J. Agric. Sci. Mansoura Univ., 34 (3): 1735 - 1744, 2009

IMPACT OF REPLACEMENT MILK FAT WITH VEGETABLE OILS ON THE QUALITY OF ICE CREAM

AL- Assar, M. A.
Dairy Sci . Dept., Faculty of Agriculture, Cairo University, Egypt.

ABSTRACT

Four types of vegetable oils, namely palm, palm kernel, coconut and sunflower oil were used to replace 50 and 100% of milk fat of vanillin ice cream mixes. The physical and physiochemical properties of ice cream mixes and the resultant frozen product were evaluated.

The obtained results could be summarized as follows:

1- Milk fat replacement by vegetable oils showed no pronounced effect on titratable acidity, pH values, specific gravity and weight per gallon of the resultant ice cream mixes. Whereas, freezing point and apparent viscosity of the experimented ice cream mixes markedly decreased, while their whipping abilities increased when 50% of milk fat was replaced by palm or palm kernel oil. Similar trend was obtained when 100% of milk fat was substituted by co-count oil. But when milk fat milk was replaced by 100% of palm oil a marked increase in the consistency and apparent viscosity was observed. On the other hand, the ice cream mixes made with sun flower oil (50 and 100 % substitution) exhibited more decrease in the abovementioned indices.
2- The obtained ice creams containing 50 and 100% sunflower oil exhibited the lowest overrun% and milting resistance among all ice creams. While, the ice creams containing palm or palm kernel oil (50% substitution) preferred the control, coconut and sun flower ice creams in the melting resistance and overrun%. But, substitution of all milk fat (100%) with palm oil (high melting point) led to increase melting resistance of resultant ice cream. Moreover, its fat destabilization index was the lowest among all treatments.
3- The ice cream made with palm oil (50% substitution) gained the highest organoleptic scores, while the replacement of milk fat with sunflower oil (50 or 100% substitution) led to oily taste and weak body of frozen product, which gained the lowest organoleptic scores.

Hence, substitution of 50% milk fat with palm oil was preferable than that of control, 50% palm kernel and 50 or 100 % coconut containing ice cream, respectively.

Keywords: Ice cream, milk fat, vegetable oil, physicochemical properties.

INTRODUCTION

Frozen desserts which include many varieties are very desirable products throughout the world, because of its palatable, healthful and relatively inexpensive cost (Pitz, 1987). Ice cream is one type of frozen desserts widely consumed by public. Mix composition of ice cream depends mainly on dairy and non dairy ingredients. Vanilla ice cream for example contains not less than 9% milk fat and 20% total milk solids (Arbuckle, 1986).

Milk fat has the advantages of improving the texture, mouth feel creaminess and rich flavor of the product (Goff and Jordan, 1989 and Marshall and Arbuckle, 1996). But, high consumption of saturated fats such as milk fat is not recommended by health authorities as they represent risk factor for heart diseases. While, consumption of unsaturated fats and oils (mainly vegetable oils) are known to reduce the level of serum LDL cholesterol and triglycerides, but has no effect on the HDL cholesterol level (Jee, 2002).

Moreover, inadequate milk supply and expensive cost of milk fat especially in developed countries have become one of the biggest problems to dairy industries. This encouraged researchers to look for suitable vegetable oils to replace milk fat in ice cream manufacturing. El-Safty *et al* (1978) studied the effect of using hydrogenated oils in ice cream making, it was reported that substitution of butter fat by hydrogenated oil, with melting point 32°c, up to 50% could be used successfully in the manufacture of ice cream. But, the flavor decreased as the added hydrogenated oil increased. So, it was suggested to improve the ice cream flavor, by adding chocolate or cinnamon to the mix. Youssef *et al* (1981) replaced butter fat by cottonseed or corn oil with a level of 25%. Abdou *et al* (1996) found that hydrogenated palm kernel oil (M.P. 33- 36°c) was a good substitute for butter fat in ice cream manufacturing. Also, the effect of partial substituting of milk fat in ice cream mixes with coconut, sunflower, peanut oils on the quality of obtained ice cream was reported in several studies (Hussein and Yasin, 2005; Al-Saleh and Hammad, 1992 and Magdoub *et al,* 1991). Moreover, Rnazaruddin *et al,*(2008) have found that combination of rice bran oil and dates concentrate in formulation of ice cream mixes led to increase the overrun% and organoleptic scores of the resultant ice cream.

