J. Food and Dairy Sci., Mansoura Univ., Vol. 8 (6): 253- 256, 2017

New Healthy Imitated Ice Dairy Products

Wafaa B. Elsabie and Karima A. M. Aboel Einen
Dairy Research Department, Animal Production Research Institute, Agric. Res. Center, Dokki, Giza, Egypt

ABSTRACT

Two new types of vegan milk: sesame and peanut milk, were used in concern for producing dietary healthy product, which based on cow milk. Imitated ice dairy products mixes were standardized to contain 29% total solids. Results indicated that viscosity for vegan imitated ice dairy products mixes recorded lower values of 42.2, 34.94 cP for sesame and peanut imitated ice dairy products mix, respectively, and of 61.55 cP, for the cow milk mix as a control. Higher specific gravity and weight /gallon values were recorded for peanut and sesame imitated ice dairy products mixes, and for their resultant ice dairy. Freezing point for the sesame, peanut and cow milk mixes recorded -1.8, -1.9 and -2.1°C, respectively. Overruns of the peanut and sesame imitated ice dairy products were 44.2 and 40.2, respectively, and 52.83% for the ice dairy products produced from cow milk. Higher melting resistance of such melting imitated ice dairy products was observed for peanut and sesame imitated ice dairy products during 120 min as compared with their control. After 120 min most of control ice dairy products had melted 93.75% while only 86.75 and 25.52% sesame and peanut imitated ice dairy products were melted. Sensory evaluation exhibited higher overall acceptability scores (90,86 and 89) for peanut, sesame imitated ice dairy product and their control. Sensory evaluation, generally, proved that good quality imitated ice dairy products can be made when using different vegan as peanut and sesame milk for producing imitated ice dairy products.

Keywords: imitated ice dairy products, monounsaturated fatty acids polyunsaturated fatty acids, sesame milk and peanut milk.

INTRODUCTION

Vegan milks are naturally rich in unsaturated fatty acids, vitamins, minerals, essential fatty acids and they have a low content of saturated fatty acids. Furthermore, they are free of casein and lactose. The requirements for alternatives dairy products are extended due to the problems of lactose intolerance, cholesterol content, allergenic milk proteins and desire for vegetarian alternatives was advised by Granato, *et al*, (2010). These are the major drawbacks related to the intake of the required dairy products, which makes the development of new non-dairy essential foods. Non-dairy products may be widely explored through the development of new ingredients processes, and products. Governmental international organizations such WHO, (2010) or FAO, (2003 & 2008), recommended the reduction of the saturated fats for the development of healthier food. Oleic acid, and polyunsaturated fatty acids, such as linoleic acid have been reported to protect cardiovascular diseases, diabetes and obesity, besides others were reported by Lunn, (2007), WHO/FAO. (2003), Vafeiadou, *et al., (2012)* and Sun, (2010)

Making ice cream using unsaturated fatty acids instead of the highly saturated fat content needs to use vegan milk. Moreover, the presence of unsaturated fats normally results in ice cream with low quality, with low overrun and melting points. To overcome these problems in making ice cream, with applying healthier non-dairy fats with highly MUFAs and PUFAs, which increase the stability of the partially destabilization of the fat interface (Zulim Botega, (2013) and Zulim Botega, *et al.,* (2013). Decorticated sesame seed containing: 45-63% oil, 19- 31% proteins, about 14% carbohydrate and about 3% ash. Sesame is rich in sulfur-containing amino acids and limited in lysine and contains significant amounts of oxalic (2.5%) and phytic acids (5%) as presented by Kapadia, *et al.,* (2002). Oxalic acid in the hulls, decortication can remove most of it. Sesame seed oil is rich in unsaturated fatty acids where the fatty acids contain 14% saturated fatty acids, 39% mono-unsaturated and 46% poly-unsaturated Carbohydrates. Sesame seed are composed from 3.2% glucose, 2.6% fructose and 0.2% sucrose and the remaining quantities seem to be dietary. sesame milk also contained more polyunsaturated fatty acids, followed by peanut milk (Toma, and Tabekhia, (1979), Ibrahim *et al,* (2011), Zahra *et al,* (2014), Elsabie and Abo El Einen, (2016).

Peanut milk and peanut milk products were considered to be highly valuable in human nutrition because of their extreme richness in protein, minerals and essential fatty acids such as linoleic and oleic acids. It is extensively used in India and other developing countries by vegetarians (Kouane, *et al*, (2005).. Another factor of no less important is the growing awareness of the nutritional benefits of vegetable proteins in low cholesterol diets by health conscious people was reported by. Kouane, *et al*, (2005).

