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PRODUCTION OF LOW-CALORIE ICE MILK

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ABSTRACT

Butter milk (BM), fat globule membrane (FGM) or whey protein concentrate (WPC) were used at different levels (15, 25 and 50%) to replace milk solids not fat (MSNF) in nonfat ice milk mixes. The control and treated mixes contained 0.52% fat, 13% MSNF, 14% sugar and 0.7% gelatin.

Analysis of nonfat ice milk mixes showed higher whipping abilites and viscosity, while lower specific gravity, weight per gallon and freezing point in mixes containing FGM and BM than in control, while WPC mixes showed an opposite trend except the freezing point. This differences were proportional to the replacement ratios. Nonfat ice milk analysis showed an increase in melting resistance of all treatments compared with the control. On the other hand, nonfat ice milk made with BM or FGM had lower specific gravity and weight per gallon than the ice milk made with WPC and control. The overrun of product increased with using FGM and BM up to 50% replacement of MSNF, while it increased with using WPC up to 25% only.

The highest score for sensoric evaluation was given to nonfat ice milk from different treatments than control, specially those containing 50% FGM, with, good flavour and smooth texture, while, replacement of 50% MSNF by WPC gave powdery flavor and coarse texture of the product.

The use of stevia leaves extract or steviana diet® as sweetner to replace of sucrose had benifical effect in improvement of physical and organoleptic properties of the frozen product, beside, decreasing of its calorie value.

It could be concluded that using FGM as MSNF replacer and stevia sweetner as sucrose substitute in the production of low-calorie ice milk is very important.

INTRODUCTION

Over the last decade, consumption of food products with a reduced calorie content has become a just way of life for many health conscious people. These food products can be prepared by using one or combinations of the following methods: (a) replacement of the carbohydrate with intense sweeteners, (b) reducing the carbohydrate content using fiber or bulking ingredients, (c) lowering the fat content and (d) using fat-substitutes to replace fat in food, whilest keeping the same functional and organoleptic properties as fats without the calories (Tamime *et al.*, 1994). As a result of this tendency, four new descriptors have been introduced for ice creame: reduced, light, low and nonfat ice cream (Baer *et al.*, 1997).

Milk fat, as known, is the main contribute to the rich flavor and mouthfeel associated with ice cream. Thus, reduction or lowering of the fat content brings a host of body & textural problems, such as coarseness and iciness, curmbly body, shrinkage, and flavor defects (King, 1994; Hatchwell, 1994 and Chantal, *et al.*, 1996). Therefore, in order to avoid these problems, several procedurs have been proposed focusing mainly on improving the sensory and physical properties of low fat and nonfat ice cream. Such procedures, addition of emulsifiers or blends of stabilizers and emulsifiers or fat replacers to an ice cream mix (Arbukle, 1986; Marshall and Arbuckle, 1996; Bear, *et al.*, 1997 and Bear, *et al.*, 1999).

Nowadays, under our conditions as developed country, inadequate milk supply and expensive cost of commercial emulsifiers and fat replacers have become from the biggest problems to dairy industries. This, encouraged researchers to look for suitable local substitutes to replace partially milk solids not fat in ice milk industry, and to improve ice milk quality and its nutritive value. Such substitutes, whey solids(Vulink and Clyne, 1990 and Jaskulka, *et al.*, 1995); whey protein concentrate (Hofi, *et al.*, 1993), soy milk (Saleem *et al.*, (1989) and Azzam (1992); potato pulp Metwally, (1994); wheat germ Salama and Azzam, 2003) and fibers, (El-Nagar and Kuri, 2001).

Sweet butter milk, as a source of milk solids not fat was used successfully in ice cream or ice milk because of its very cheap price, besids its advantage of improving the texture, body and foam properties of product leading to smooth body and better overrum (Mahran, *et al.*, 1976; Fikry, *et al.*, 1994 and EL-Dieb, *et al.*, 1995). Of course, the useful role of buttermilk in ice cream is attributed to contains a large proportion of the fat globule membrane (FGM), which acts as a natural emulsifying agent and thus, increased the consistency of ice cream mix (Mc Pherson *et al*, 1983; Arbuckle, 1986 and El-Dieb, *et al.*, 1995).

On the other hand, reduction or replacement of sucrose in ice cream mix as mean to reduce the calories has a negative effect on the physical and sensory properties of ice cream, because sucrose helps control freezing point and ice crystal size (Smith, and Bradley, 1983). Therefore, several artificial and natural sweeteners as substitutes for sucrose have been suggested in reduced-calorie frozen desserts.