Generally, there are five factors as reported by Marshall *et al* (2003)and Goff (2006). should be considered in the selection of vegetable oil for use in imitation ice cream; these are crystal structure, rate of fat crystallization, temperature dependent melting profile, the content of high melting triglycerides and flavor and purity of the oil. Also it is well known that the type of fat influence the characteristics of the resultant ice creams by affecting their rheological and sensory properties.

Therefore the objective of this study was to substitute 50 and 100% of milk fat in ice cream mixes by palm, palm kernel, coconut or sunflower oil to extend studying of their effect on the physicochemical and quality of the obtained ice cream, aiming to choose the suitable oil and its percentage of substitution.

MATERIAIS AND METHODS

Palm oil was obtained from Misr Gulf oil processing Co., Attaka, Suez, Egypt; coconut oil was obtained from Savola Sime Egypt Co., Suez, Egypt; palm kernel oil was obtained from Premium, Malizia. white sunflower oil was obtained from Arma Food Ind., 10th of Ramadan City, Egypt.

Fresh raw buffalo's milk was obtained from the herd of the Fac. Agric., Cairo Univ., Egypt. Milk was skimmed (using a separator ALFA LAVAL) into skim milk (0.1% fat and 10.3% T.S) and cream (57% fat and 61.8% T.S).

Skim milk powder (0.5% fat and 97% T.S) was imported from Sweden. It was purchased from the local market.

Other ingredients (cane sugar, gelatin and vanillin) were obtained from the local market.

Ice cream mixes were formulated according to Arbuckle (1986), as shown in Table (1). All ice cream mixes were standardized to contain 8% fat, 12% milk solids not fat (MSNF), 14% sugar and 0.7% gelatin. Eight treatments in addition to control treatment were carried out in which palm, palm kernel, coconut or sunflower oil was used to replace 50 and 100% of fat in ice cream mix.

Table (1): Formulations of ice cream mixes

Ingredients (gm)	Control	Vegetable oil in ice cream mix*	
		50%	100%
Skim milk	3000	3000	3000
Fresh cream	695	348	-
Vegetable oil	-	199	397
Dried skim milk	270	287	305
Sucrose	700	700	700
Gelatin	35	35	35
Water	300	431	563

- **Ice cream mix made with substitution of 50% or 100% milk fat by palm, palm kernel, coconut or sunflower oil.**

Fresh cream and skim milk were mixed together and heated to 65°c. During heating, skim milk powder and sucrose were added at 40 – 50°c, while, gelatin was added as a solution to the mix at 60°c. All ice cream mixes were homogenized at 65°c at pressure of 150 bar using a homogenizer (Rannie, Denmark), pasteurized at 75°c for 30 min and rapidly cooled, in ice bath, to 8°c. Mixes were aged at 5 $\pm$ 1°c overnight. Just before freezing in a batch freezer (Star Matic vsoo, Italy), 0.03% vanilla was added to each mix. The resultant ice cream was packaged in 120ml cups and hardened in a deep freezer at -25°c for 24 hr at least before analysis. All treatments were carried out in triplicates.

Total solids, fat, titratable acidity and pH value were determined according to A.O.A.C (1996). Flow time of the mix was measured as the time in seconds to empty a 50ml pipette at 5°c under atmospheric pressure as mentioned by Arbukle, (1986).