This study aimed to evaluate the possibility of producing imitated ice dairy product through using two new types of healthier vegan milk: sesame milk and peanut milk, which are rich with MUFAs and PUFAs. Also, evaluate the physicochemical properties of the mix and the produced vegan ice product was compared with their similar control from cow milk.

MATERIALS AND METHODS

Fresh cow milk was obtained from the industry unit of milk. Animal Production Research Institute, Ministry of Agriculture. Peanut and sesame seeds, skim milk powder, sugar, coca powder, and Nescafe powder were purchased from the local market; Uni-cream120 (as stabilizer and emulsifier) was supplied from united food industries co. Cairo, Egypt.

Imitated ice dairy products mixes formulation consists of peanut milk and sesame milk that was prepared as descried previously mentioned by Elsabie, and. Abo El Einen (2016), and the cow milk as a control. All treatments were adjusted with total solids around 29%. Also, all of the different treatments mixes were standardized to contain 15% sugar, stabilizer/emulsifier 0.3%, 1%coca powder, 0.5% Nescafe powder. In ice cow mix skim milk powder was added at a level of 2.5%.

Processing of the imitated ice dairy products mixes were done by Marshall, *et al*.,(2003). All ingredient were blended together and heat treated at 75 C° for 15 min.

subsequently, all mixes were cooled and kept at 4 C° for 24 h aging, then analyzed for some physicochemical properties

Imitated Ice dairy products were processed by aging different type of mixes and were whipped and frozen by a batch freezer system (Linde-Polaris 1605). The resultant imitated ice dairy products samples were packaged in plastic cups and stored at -18 C° for 24 h before physiochemical analysis. Moreover, sensory evaluations for the imitated ice dairy products treatments were conducted by panelists of dairy department at Animal Production Research Institute.

Fatty acids, total solids and protein content were determined by AOAC (2012)) as mentioned previously with Elsabie, and. Abo El Einen (2016). Fat content for the prepared vegan milk analyzed properly by AOCS. (2005). Cow milk fat content was determined using the modified Gerber method as reported by Ling, (1963). The pH values of all treatments samples were recorded using a digital pH meter (Jenway 3505 pH meter). Specific gravity of mixes and resultant ice dairy products were measured and weight per gallon was calculated. Overrun and melting resistance of the imitated ice dairy products and their control were determined according to Marshall, and Arbukle (1996). Freezing point was determined using specific thermometer. Viscosity was measured by Brookfild DV-E Viscometer, (Brookfild Engineering Laboratories, Inc, Middle boro, U.S.A.). Sensory evaluation was organoleptically assessed for flavour (50), body & texture (40), and melting quality (10) as reported by Kaul and Mathur. (1982)

RESULTS AND DISCUSSION

The procedures of this research parameters for the prepared imitated ice dairy products were presented and discussed as follows:

Data recorded in Table (1) showed that peanut mix recorded the highest pH value of 6.78, followed by sesame mix (6.54), as compared with their control pH of 6.33, (cow milk mix). Which is more likely due to their protein content in each mix.

Data in the same Table also show that the viscosity of the cow mix (control) increased after aging time 24h, and recorded 61.55 cP, in which cow milk fat started to crystallize at 5 ºC. However, unsaturated fatty acids which were in peanut and sesame fat mixes, (oleic and linoleic acid) needs more than 24 h to be solid as clarified by Marta, *et al*, (2016), who stated that unsaturated fatty acids require more aging time to be crystallize and to attain the expected increase of their viscosity.

It should also be noticed that sesame mix which contain lower monounsaturated fatty acid (Oleic acid) and higher polyunsaturated fatty acids content, (linoleic acid) as shown in (Table 2, Fig 1) recorded more viscosity value, compared with peanut mix. Moreover, the cow milk mix recorded higher viscosity value, which might be due to the different degree of fat solidity in milk fat (control) of high saturated fatty acids being in solid state at 5 C refrigerator temperature during aging time. While peanut mix, which contains more monounsaturated fatty acids, was semi-solid at 5 C as discussed by (Cosmas, (2003). It could be noticed why ice mix with 3.9% fat (control) is more solid during the ageing process, compared with peanut and sesame mixes. Such results are in agreement with Goh and Dale, (2006) and Im and Heymann. (1994). It could be pointed out that as milk fat containing high oleic fatty acid, the viscosity of the resultant product decreased, which agrees with Marta, *et al*, (2016) and Gonzalez*, et al, (2003)*

Results in Table (1 & 2) indicated that the values of specific gravity (1.099,1.094), and weight/gallon (4.161,4.142 Kg) were higher for peanut and sesame mixes, compared with their control mix (1.088, 4.119 Kg), respectively. The same trend was observed for their resultant imitated ice dairy products. It was noticed that the high values of specific gravity and weight/gallon depended on the type of milk fat which contain as more monounsaturated fatty acids (Oleic acid), Similar results were previously reported by O'Brien, (2003) and Walstra, and .Jnness, (1984).