Stevia (*Stevia rebaudina* Bertoni) as non caloric natural sweetner (2.5-3 times as sweet as sucrose), not carcinogenic and safe human health, was used successfully to sweeten a variety of food products including fruit flavoured drink and other beverages and frozen desserts (Ju, 1992; Buckenhuskers and Omran, 1997, Richman *et al.*, 1999 and Salem and Massoud, 2003).

Generally there is a few published information about how milk fat globule membrane (FGM) functions in nonfat ice milk. Therefore, the first objective of this study was to evaluate the effect of adding FGM compared with butter milk (BM) and whey protein concentrate (WPC) in nonfat ice milk mix making. Whilest, a second objective was to determined the effect of using "stevia sugar" as replacer of sucrose on physical and sensory properties of nonfat ice milk.

MATERIALS AND METHODS

Ingredients:-

Fresh buffalo's skim milk, (0.2% fat and 10.6% T.S) and fresh cream (53% fat and 57.2% T.S) were obtained by separating whole buffaloe's milk. Part of the previously obtained cream (53% fat) was standardized by skim milk (0.2% fat) to cream (40% fat) and pasteurized after cooling at 12°C, the cream was churned and the butter milk (BM) was recovered. BM was pasteurized and analysed, its compostion was 10.8% T.S, 0.8% fat and 0.18% T.A. Isolation of fat globule membrane (FGM) from the previous BM was carried out according to Abbas et al., (1996) with simple modification, as fellows: the butter milk (BM) was centrifuged (4000XG for 20 min) at 5°C then, free fat and unchurned fat globules were removed. The combined fat globule membrane (FGM) with the equeous phase was collected by filtration through funnel puchnar under vacuum. The composition of the prepared FGM was 0.4% fat and 30.82% T.S.

Stevia leaves were obtained from Sugar Crop. Inst., Agric. Research Center, Giza. Leaves were dried in electric oven at 50°C for 1 hr, grounded and sieved through 50 mesh screen (Salem and Massoud, 2003). Other ingredients, skim milk powder (96% T.S.); can sugar; vanillin, gelatin and steviana diet® (commercial form of stevia sugar) were obtained from local markets, while mannitol, was purchased from Sigma Chemical Co. Whey protein concentrate powder (97% T.S; 62% protein; 3.1% fat; 28% lactose and 3% ash) was obtained from Nutra Sweet-Kelco Co., Surrey KT20 5HQ, UK.

Ice milk mix making:-

As shown in table (1), six ingredients, buffaloe's skim milk; skim milk powder; fresh cream; cane sugar; gelatin and water were combined to give 0.52% fat; 13% milk solids not fat; 14% sugar and 0.7% gelatin in a basic nonfat ice milk mix (control). Three treatments were carried out using butter milk solids to replace 15; 25 and 50% of milk solids not fat in the mix. Also butter milk solids (BMS) were replaced, once, by fat globule membrane (FGM) and other by whey protein concentrate (WPC) at the same ratios in another six experiments (Table 1). In other attempt to reducing of calories, both stevia leaves powder and steviana diet® were used to replace 100% of sucrose in the acceptable frozen product from between the ten previous nonfat ice milk mixes (Table 5). When using stevia leaves powder, its amount is accounted to provide sweetness equivalent of the 14% sucrose in control sample as mentioned in the references. These leaves were boiled with amount of water equal to water which was added to the chosen mix and strained through cheese cloth to remove residuals. Then stevia leaves extract was added to for the mix based on its solids. Mannitol as bulking agent is used to maintain a constant total solids ice milk mixes.

Table (1): Formulations of nonfat ice milk mixes[1].

Ingredients	Formula No.									
	1 (control)	2	3	4	5	6	7	8	9	10
Skim milk	3000	2025	1375	-	2680	2466	1932	2897	2829	2658
Fresh cream	38	26	19	-	36	35	33	32	28	19
Skim milk powder	350	355	358	339	284	240	129	261	200	50
Butter milk (BM)	-	*975*	*1625*	*3250*	-	-	-	-	-	-
Fat globule membrane (FGM)	-	-	-	-	320	534	1068	-	-	-
Whey protein concentrate (WPC)	-	-	-	-	-	-	-	103	171	342
Sucrose	700	700	700	700	700	700	700	700	700	700
Gelatin	35	35	35	35	35	35	35	35	35	35
Water	*877*	*884*	*888*	*676*	*495*	*990*	*1103*	972	1037	1196

[1]= Weight in grams for ingredients in mixes.

