SUBSTITUTION OF NON-FATTY MILK SOLIDS WITH SOME BY-PRODUCTS IN MAKING ICE MILK

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Abstract

In this study , 25% and 50% of milk solids not fat in ice milk mixes (11%) were partly substitited by sweet whey, acid whey sweet buttermilk and fresh skimmilk.

Results indicated that subtitution with sweet buttermilk enhanced the physical and chemical properties, and improved the organoleptic quality of ice milk with a manner better than both fresh skimmilk or whey. It could be recommonded that, promising substitution could be carried out up to 50% with sweet buttermilk or fresh skimmilk and up to 25% with sweet or acid whey in making ice milk.

INTRODUCTION

Skimmilk, buttermilk and whey are the most common by-products of the dairy industry remaining during production of cream, butter and cheese, respectively. Such by-products were found to solve problems besides keeping of a valuable milk nutrients.

Whey solids can play an important role in frozen dairy products by increasing their nutritional value with possible functional benefites (Rothwell 1976 and Huse et al. 1984). Also, sweet buttermilk and fresh skimmilk can be used as a source of serum solids in making ice milk because of their reasonable price in addition to low acidity and clean flavour (Arbukle 1986).

The object of the present investigation is to throw some light on the substitution of non-fatty milk solids with some by-products, namely, whey skimmilk and buttermilk in making ice cream.

MATERIALS AND METHODS

1.Ingredients used:

Whole milk powder (Lactose 36%, fat 26%, protein 20% and moisture 3% max.) was imported from Holland, sweet whey was obtained from rennet casein making (T.S. 7.15%, fat 0.4% and T.A. 0.12%, acid whey was obtained from Labneh making (T.S. 7.32%, fat 1.2% and T.A. 0.5%), fresh baffaloes skimmilk (T.S. 11% and T.A. 0.17%), sweet buttermilk was obtained from churning sweet cream (T.S. 9% and T.A. 0.18%). All these products were manufactured in the Laboratory of Animal Production Research Institute.

2. Preparation of ice milk mixes:

The control mix was prepared from reconstituted whole milk containing 4% fat, 11% solids not fat (MSNF), 15% sucrose and 0.5% gelatin. About 25% and 50% of (MSNF) in the control mix were subtituted by sweet buttermilk (SBM), fresh skimmilk(FSM), sweet whey (SW) and acid whey (AW)individually.In each of the above trials, ice milk was made according to the method of Rothwell (1976).

3. Methods of analysis :

Ice milk mixes were examined for total solids (American Standard Methods 1960), titratable acidity (Ling 1963), and pH value was measured by using pH meter of Research digital Inolyzer Model 501. Besides, the specific gravity (Winton 1958), viscosity (Bhanumurthi *et al. 1972)* and lactose (Nickerson *et al.* 1976) were determined. The overrun of ice milk (Arbuckle 1986) and the melting resistance of frozen ice milk (Bhanumurthi *et al.* 1972) were measured.

Organoleptic evaluation was carried out by the staff members of Dairy Departmentt of Animal Production Research Institute. Score points reported by Nelson and Trout (1951) were applied.

RESULTS AND DISCUSSION

1. Ice milk mixes

Results in Table 1 represent the effect of replacing whole dried milk serum solids (SS) with those of (SBM), (FSM), (SW) or (AW) on the properties of ice milk mixes. In all treatments, it could be noticed that, the total solids decreased by increasing the replacement ratio. This may be due to the low fat content in the added subtitutes, compared with control mix. On the other hand, titratable acidity increased parallel with the replacement ratio,which was more obvious in the acid whey. No differences were observed in pH value by using (SBM) or (FSM). However, the use of (SW) or (AW) reduced the pH of the mixes.

A slight decrease noticed in the specific gravity and wt/gal in all treatments as compared with control.

These results are in agreement with Khalafalla *et al.* (1975) who found that the specific gravity and wt/gall of ice milk samples decreased when a part of (SS) was replaced by whey powder, but are on contrary with those reported by Magdoub *et al.* (1992). Protein stability showed the same results for control mix when 25% of (SS) was replaced by adding (SBM) or (FSM). Slightly lower protein stability was obtained with 50% (SS) replacement ratio. Protein stability of mixes containing whey were not determined because of their high acidity. With the exeption of using whey, ice milk mixes viscosity of other trials were decreased by increasing the replacement ratio. With extending aging period, there was no increase in the viscosity of mixes.

Replacementof 50% of the (SS) with (FSM) exhibited the highest increase of viscosity after 24h of aging. Viscosity was not determined in the ice milk mix made by adding acid whey as a reason of its nonhomogeneity.

2. Ice milk properties :

As shown in Table 2, decreasing both specific gravity and wt/gall was noticed as (SS) of (SBM) or (FSM) were increased. An opposite trend was obtained by using sweet or acid whey. Results also showed some increase in overrun of ice milk made by adding the (SBM) or (FSM), while using the (SW) or (AW) showed contrary results. This could be attributed to the high protein content in (SBM) or (FSM), the high

content of lactose in the sweet whey and the high acidity in the acid whey which decreased the overrun. The lactose content, as shown in Table 2, was increased parallel with the replacement ratio in all treatments as compared with control. On the other hand, the loss percent was decreased as the (SS) of whey or sweet buttermilk increased, but was on contrary with the (FSM).