Table 1. Physicochemical properties for the various imitated ice dairy products mixes and their control.

properties	Control	Imitated ice dairy products mixes	
	cow milk	Sesame mix	Peanut mix
Tota solids %	28.5	29	28.8
Protein %	4.6	3	3.7
Fat %	3.9	7.2	6.4
pH	6.13	6.54	6.78
Viscosity (c.P)	61.55	42.20	34.94
Specific gravity	1.088	1.094	1.099
Weight/gallon (Kg)	4.119	4.142	4.161
Freezing point C°	-2.1	-1.8	-1.9

Freezing point for sesame ice mix recorded the highest value (-1.8 °C), followed by peanut ice mix (-1.9°C) and (-2.1°C) for cow ice mix (Table 1). Such results might be due to the type of fatty acid content in each fat type of the different treatments in ice mixes. These results were proved earlier by Arbuckle, (1986). Moreover, it is noticed that freezing point increased by increasing the fat content in each type of mixes, which is in agreement with Arbuckle, (1986).

Table 2. Unsaturated fatty acids % for sesame, peanut milk and cow milk

Fatty acids	Unsaturated fatty acids%		
	cow milk	Sesame milk	Peanut milk
C18:1n9c Oleic	16.0	31.73	47.46
C18:2n6c Linoleic	3.3	44.35	34.06
MUFA*	21.52	35.32	48.52
PUFA**	1.6	44.35	34.06

MUFA*: monounsaturated fatty acids
PUFA: polyunsaturated fatty acids**

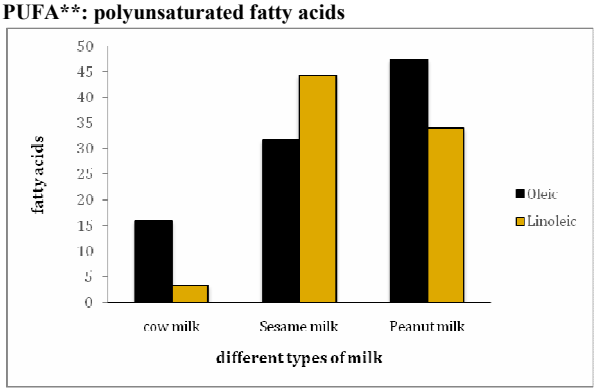

Fig. 1. Fatty acids content% of sesame, peanut and cow milk

Overrun was lower for all the different types of imitated ice dairy products (Table 3), which might be due to the low

fat destabilization produced, and due to the type of freezer being used. Similar results obtained by Goff, and Hartel (2013) and Méndez, and Goff, (2012). The foamability of the mixes decreased. Peanut and sesame imitated ice dairy product foamability were 44.2 and 40.2%, respectively, compared to the control (52.83%) for the ice dairy products produced from cow milk. The reduction of air cells are reasonable as the more monounsaturated fatty acids content (Oleic acid), which may not be enough to withstand the physical structure, which support the aeration during whipping process. Similar results were achieved by Méndez, and Goff, (2012). In other words, the decreased of foamability as the percentage of liquid fat type increased in the mix. Moreover, the low fat destabilization, is probably responsible of the low air incorporation,

Table 3. Physicochemical properties for imitated Ice dairy products and their control

Properties	control	Imitated ice dairy products	
		Sesame	Peanut
Specific gravity	0.66	0.70	0.77
Weight / gallon (kg)	2.50	2.65	2.92
Overrun %	52.83	40.2	44.2
Melting resistance as weight loss % after: 30 min.	1.09	0.026	0.026
60 min.	39.7	9.49	5.97
90 min.	82.55	48.33	17.2
120 min.	93.75	86.75	25.52

The melting rates in this study for the different treatments types of imitated ice dairy products and their control represented by percentage of mass melted after 30, 60, 90 and 120 min at 20 °C. Such data in (Table 3) showed that higher melting resistance were observed for peanut and sesame imitated ice dairy products during 120 min at 20°C as compared with the control. After 120 min most of control ice dairy products (93.75%) had melted while only 86.75 and 25.52% sesame and peanut imitated ice dairy product respectively melted. It could also be noticed that the fat particles of peanut and sesame imitated ice dairy products can hamper the incorporation of air in addition of helping the fat to stabilize the air cells in the imitated ice dairy products. This trend could be attributed to their content of more unsaturated fatty acids. Similar results were noticed by Méndez, and Goff, (2012), Dalgleish, (2006). And Goff, *et al.* (1999). The air cells are smaller and less susceptible to merge, followed by decreasing the meltdown of the imitated ice dairy products was reported by Méndez and Goff (2011) and Eisner & Jeelani. (2007).

