HFCS 42% + palsgaard + water

All mixes were standardized to contain 4% fat 11/M.S.n.f., 15% sugar and 0.6% palsgaard. The mixture (sugar + stabilizer + water) was heated at 85%/10 min. and cooled before adding the fermented milk in all treatments. Prepared mixes were cooled to 4°C for 18 hours; vanilla was added before freezing. The freezing machine from Prontog Carpigani, Italy was used. The resultant products were packed in plastic cup and kept for 24h at-18°C for hardening.

Methods of analysis

The prepared mixes were examined for total solids (T.S) (American Standard Method, 1960), acidity and ash (Ling 1963), pH using pH meter of Research Digital Ionalyzer Model 501, specific gravity (Winton, 1958), weigh per gallon (Burke, 1947), viscosity using Hoppler viscometer type BH2 No 644312 (Bhanumurthi *et al.*, 1972) freezing point (FAO laboratory mannual, 1977), caloric value was calculated as mentioned by Kroger and Weaver (1973). The resultant ice milk products were also analysed for specific gravity, weight per gallon according to Winton (1958), Overrum (Arbuckle, 1986), metting resistance (Bhanumurth *et al.* 1972), organoleptic scoring according to Rothwell (1960).

Table 1 Dietary Composition and Chemical analysis of the basal layer diet.

Composition	%	Chemical analysis (Calculated)*	
Yellow corn	67	Crude protein (N X 6.25)	17.0
Protein concentrate **	10	Metabolizable energy (Kcal/kg)	2850
Lime stone	7.0		
Corn glutin	5.0	Calcium	3.54%
soya bean meal	5.0	Available phosphorus	0.7%
Sun flour meal	3.0	lysine	0.80%
Wheat bran	2.8	Methionine	0.44%
L.lysine	0.2		
Total	100.0		

RESULTS AND DISCUSSION

Results in Table 1 show that the mixes of acidophilus ice milk was lower in T.S %, acidity, ash, freezing point, specific gravity and weight per gallon than those of the mixes of biogarde. It was also noticed that, the results of viscosity had obvious decrease in acidophilus compared with that of biogarde ice milk mixes. On the other hand, using HFCS 55% gave higher T.S. %, Ash calories and viscosity than the others, but lower in specific gravity and weight per gallon because of its hygroscopic character. These results may be due to the composition of fructose and HFCS used which may affect also the difference between in freezing point of the treatments.

Table 1. Physical-chemical proprties of Acidophilus and Biogarde ice milk mixes containing Fructose and HFCS.

Poperties	Acidophilus ice milk mix			Biogarde ice milk mix		
	A	B	C	A	B	C
T.S.	24.40	26.64	25.77	26.21	28.07	27.49
T.A.	0.57	0.61	0.65	0.65	0.68	0.70
pH	5.60	5.58	5.57	4.93	4.92	4.90
Ash	0.89	0.95	0.93	0.90	0.96	0.95
Calories/ 100g	114.04	122.76	119.36	121.24	0.96	126.16
Freezing Point ^{o}C	-2.85	-2.87	-2.95	-3.10	-3.15	-3.20
Viscosity						
0 h	97.74	261.96	162.03	194.47	438.24	193.42
24 h	117.29	327.45	245.38	324.12	576.14	468.00
Specific gravity	0.952	0.916	0.922	0.989	0.973	0.978
Weight per gallon (Kg)	7.944	7.641	7.689	8.255	8.123	8.159

A = Fructose B = HFCS 55% C = HFCS 42 %

From Table 2, the results indicated that specific gravity and weight per gallon of the resultant acidophilus and biogarde ice milk followed the same trend of the

forementioned mixes. In the same table, the overrun percentage of the resultant products was higher in acidophilus ice milk than that in biogarde ice milk due to the high viscosity in the latter.

Table 2. Physical properties of Acidophilus and Biogarde ice milk containing Fructose and HFCS.