Fat destabilization index was determined according to Goff and Jordan (1989) as follows: Experimented ice cream mixes and thawed resultant ice cream samples were gently mixed, 3g of each sample were weighed into a 50ml Erlenmeyer flask, 27ml distilled water at room temperature were added, 1ml of the 1:10 dilution was placed in a 50ml volumetric flask and diluted to the mark with distilled water, and a sample of the 1:500 dilution was placed in a spectrophotometer tube. The tube was centrifuged for 5 min at 1000 rpm, allowed to stand for 10 min, and absorbance (A) was measured at 540 nm on WLW spectrophotometer

Jenway, 6320 U.K, England. Percent of fat destabilized was calculated according to the following equation:

$$\frac{A\ (\text{unfrozen mix}) - A\ (\text{ice cream sample})}{A\ (\text{unfrozen mix})} \times 100$$

Distilled water was used as a blank to zero the instrument.

The whipping ability of the ice cream mix was estimated by the overrun method (Phillips *et al*, 1987). The mix (350ml) was placed in a 0.75 L glass bowl, calibrated with known volume of water, and placed inside a 2.5 L stainless steal bowl. An ice and salt mixture was placed between the bowls to cool the mix to 4 °c. whipping was carried out using mixer (Toshiba, Japan) at speed 5. Overrun values were calculated at 4 min intervals by weighing a unit volume of both mix and foam (resultant ice cream). After weighing, the foam was returned to the mixer for further whipping within 1 min. the test was stopped after overrun values were peaked.

Whipping ability was expressed as the percentage of overrun and calculated as follows:

$$\%\ \text{overrun} = \frac{\text{Weight of unit volume of mix} - \text{Weight of unit volume of foam}}{\text{Weight of unit volume of foam}} \times 100$$

Meltdown of frozen ice cream was determined by modifying the method described by Arbuckle (1986) as follow: A 113g sample of tempered ice cream was placed on a 100 – mesh metal screen in an 25°c gravity convection refrigerator/ incubator (Tembra, Island) to simulate ambient summer temperatures, and the volume of melted liquid collected in a graduated cylinder was recorded every 15min for 60 min.

The specific gravity of the mix and ice cream were determined using the method described by Winton (1958) and freezing point (FAO, 1977). The weight per gallon was calculated according to Burke (1947). Viscosity of ice cream mix was carried out as described by Petersen *et al* (2000), using a Brookfield DV II + helical viscometer (Brookfield engineering laboratories, Inc., Stoughton MA) fitted with a VL Adaptor. The overrun % of the resultant ice creams was estimated as reported by (Arbuckle, 1986):

The sensory properties of the resultant ice creams were assessed by 15 panelists for flavor (50 pints), body & texture (30 points), melting quality (10 points) and appearance (10 points) according to Marshall *et al* (2003).Three replicates were carried out and their average was recorded.

RESULTS AND DISCUSSION

As shown in Table (2), the replacement of milk fat with vegetable oils had no marked effect on both of pH and titratable acidity values. There were no marked differences among pH and titratable acidity values of ice cream mixes containing vegetable oils as compared with those of control treatment. The pH ranged from 6.47 to 6.43 while the titratable acidity ranged from 0.21 to 0.23%. These values of all treatments are within the normal range reported by Marshall *et al* (2003).

Table (2): Properties of ice cream mixes as affected by milk fat replacement by vegetable oils

Properties	Control	Ice cream mixes containing vegetable oil							
		Palm oil		Palm kernel oil		Coconut oil		Sunflower oil	
		50%	100%	50%	100%	50%	100%	50%	100%
Titratable acidity %	0.22	0.22	0.21	0.22	0.22	0.22	0.21	0.21	0.23
pH value	6.46	6.47	6.44	6.46	6.43	6.43	6.43	6.47	6.43
Specific gravity g/cm^3	1.044	1.038	1.036	1.041	1.050	1.069	1.079	1.055	1.074
Weight per gallon (Lb)	8.712	8.662	8.645	8.690	8.762	8.921	9.004	8.804	8.963
Flow time (sec)	51	54	66	49	42	46	40	39	27
Freezing point (^{o}c)	-1.8	-1.9	-1.4	-2.3	-2.2	-2.2	-2.4	-2.2	-2.3
Apparent viscosity (cp)	203.8	138.1	226.7	121.6	98.1	175.7	132	97.1	84.3

The consistency of ice cream mix as measured by the flow time differed between treatments. Flow time increased as the substitution % increased in case of using palm oil (Table 2). The opposite trend was observed for the substitution with palm kernel, coconut and sunflower oil. The flow time of ice cream mix containing palm oil was higher than that of the control. On the other hand the flow time of ice cream mix containing other experimented vegetable oils was lower than that of control.