3. Organoleptic properties:

From the foregoing results, it could be concluded that, the use of (SBM) or (FSM) whey in making ice milk improved the flavour. This may be attributed to the dilution of the intensity of the taste of whole milk powder which was noticed in the control sample. In Table 2, moreover, the best flavour scores were taken with the use of (SBM) which contributes a richness of flavour of the resulting ice milk. The body and texture were improved with using (SBM) or (FSM) as compared with the control.

These results are in agreement with Ziemar *et al.* (1962) who mentioned that adding (FSM) improved the flavour, body and texture of of ice milk. However, using whey gave an opposite trend. This may be due to its lower T.S. and protein. The total scores were higher in treatments (SBM) and (FSM) than those with whey (Table 2).

Finally, the ice milk made with 25% replacement ratio of (SS) with (SBM) was the best one and gained the highest scores (96%). Similar results were reported by Arbuckle (1986) who found that adding buttermilk by ~_ 20% improved the flavour of ice milk.

Table 1 : Effect of partially replacement of ice milk mix serum solids with some by-products on some of its properties.

Mix. properties	Control	Sweet buttermilk (SBM)		Fresh skimmilk (FSM)		Sweet whey (SW)		Acid whey (AW)	
		25	50	25	50	25	50	25	50
Total solids %	31.20	30.10	28.68	30.15	29.50	29.66	27.45	30.54	28.15
pH value	6.50	6.50	6.50	6.50	6.50	6.14	5.63	5.98	5.17
Acidity	0.185	0.20	0.21	0.185	0.19	0.22	0.22	0.34	0.52
Protein stability	7	7	6	7	6	-	-	-	-
Specific gravity	1.114	1.112	1.105	1.114	1.109	1.097	1.093	1.1004	1.094
wt/gall. (lbs)*	9.296	9.280	9.221	9.290	9.255	9.160	9.121	9.183	9.129
Viscosity in CP:									
at zero time	6.68	5.54	5.27	5.62	5.25	6.39	5.59	-	-
after 4 h	11.01	9.63	7.27	8.85	7.40	8.79	6.99	-	-
after 24 h	12.37	12.62	14.29	16.20	24.77	12.67	10.94	-	-

* Weight per gallon in pounds.

CP : Canti pois

Table 2 . Some properties of ice milk as affected by partial replacing of serum solids with some by-products.

Ice milk properties	Control	Sweet buttermilk (SBM) Repacement Ratio		Fresh skimmilk (FSM)		Sweet whey (SW)		Acid whey (AW)	
		25	50	25	50	25	50	25	50
Specific gravity	0.694	0.679	0.662	0.687	0.681	0.705	0.729	0.758	0.771
* Wt/gall. (lbs)	5.791	5.666	5.524	5.733	5.683	5.667	6.084	6.299	6.436
Overrun %	61.48	64.06	66.92	61.86	62.85	55.60	49.91	45.79	41.86
Lactose %	6.1	6.3	6.6	6.3	6.8	6.32	6.9	6.15	6.55
Loss percent at :									
the end of 30 min.	32.38	27.76	24.80	35.20	39.58	9.47	4.45	0.97	1.40
60 min.	79.46	76.69	70.88	84.95	87.38	57.22	47.26	39.03	41.60
90 min.	-	-	-	-	-	85.91	75.97	71.64	74.80
Organoleptic properties :									
Flavour (45)	41	44	44	44	43	41.5	42	43	40
Body & Texture (30)	24	28	28	27	27	23.5	22	24	20
Total score	65	72	72	71	70	65	64	67	60
Total percent	86.7	96	96	94	93.3	86.7	85.3	89.3	80

* Wt/gall : Weight per gallon.

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إستبدال جوامد اللبن اللادهنية ببعض النواتج الثانوية فى صناعة المثلجات اللبنية

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أجريت هذه الدراسة بهدف إستبدال ٥٢٪ أو ٥٠٪ من جوامد اللبن اللادهنية فى مخلوط المثلجات اللبنية بجوامد الشرش الحلو او الحامض او اللبن الخض الطازج او اللبن الفرز الطازج مع المحافظة على ثبات هذه النسبة عند مستوى ١١٪ جوامد لبن لادهنية فى صناعة المثلجات اللبنية.

ولقد أوضحت النتائج المتحصل عليها تحسن الصفات الطبيعية والكيماوية والحسية طبقاً للمواصفات المرغوبة فى المثلجات اللبنية خاصة بإضافة اللبن الخض الطازج عن إستعمال كل من اللبن الفرز الطازج او الشرش بنوعيه.

نستخلص من هذه الدراسة انه يمكن صناعة المثلجات اللبنية بنجاح بإستبدال جوامد اللبن اللادهنية بنسبة ٥٠٪ بمثيلاتها من اللبن الفرز الطازج او اللبن الخض الطازج او بنسبة ٥٢٪ بمثيلاتها من الشرش بنوعيه الحلو او الحامض.