Mix preparation and freezing:-

In all previous mixes, ingredients were mixed together, heated at 75°C for 30 min, cooled and aged at 5°C overnight. The mixtures (5 kgs mix for each treatment) were flavored with 0.03% vanillin and then frozen in an ice freezing machine (batch freezer, STARMATIC V 500, Italy). The frozen product was packaged in plastic cups (120 cm^3) and kept in a freezing cabinet at -18°C for hardening.

Methods of analysis:-

The prepared nonfat ice milk mixes were analyzed in triplicate for titratable acidity (T.A) and total carbohydrates according to British standards institution (1952). Total protein was determined by kjeldahl micro-method as described by ling (1963). The specific gravity of the mix was determined by the method described by Winton (1958). Whipping abilities of nonfat ice milk mix were estimated using mixer at speed setting 2 with two 3-cm whipping blades (Mixmaster PHILIPS-Holand). A 0.75L glass mixing bowl was calibrated with known volumes of water and placed inside a 2.5L stainless steal bowl. An ice and salt mixture was placed between the bowls to cool the mix as it was whipped. An initial volume of 350 ml of mix was used, and measurements were taken at 2, 5, 10 and 20 min during whipping to detect changes in mix volume. Freezing point FAO, (1977), caloric value was calculated as outlined by Arbuckle (1986) while the wheight per gallon was calculated according to Burke (1947) in the mix and ice milk product. Viscosity of ice milk mix was detected as described by Petersen et al., (2000). A bookfield DV_{11}+ helical viscometer (Brookfield Engineering laboratories, Inc., Stoughton, MA) fitted with a UL adaptor was used to measure viscosity. 16ml of ice milk mix was tempered 20°C; and then the viscometer (80 rpm) was activated. Ice milk melting resistance and overrum were determined according to Arbuckle (1986). Scoring card was used for the sensory evaluation of the product carried out by 15 panelsists from the Dairy Dept. Staff.

RESULTS AND DISCUSSION

The nonfat ice milk mix properties:-

Differences among specific gravity and thus weight per gallon values of the BM, FGM and WPC nonfat ice milk mixes were observed, however,these differences were not considerable (Table 2). An example, the weight per gallon ranged from 8.9 of BM and FGM mixes to 9.4 in WPC mixes. These values approximated the mean weight per gallon of nonfat ice milk mix which is 9.2(Fikry *et al.*, 1994).

On the other hand BM nonfat ice milk mixes and FGM mixes have similar properties for viscosity and whipping ability, but addition of FGM to the mix instead of BM improved these properties, while opposite trend was found with WPC, which led to more viscosity and loss in whipping rate of these mixes. In this respect, Arbuckle, (1986), mentioned that the proper level of viscosity is essential for good whipping and for retention of air. Therefore, the whipping ability of the control was higher than that of the mix containing 50% WPC, while the FGM mixes (No. 7, 6, 5) had highest whipping abilities at 20 min of 565, 553 and 547 cm^3 respectively, followed by BM nonfat ice milk mixes (Table 2).

Hence it could be concluded that, the improvement of the rheological properties of nonfat ice milk mixes brought by butter milk was due to its FGM content and which act as a natural emulsifying agent in the mixes (Rajasckaran and Rajor, *1989* and EL-Dieb *et al., 1995*). *Also, a slight* decrease was noticed in freezing point of nonfat ice milk mixes when, part of their milk solids not fat was replaced by BM or FGM or WPC. This decrease was more obvious in case of using WPC, due to, its high lactose and salt *contents(Magdoub et al.*, 1992).

Table (2): Effect of using BM, FGM and WPC in replacing MSNF with different ratios on some properties of nonfat ice milk mix[1].