Regarding, the freezing point and apparent viscosity values of the ice cream mixes made with vegetable oils it was found that both of freezing point and apparent viscosity values were lower than that of their respective value of the control except for that of ice cream mix containing 100 % palm oil where these value were higher than that of the control one (Table 2). This decrease was proportional to the rate of substitution by vegetable oils except for the palm oil, treatment at 100% substitution where the ice cream mix had the highest freezing point (-1.4^{o}c) and the highest apparent viscosity (226.7 cp) as compared to control -1.8^{o}c and 203.8 cp respectively as shown in Table (2). This could be attributed to the properties of palm oil which had higher content of saturated fatty acids as compared with other vegetable oil used. The decrease in viscosity when vegetable oils other than palm oil were used as substitutes may be attributed to the liquid nature and to the absence of agglutinin in such oils which accelerate the formation of fat clumping in case of milk fat (Abdou *et al*, 1996, Rabie *et al*, 1987 and Yousef *et al*, 1981). Also, the vegetable oils had higher unsaturated fatty acids content than the milk fat, which resulted in decreasing the viscosity of ice cream mix (Im *et al*, 1994).

The whipping abilities of ice cream mixes as measured by determination of percentages of overrun varied among treatments (Fig 1 a and b). overrun values compared at 4 min showed that ice cream mixes made with palm oil (50% substitution), coconut oil (100% substitution) or palm kernel oil (50% substitution) produced significantly higher air incorporation (123.9, 114.4 and 107%, respectively) than the ice cream mix made with milk fat (control) (90.6%), followed by the ice cream mixes made with coconut oil (50% substitution), palm kernel oil (100% substitution) or palm oil (100% substitution) (52.3, 78.1 and 76.4%) respectively, (Fig 1 a, b). Overrun for the control peaked in 4 min, decreased at 8 min, and then leveled off. The ice cream mixes made with sunflower oil (50 & 100% substitution) incorporated the least amount of air (64.2 and 60.3% at 4 min, respectively) because of its higher unsaturated fatty acids content and the liquid nature, which could not retain air bubbles. Also, the overrun of the mix containing palm oil (100% substitution) rapidly decreased as compared with any other mix containing palm kernel or coconut oil. This decrease in overrun was due to the high viscosity of this mix, which, do not favor foaming capacity and foam stability (Stanley *et al* 1996 and Arduckle, 1986).

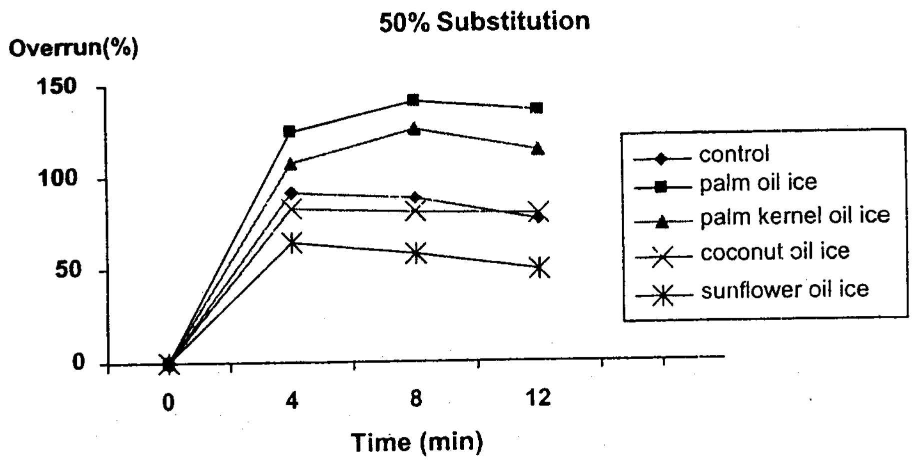

Fig (1a): Mean (percentage) of overrun values of five ice cream mixes measured at 4 min intervals