Poperties	Acidophilus ice milk mix			Biogarde ice milk mix		
	A	B	C	A	B	C
Specific gravity	0.659	0.576	0.633	0.764	0.732	0.750
Weight per gallon (kg)	5.503	4.807	5.282	6.376	6.109	6.259
over run%	40.61	59.09	44.14	29.47	33.56	31.38
Rate of melting						
60 min	15.03	23.05	16.70	4.36	11.49	7.64
90 min	46.81	64.05	49.45	30.73	41.99	41.37
120 min	77.06	91.74	78.59	57.67	77.81	71.21

A = Fructose B = HFCS 55% C = HFCS 42 %

On the other hand, using of HFCS 55% as sweetener gave higher overrun than HFCS 42% and fructose. The results indicated that the overrun increased as specific gravity and weight per gallon decreased. These results are in agreement with those of Mahran *et al.* (1984), who stated that specific gravity of ice cream is inversely proportional to the changes occurring in the overrun. As regards to the melting resistance, it was found that, biogarde ice milk had a melting resistance higher than that in acideophilus ice milk, due to soggy body and compact texture. Using HFCS 55% gave the highest percentages of the melting in fermented ice milk.

Organoleptic properties of the resulting products are shown in Table 3. It could be observed that, acidophilus ice milk gained higher total scores than biogarde ice milk. When using HFCS 55% as a sweetener agent, the products gained the highest scores.

Generally, acidophilus ice milk with HFCS 55% gained the highest sensory scores, followed by that with HFCS 42%, biogarde ice milk with HFCS 55% and

HFCS 42%, while, the products with fructose got the lowest total scores.

From the foregoing results, satisfactory fermented ice milk, free from cholesterol and scurose with good therapeutic properties could be prepared from fermented products such as acidophhilus milk and biogarde with coconut oil, HFCS 55% as a sweetener agent and palsgaard as a stabilizer.

Table 3. Organoleptic properties of Acidophilus and Biogarde ice milk containing Fructose and HFCS.

Poperties	Acidophilus ice milk			Biogarde ice milk mix		
	A	B	C	A	B	C
Flavour (50)	41	47	45	39	46	44
Body & Texture (40)	35	38	37	32	34	32
Melting quality (10)	7	7	8	7	8	8
Total score (100)	83	92	90	78	88	84

A = Fructose B = HFCS 55% C = HFCS 42 %

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صناعة مثلجات لبنيه متخمره باستخدام لبن الاسيدوفلس والبيوجارد

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فى هذا البحث تم استخدام اللبن الفرز المسترجع وزيت جوز الهند فى تصنيع مثلجات لبنيه متخمره مثل لبن الاسيدوفلس باستخدام L.acidophilus والبيوجارد (باستخدام بادى ABT) ثم استخدمت هذه الالبان المتخمره فى عمل خلطات من المثلجات اللبنيه المحلاه بسكر الفركتوز وشرات الفركتوز بتركيز ٥٥ ٪ ، ٤٢ ٪) بدلا من السكروز ، كما تم اضافة Palsgaard كمثبت ومادة استحلاب . وذلك لانتاج منتج غذائى مثلج ذى صفات غذائية خاصة خالى من الكولسترول والسكروز.

ومن النتائج المتحصل عليها وجد انخفاض فى الحموضة والوزن النوعى ووزن الجالون واللزوجه وزيادة نقطة التجمد لخاليط المثلجات اللبنيه بالاسيدوفيلس عن البيوجارد وكذلك انخفاض الوزن النوعى ووزن الجالون بالكيلو جرام والمقاومه للانصهار مع زيادة الريع فى مثلج الاسيد وفيلس اللبنى عن البيوجارد.

اما فى حالة استخدام شراب الفركتوز فقد أعطى ارتفاعا فى الحموضه واللزوجه وانخفاضا فى الوزن النوعى ووزن الجالون بالكيلو جرام بإستعمال الفركتوز فى مخاليط المثلجات اللبنيه التخمره، اما المنتج النهائى فقد أعطى استخدام شراب الفركتوز (٥٥ ٪) اعلى ريع.

وقد حقق المثلج اللبنى المتخمر بالاسيد وفيلس والمستخدم فيه شراب الفركتوز ٥٥٪ قبولا كبيراً من حيث الطعم والنكهه والقوام مع اقل تكلفه اقتصاديه عن استعمال السكروز. ولذلك ينصح بادخال لبن الاسيدوفيلس المصنع من اللبن الفرز المعدل بزيت جوز الهند والمحلى بشراب الفركتوز ٥٥٪ لانتاج مثلجات لبنيه ذات صفات خاصة.