Properties	Control	Ice milk mixes								
		BM[2]			FGM[3]			WPC[4]		
		Substitution levels (%)								
	0	15	25	50	15	25	50	15	25	50
Sp.gr	1.0936	1.0854	1.0776	1 075	1.079	1.0736	1.0718	1.1096	1.115	1.126
Wt / gall (Lbs)	9.126	9.058	8.993	8.971	9.004	8.959	8.944	9.259	9.305	9.396
Viscosity (cp)	14.71	17.97	18.32	18.96	18.44	19.36	20 11	22.44	23.70	26.18
Freezing point °C	-2.2	-2.2	-2.4	-2.4	-2.3	-2.3	-2.4	-2.6	-2.7	-2.7
Wip. Abi cm^3 after 0 min	350	350	350	350	350	350	350	350	350	350
2	453	489	495	487	483	496	510	479	463	472
5	503	512	315	506	517	528	529	513	495	498
10	514	520	527	526	531	536	548	518	510	498
20	519	530	539	540	547	553	565	525	515	505

1= Mixes titratable acidity were around 0.20-0.23%.
2 = Butter milk mixes (No 2, 3, 4)
3 = Fat globule membrane mixes (No. 5, 6, 7).
4 = Whey protein concentrate mixes (No. 8, 9, 10).

The nonfat Ice milk properties:-

Table (3) shows that, the type and ratio added of substitutes (BM, FGM and WPC) had pronounced influence on specific gravity and thus, weight per gallon of the nonfat ice milk product. As example, the weight per gallon of different nonfat ice milk decreased with the increase of BM or FGM ratio added, while, the use of WPC showed an opposite trend. In addition, the overrum of the nonfat ice milk product increased as a result of replacing MSNF with FGM; followed by BM. This increase of the overrum ran parallel with the replacing ratio. These results are in agreement with Arbuckle, (1986), and El-Dieb *et al.*, (1995). *They mentioned that an improvement in the* whipping ability could be achieved by adding BM or its FGM content in ice cream mix.

On the other hand, when WPC was used in place of MSNF with ratio *more than 25%, the overrun* decreased. This decrease might be due to the high lactose and salt contents of the WPC, which results in lowering the freezing point and thus, decreasing the overrum (Huse *et al.*, 1984).

As seen from Table (3), the melting resistance of nonfat ice milk differed among treatments based on substitiute type. Ice milks containing the WPC exhibited the highest melting resistance, which did not release any fluid for 15 min. These results could be reffered to the higher protein content of the WPC and lower overrun values (Huse *et al.*, 1984). On the other hand, the initiation of fluid release was slower for the BM and FGM nonfat ice milk product, but total conversion to liquid was more identical compared with the control. This might be due to its higher emulsion stability than control, which melt faster. These results are in agreement with those reported by Fikry *et al.*, (1994).

Table (3): Effect of using BM, FGM and WPC in replacing MSNF with different ratios on some properties of nonfat ice milk product.

Properties	Control	Ice milks								
		BM			FGM			WPC		
		Substitution levels (%)								
	0	15	25	50	15	25	50	15	25	50
Specific gravity	0.764	0.726	0.710	0.699	0.701	0.689	0.672	0.758	0.767	0.783
Wt / gall (Lbs)	6.375	6.062	5.924	5.833	5.849	5.749	5.607	6.325	6.401	6.534
Overrun, %	43.1	49.4	51.80	53.80	53.90	55.80	59.51	64.40	45.30	43.80
Mlt. Resis. Wt. loss% after 15 min	28.2	4.2	3.6	3.5	2.6	2.4	2.1	0.0	0.0	0.0
30	65.3	33.2	24.4	24.4	26.6	21.9	16.2	4.9	3.4	1.9
45	83.7	60.8	44.1	39.4	56.2	40.4	34.8	47.5	40.8	31.0
60	98.9	87.2	87.9	82.0	81.5	80.8	80.5	73.1	69.1	47.5
75	-	97.5	95.6	95.3	93.8	93.6	92.0	89.2	86.3	84.2

Organoleptic properties:-

Scoring of nonfat ice milk showed that as the ratio of FGM added increased, the total scores (flavour and body & texture) increased (Table 4). This might be due to the smooth texture caused by the phospholipids content of FGM and its benefical effect on the whipping ability of mix (El-Dieb *et al.*, 1995). Butter milk also, improved both flavour and body & texture of nonfat ice milk product when it was replaced parially with MSNF mixes (No. 2, 3 and 4). On the other hand, when the WPC increased up to 25% in nonfact ice milk mix, the scoring of flavour and body & texture remained constant but was decreased at ratio 50% WPC (Table 4). This decrease might be due to the powdery flavour and coarse texture(Magdoub *et el.*, 1992).