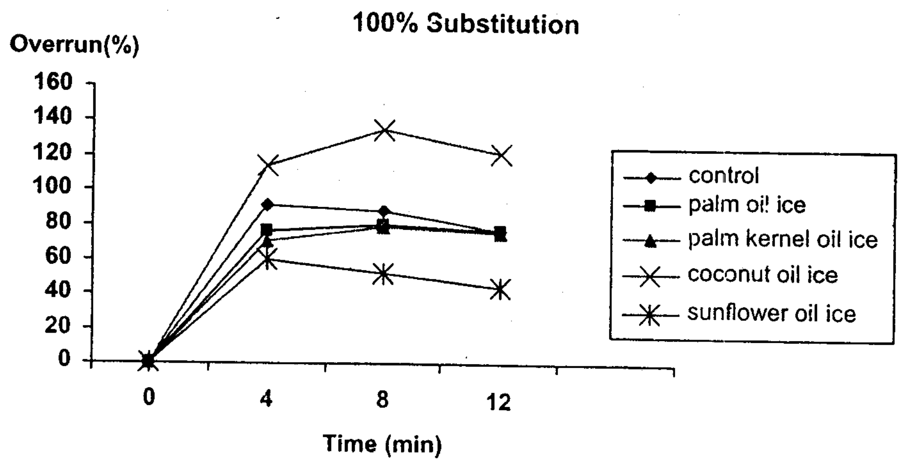

Fig (1b): Mean (percentage) of overrun values of five ice cream mixes measured at 4 min intervals.

Moreover, substitution of milk fat with vegetable oil had negligible effect on specific gravity and weight per gallon (Table 2). These results are in line with the data obtained by (Hussein and Yeasin_2005, Yousef *et al*, 1981 and Elhami *et al*, 1977).

Qualitative properties of the ice cream treatments made with vegetable oils are shown it Table (3). The ice cream made with sunflower oil (50% & 100% substitution) showed the lowest overrun % (34.4 and 30.8%, respectively) and melting resistance (31.2 & 44.3% loss after 15 min, increased to be 93.5 and 98.5% loss after 45 min) as shown in Table 3. The overrun% and melting resistance decreased with increasing the sunflower oil ratio added. While, the ice cream made with palm oil (100% substitution) had the highest melting resistance (53.3% loss after 60 min). This increase in melting resistance for palm oil ice cream might be due to high melting point of palm oil (Hui Y.H, 1996) Thus, the differences in the melting resistance of vegetable oil ice creams were mainly due to the differences in melting points of vegetable oils used in forming ice cream mixes (Goof and sbangnuolo, 2001).Moreover Im *et al*, (1994) reported lower melting resistance for ice cream made with milk fat and vegetable oil (higher content in unsaturated fatty acids) than that made with milk fat alone.

Table (3): Qualitative properties of ice cream as affected by milk fat replacement by vegetable oils

Properties	Control	Ice cream containing vegetable oil							
		Palm oil		Palm kernel oil		Coconut oil		Sunflower oil	
		50%	100%	50%	100%	50%	100%	50%	100%
pecific gravity g/cm^3	0.6746	0.6363	0.7297	0.6494	0.7022	0.7070	0.6626	0.7849	0.8208
Veight per gallon (Lb)	5.63	5.31	6.09	5.42	5.86	5.90	5.53	6.55	6.85
)verrun (%)	54.7	63.1	42	60.3	49.5	51.2	62.7	34.4	30.8
Aelting resistance Loss %									
fter 15 min	11.4	8.2	5.1	7.6	6.2	10.3	10.8	31.2	44.3
30 mi	24.3	17.8	13.3	18.3	14.8	22.9	18.7	64.3	72.4
45 mi	65.6	45.5	22.4	47.2	38.1	59.3	53.1	93.5	98.5
60 mi	98.2	78.2	53.3	74.8	69.8	86.1	81.7	-	-
at destabilization index (%)	7.24	5.56	2.15	4.32	3.98	6.94	5.95	7.4	7.98