Smoothnees and acceptability, as evaluated by sensory tests, indicated that substitution of FGM up to 50% of MSNF in the nonfat ice milk mix produced acceptable nonfat ice milk. Therefore, 50% FGM nonfat ice milk mix (treat. No. 7) was chosen for further investigation, which, represented in replacement of the sucrose in this mix with stevia extract (treat. No. 11) and steviana diet® (treat. No. 12) Table 5.

Table (4): The organoleptic properties of nonfat ice milks made with BM, FGM and WPC substituting MSNF.

Mean Score	Control	Ice milks								
		BM			FGM			WPC		
		Substitution levels (%)								
	0	15	25	50	15	25	50	15	25	50
Flavour (45)	38	41	42	42	42	43	45	40	41	38
Body & texture (35)	28	32	31	32	32	32	32	31	30	29
Melting quality (5)	2	3	3	4	4	4	4	3	3	3
Total (85)	68	76	76	78	78	79	81	74	74	70

Table (5): Formulations of nonfat-non sucrose ice milk mixes[1].

Ingredients	Formula No.		
	7 (Control)[2,3]	11	12
Skim milk	1932	1932	1932
Fresh cream	33	33	33
Dried skim milk	129	129	129
Fat globule membrane (FGM)	1068	1068	1068
Sucroes	700	-	-
Stevia leaves extract (14.6% T.S)	-	1095	-
Steviana diet®[4]	-	-	70
Mannitol	-	540	630
Gelatin	35	35	35
Water	1103	168	1103

1 = Weight in grams for ingredients in mixes.
2 = It is selected mix, as aresult for sensory evaluation of ten previous mixes and serve as control for mixes 11, 12.
3 = Control= nonfat ice milk mix, 50% of its MSNF was substituted with FGM.
4 = Each 1.0 g steviana diet® has the same sweetness as 10g sucrose and give 4.0 calories (as desribed on backage)

The effect of stevia extract and steviana diet® on nonfat, non sucrose ice milk mixes and the frozen product properties:-

Table (6) shows that the replacement of sucrose in nonfat ice milk mix by stevia extract or steviana diet® caused slight increase in weight per gallon, viscosity and whipping ability of the mixes (No. 11 and 12) compared with the control (No. 7). This might be due to soluble contents and gum like substance contents of stevia leaves (Darise *et al.*, 1983 and Salem and Massoud, 2003). Therefore ice milk product with stevia products had the highest overrum and the melting resistance (Table 6). Also, in Table (6), the freezing point of ice milk mixes showed noticable decrease due to mannitol, as bulking, which caused depression of freezing point in low calorie frozen desserts.

Results in Table (7) show that the addition of stevia extract or steviana diet® improved some organoleptic properites, specially, body & texture of nonfat ice milk product, but with sweetbetter flavour in stevia extract nonfat ice milk. Calculating the caloric values indicated that replacing sucrose in FGM mix (No. 7) by stevia extract and steviana diet® gave a reduction of 32.9% and 25.38% in the energy value of the resultant ice milk from mix No. 7 respectively. This is due to that stevia is no calorie sweetener

(Ishu and Bracht, 1995). Moreover, 1g mannitol, which used as bulking agent in this mixes, give only 1.6 calorie Stogo (2001) (Table 7).

It is apparent from this study that FGM or BM as emulsifying agent and stevia extract or steviana diet® as sweetener could be used in nonfat ice milk mix making at a level up to 50% of MSNF and up to 100% sucros, respectivily, for the production of nonfat-non sucrose, low calorie ice milk with high quality. Moreover, FGM and stevia extract not only improves the most improtant properties of products (body & textre, whiping ability and overrum) but also raises their nutritional value Metwally *et al*, (1988); EL-Dieb, (1991) and Jeppensen *et al.*, (2000).

Thus, we recommend, using stevia as replacer of sucrose and replaced up to 50% of MSNF by FGM in the manufacture of low calorie ice milk.

Table (6): Effect of using stevia exctract and steviana diet® as replacers of sucrose on some properties of nonfat-non sucrose ice milk mix made with 50% FGM substituting MSNF and the frozen product.