Fat destabilization index of ice cream made with vegetable oils compared with ice cream made with milk fat (control) is shown in the same Table. Fat destabilization of the resultant ice creams was previously found to be dependant on melting point of the vegetable oils used. It decreased as melting point of the vegetable oil used increased. For instance, increased solidified fat such as palm oil (high melting point) reduces shear sensitivity of the fat in ice cream mix and thus resulted in less fat destabilization (2.15%). Whereas, increases sunflower oil (low melting point) in ice cream mix increases the susceptibility of ice cream fat to be ruptured by the shear forces (from the blades) during freezing and thus increases fat destabilization (7.98%) (Adleman and Hartel, 2002 and Rnazaruddin *et al*, 2008).

Concerning the specific gravity and weight per gallon, which depend on the mix ability to hold air bubbles in the resultant ice cream, it was observed that the weight per gallon of ice cream increased (Table 3) as a result of replacing milk fat with sunflower oil (50 & 100% substitution) and palm oil (100% substitution) (low whipping abilities, Fig 1 a, b). While, using of palm oil (50% substitution), coconut oil (100% substitution) or palm kernel oil (50% substitution) showed an opposite trend (Table 3). These data are in agreement with that of Hussein and Yasin (2005) who indicated that overrun decreased, but specific gravity and weight per gallon increased when milk fat was replaced with peanut oil.

Scores of sensory evaluation of the examined treatments of ice creams are shown in Table (4). The ice cream made with palm oil (50% substitution) characterized with smoothness and creaminess. Moreover, panelists have found no pronounced differences in appearance, melting quality and body & texture parameters among ice creams made with palm oil (50% substitution), palm kernel oil (50% substitution) or coconut oil (100% substitution). However, the ice cream made with palm oil (50% substitution) exhibited the highest flavor scores, followed by that made with coconut oil (50% substitution) and palm kernel (50% substitution) and coconut (100% substitution) (Table 4). On the other hand, the ice cream made with sunflower oil (50 & 100% substitution) had the lowest body & texture and flavor scores, because of its oily taste, weak body and fast melting down (Table 4). These results are in agreement with those obtained by Rothwell (1976), who found that oily taste and weak body have accompanied the ice cream made with vegetable oil. Similar results were reported by Hussein and Yasin (2005) who used the peanut oil in ice cream making, so, they flavored this ice cream by coffee to improve the taste of product.

Table (4): Sensory evaluation of ice cream as affected by milk fat replacement by vegetable oils

Properties	Control	Ice cream containing vegetable oil							
		Palm oil		Palm kernel oil		Coconut oil		Sunflower oil	
		50%	100%	50%	100%	50%	100%	50%	100%
Flavor (50)	47	48	44	45	43	46	45	37	33
Body & texture (30)	27	28	22	27	24	26	28	19	16
Melting property (10)	9	9	6	9	7	9	8.5	5	4
Appearance (10)	9	9	9	9	8	8	8.5	6	6
Total score (100)	91	94	81	90	82	90	90	67	54

*** Substitution percent.**

Finally, from the above mentioned results, it could be concluded that the substitution of milk fat by palm oil at the rate of 50% could be recommended in making ice cream, as it doesn't negatively affect the resultant ice cream properties. Coconut oil or palm kernel oil at the rate of 50% substitution came in the second choice in replacement of milk fat with vegetable oils.

REFERENCES

Abdou, S.M., Montasser, E.A. and Younis, H.A. (1996). Evaluation of some blends for dietetic and diabetic ice cream. Egyptian J. Dairy Sci., 24:103.

Adleman, R. And Hartel, R.W. (2002). Lipid crystallization and its effect on the physical structure of ice cream. In: Crystallization processes in fats and Lipid Systems. pp. 329-355. N. Garti and K. Sato (Ed), Marcel Dekker, Inc., NY, USA.

Al-Saleh, A.A and Hammad, Y.A. (1992). Effect of substitution of camel or cows milk fat by edible oils an ice cream quality. Annals Agric. Sci., Ain Shams Uinv., Cairo, Egypt, 37:459.