Properties	Control[1]	Sucrose replacers	
		Stevia extract	Steviana diet®
Nonfat ice milk mix:			
Specific grarity	1.0718	1.0891	1.088
Weight/gall (Lbs)	8.944	9.088	9.079
Viscosity (cp)	20.11	22.17	22.55
Freezing point	-2.4	-2.8	-2.9
Wipping ability, cm^3 after 0 min	350	350	350
2	510	501	514
5	529	534	545
10	548	564	570
20	565	590	601
Frozen product:			
Specific gravity	0.672	0.675	0.670
Weight/gall (Lbs)	5.607	5.632	5.591
Overrun (%)	59.51	61.36	62.39
Melting resistance, weight loss % after 15 min	2.1	1.7	1.3
30	16.2	13.7	13.8
45	34.8	25.8	29.2
60	80.5	76.4	79.9
75	92.0	89.1	90.2

[1] = Nonfat ice milk mix (No. 7), 50% of its MSNF was substituted with FGM.

Table (7): The organoleptic properties and calorie value of nonfat-non sucrose ice milks made with stevia extract and steviana diet® substituting sucrose.

Nonfat-non sucrose ice milk	The organoleptic properites				Calorie value	
	Flavour (45)	Body & texture (35)	Melting quality (5)	Total (85)	K. cal/ 100 gm	Reduction %
Control[1]	45	32	4	81	111.30	-
Stevia extract	43	35	4	82	74.68	32.9
Steviana diet®	45	35	4	84	83.16	25.38

[1] = nonfat ice milk, 50% of its MSNF was substituted with FGM.

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إنتاج مثلجات لبنية منخفضة السعرات

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في محاولة لانتاج مثلجات لبنية منخفضة السعرات وعالية الجودة تم دراسة تـأثير اسـتبدال ١٥، ٢٥، ٥٠% من جوامدها اللبنية اللادهنية بأغشية حبيبات الدهن كعامل اسـتحلاب علـى بعـض الخـواص الفيزيقية لمخاليط تلك المثلجات وعلى بعض الخواص الحسية للمثلجات الناتجة مقارنة بتـأثير جوامـد لبـن الخض ومركزات بروتينات الشرش المجففة عند نفس نسب الاستبدال السابقة. وتشير النتائج المتحصل عليـها إلى ما يلي:-

١- أظهرت مخاليط المثلجات خالية الدهن والمحتوية على اغشية حبيبات الدهن أو لبن الخض ارتفاعا فـي لزوجة المخلوط وقابليتة للخفق مع انخفاض وزنه النوعي ووزن الجالون منه بالرطل وذلك عكس مـا أظهرته المخاليط المحتوية على مركزات بروتينات الشرش المجففة.
٢- انخفاض نقطة تجمد جميع المخاليط عن مثيلتها للكنترول وان كانت اكثر انخفاضا للمخاليط المحتويـة على مركزات بروتينات الشرش المجففة.
٣- انخفاض الوزن النوعى ووزن الجالون بالرطل للمثلجات الناتجة سواء المحتوية على أغشـية حبيبـات الدهن أو جوامد لبن الخض عن مثيلهما في المثلجات المحتوية علـى مركـزات بروتينـات الشـرش المجففة والكنترول.
٤- زيادة ملحوظة في ريع المثلجات الناتجة والمحتوية على أغشية حبيبات الدهن وكذلك على لبن الخـض وهذه الزيادة تتناسب طرديا مع نسبة الاستبدال بينما انخفض الريع للمثلجات التي زادت نسبة اسـتبدال جوامدها اللبنية اللادهنية بمركزات بروتينات الشرش المجففة عن ٢٥%.
٥- زيادة مقاومة جميع المثلجات الناتجة للانصهار مقارنة بالكنترول وان كانت المحتوية علـى مركـزات بروتينات الشرش المجففة أكثرهم مقاومة للانصهار على الإطلاق.
٦- حازت عينة المثلجات التي استبدلت ٥٠% من جوامدها اللبنية اللادهنية بأغشية حبيبات الدهـن علـى اعلى درجات التحكيم الحسي وقد درس تأثير استبدال سكروز تلك المثلجات بمحلى طبيعي وهو مستخلص أوراق نبات الاستيفيا *Stevia rebaudina* Bertoni وسكر الاستيفيا التجاري ®Steviana diet وكان لـهما الأثـر الواضح والمفيد فى زيادة الريع وتحسن في خواص القوام والتركيب للمثلجات الناتجة الخالية من الدهن والسكروز.

لذلك نوصى باستخدام اغشية حبيبات الدهن لتحل محل ٥٠% من الجوامد اللبنية اللادهنيـة فـي مخاليط المثلجات الخالية من الدهن مع استخدام مستخلص أوراق الاستيفيا بدلا من سكروز تلـك المخـاليط لانتاج مثلجات لبنية منخفضة السعرات وعالية الجودة.