AOAC (1990). Official Methods of Analysis. (15^{th}ed.). Association official Analytical Chemists. Arlington VA., USA.

Arbuckle, W.S. (1986). Ice cream. 3rd ed. AVI publ. co., Westport, CT.

Elhami, M., Khlifa, M.Y., El-Safty, M.S. and Nofal, A.A (1977). Use of margarine in ice cream making. Egyptian J. Dairy Sci., 5:143.

El-Safty, M.S., Khalifa, M.Y., Elhami, M. And Nofal, AA (1978). Use of hydrogenated oils in ice cream making – Egyptian J. Dairy Sci., 6:81.

FAO, Regional Dairy Development and training Center for the Near East (1977). "Laboratory Manual". Spring.

Goff, H.D., (2006) Ice Cream History and Folklore. http://www.foodsci.uoguelph.ca/dairyedu/ichist.html.

Goff, H.D., and Jordan, W.K. (1989). Action of emulsifiers in promoting fat destabilization during the manufacture of ice cream. J. Dairy Sci. 72: 18-29.

Goff, H.D., and sbangnuolo p. (2001) Effect of stabilizer on fat destabilization measurements in ice cream. Milchwissenschaft 56:450 -453

Hui, Y.H, (1996). Bailey's industrial oil & Fat production volume 3 Edible oil & Fat products: products and application technology, fifth edition, Chapter 4 Shortening: Types and Formulation volume 1 edible vegetable oil.

Hussein, G.A.M. and Yasin, N.M.N. (2005). Characteristics of extracted peanut oil and impact of its use in partial replacement of milk fat on the quality of ice cream. Egyptian J. Dairy Sci., 33:279-293.

Im, J.S., Marshall, R.T. and heymann, H. (1994). Frozen dessert attributes changes with increased amount of fatty acids. J. Food Sci., 59:1222.

Jee, M. (Ed) (2002). Milk fat and other animal fats. In: Oils and fats Authentication. P.115. Blackwell publishing, CRC press.

Magdoub, M.N.I., Hammad, Y.A. and Yassen, M.M. (1991). Effect of vegetable oils on plain ice cream properties. Egyptian J. Food Sci., 19:9.

Marshall, R.T., Goff, H.D. and Hartel, R.W. (2003). Ice cream (6^{th}ed). Kluwer Academic/ Plenum publishers, London, USA.

Marshall, T. And Arbuckle, W.S. (1996). Ice cream. 5^{th} ed. Chapman and Hall, New York, NY.

Petersen, B.L.; Dave, R.I.; MC-Mahon, D.J.; Oberg, C.J. and Broadbent, J.R. (2000). Influence of capsular and ropy exopoly saccharide producing streptococcus thermophilus on Mozzarella cheese and cheese whey. J. Dairy Sci. 83:1952.

Phillips, L.G.; Haque, Z. and Kinsella, J.E. (1987). A method for the measurement of foam formation and stability. J. Food Sci. 52: 1074 – 1077.

Pitz, D.E., (1987). Lactose-free synthetic ice cream. United States patients US 4643.906.pp.3. Cited from Dairy Sci. Abst., 49:4964.

Rabie, A.M., El-Neshawy, A.A., Abdel-Baky, A.A and Metwally, S.A (1987). Effect of replacing milk fat by vegetable oils on some properties of ice cream. Egyptian J. Appl. Sci., 3:461.

Rnazaruddin, Assyaliza and Aiwan Rosnani (2008). The effect of vegetable fat on the physicochemical characteristics of dates ice cream. International J. of Dairy Technology. 61: 265-269

Rothwell, J. (1976). Ice cream – its present day manufacture and some problems. J. Soc. Dairy Technol., 29:161.

Stanley, D.W.; Goff, H.D., and Smith, A.K. (1996). Texture -- structure relationships in foamed dairy emulsions. Food research International, 29, 1-13.

Winton, A.L. (1958). "Analysis of Foods". 3rd Printing P. 6 John Wiley and Sons Inc. New York.

Yousef, A.M., Salam, A.E. And Salama, F.A. (1981). Manufacture of a high quality ice cream. II. Substitution of fresh cream fat by butter, cottonseed and corn oils. Egyptian J. Dairy Sci., 9:51.

تأثير استبدال دهن اللبن بزيوت نباتية على جودة الأيس كريم الناتج

محمد عبد الغني الأعسر

قسم علوم الألبان – كلية الزراعة – جامعة القاهرة – الجيزة – مصر

في هذا البحث تم استبدال نصف وكل دهن اللبن في مخاليط الأيس كريم بزيت النخيل أو زيت نوى النخيل أو زيت جوز الهند أو زيت عباد الشمس. ودرس تأثير الاستبدال على الخواص الطبيعية والطبيعية الكيميائية لتلك المخاليط والأيس كريم الناتج بالإضافة إلى الخواص الحسية للأيس كريم الناتج. وقد أشارت النتائج المتحصل عليها إلى ما يلي:

١-أن استبدال نصف دهن اللبن في مخلوط الآيس كريم بزيت النخيل أو زيت نوى النخيل أو استبداله بزيت جوز الهند قد أدى إلى انخفاض ملحوظ في كل من نقطة تجمد ولزوجة المخلوط مع زيادة قدرته على الخفق. في حين أن استبدال دهن اللبن كله بزيت النخيل أدى إلى زيادة كبيرة في الـ Consistency ونقطة تجمده ولزوجته الظاهرية مع انخفاض قدرته على الخفق.

٢-أن استبدال نصف أو كل دهن اللبن بمخلوط الآيس كريم بزيت عباد الشمس أدى إلى نقص شديد في قدرة المخلوط على الخفق إلى جانب انخفاض اللزوجة ونقطة التجمد والـConsistency .

٣-لم تتأثر % للحموضة ودرجة الـ pH والوزن النوعي للمخلوط ووزن الجالون منه بالرطل باستبدال نصف أو كل دهن اللبن في المخلوط بتلك الزيوت النباتية مقارنة بالكنترول.

٤-أظهر الآيس كريم المصنع بإحلال زيت عباد الشمس محل نصف أو كل دهن اللبن أدنى ريع وأدنى مقاومة للانصهار بينما الآيس كريم المحتوي على زيت النخيل أو زيت نوى النخيل (محل نصف الدهن) كان أفضل في مقاومته للانصهار عن الكنترول. في حين أدى استبدال كل دهن اللبن في مخلوط الآيس كريم بزيت النخيل (ذات نقطة الانصهار العالية) إلى زيادة مقاومة الآيس كريم الناتج للانصهار ووصول قيم عدم ثبات الدهن فيه إلى أدنى مستوى لها مقارنة بالكنترول. كما اعتمد الوزن النوعي ووزن الجالون من الآيس كريم المنتج بالرطل على مقدرة مخلوط الآيس كريم على الاحتفاظ بفقاعات الهواء أثناء الخفق والتجميد الأولي.

٥-أظهرت نتائج التقييم الحسي أن الآيس كريم المصنع بإحلال ٥٠% زيت النخيل محل دهن اللبن هو الأفضل حيث حصل على أعلى درجات التحكيم الحسي مظهراً وقواماً ومذاقاً بل وفضله المحكمون عن الكنترول بينما لم يفضل معظم المحكمون الآيس كريم المحتوي على زيت عباد الشمس لطعمه الزيتي الواضح ولضعف قوامه وسرعة انصهاره.

ومما سبق نخلص إلى أن استبدال نصف دهن اللبن في الآيس كريم بزيت النخيل كان الأفضل عن الكنترول لما لخليط زيت النخيل ودهن اللبن (١ : ١) من خصائص أكسبت الآيس كريم الناتج خصائص حسية أفضل علاوة على زيادة الريع.

كما أن استبدال نصف دهن اللبن في الآيس كريم بزيت جوز الهند أو زيت نوى النخيل يأتي في المرتبة الثانية في حين لا ينصح باستخدام زيت عباد الشمس.