Table 4. Sensory evaluation of the two types of imitated ice dairy products and their control.

Properties	Control	Imitated ice dairy products	
		Sesame	Peanut
Flavour (50)	47	45	47
Body&texture (40)	36	34	35
Melting resistance (10)	6	7	8
Total (100)	89	86	90

Results of the sensory evaluation revealed that imitated ice dairy products and their control having acceptable flavor which recorded in Table (4). Such scores were similar (47) for peanut imitated ice dairy product and the control, meanwhile sesame imitated ice dairy products recorded the 45 score.

Also, data showed that peanut imitated ice dairy product received the highest melting resistance scores 8 followed by sesame imitated ice dairy product (7) which was recorded as compared with the control of score 6. These results were coincided with the content of imitated ice dairy products more monounsaturated fatty acids as compared with their control as clarified previously.

Results obtained from the sensory evaluation had a higher overall acceptability scores 90,89 and 86 for peanut ice dairy product control and sesame imitated ice dairy product respectively.

Presented sensory evaluation generally proved that good quality imitated ice dairy products can be made when using vegetarian milk as peanut and sesame milk.

CONCLUSION

Results clarified that vegan milk, like sesame and peanut milk, were successfully made and used for the manufacture of healthy imitated ice dairy products. Fresh mixes which obtained from sesame and peanut milk proved almost similar trend compared to the mix which produced with cow milk (control). The overrun for the control was 53.83,whereas it was 44.2 and 40.2 for peanut and sesame imitated ice dairy products. Despite the differences in overrun and their solid fat content, the melting rate of the unsaturated fat in sesame and peanut imitated ice dairy products decreased compared to their control this is because of the developed structure during ice dairy products production. The obtained results in this work, are of great beneficial and interest for producing healthier imitated ice dairy products.

REFERENCES

AOAC, 2012. Official method of analysis, Kjeldahl method No.984.13, chapter 4, P.31, 19th Ed.

AOCS. (2005). ANKOM Technology Method, Official Procedure Am 5-04.

Arbuckle, W.S. (1986). Ice cream. Third ed. Avi Publishing Co. Inc. Westport.

Cosmas,H.O. (2003). The Benefits of Omega 3 Fatty acids found in Seal oil. As opposed to Fish and flaxseed oils Chapter 11 Basic Chemical Structures Amongst Fats.

Dalgleish, D. G. (2006). Food emulsions – their structures and structure- forming properties. Food Hydrocoll. , 20, 415–422.

Eisner, M. D., and S.A.K. Jeelani. (2007). Bernhard, L., Windhab, E. J., Stability of foams containing proteins, fat particles and nonionic surfactants. Chem. Eng. Sci. 62, 1974–1987.

Elsabie,W.B. and K.A.M. Abo El Einen. (2016). Comparative evaluation of some physicochemical properties for different types of vegan milk with cow milk. J.Food and Dairy Sci., Mansoura Univ., Vol.7 (11): 457-461

Food and Agricultural Organization of the United Nations. (2008). Fats and fatty acids in human nutrition.

Goff, H. D and R.W.Hartel. (Eds.), (2013). Ice Cream, 7th Edn., Springer, New York .

Goff, H. D., E.Verespej and A.K.A.Smith. (1999). Study of fat and air structures in ice cream. Int. Dairy J, 9, 817–829.

Goh, K.T.K., Ye,A. and N.Dale. (2006). Characterization of ice cream containing flaxeed oil. Int. J. of Food Sci. and Technology, 41,946-953.

Gonzalez, s., Duncan,S.F., O'Keefe and S.S.Sumner. (2003).Oxidation and textural characteristic of butter and ice cream with modified fatty acid profiles J. Dairy Sci. 86,70-77.

Granato, D., G.F Branco., F. Nazzaro, , A.G. Cruz., and J.A. Faria. (2010). Functional foods and non-dairy probiotic food development: trends, concepts, and products. Compr. Rev. Food Sci. Food Saf. 9 (3), 292–302.

Im,J.S.,R.T and H.Heymann. (1994). Frozen Dessert attribute change with increased amounts of unsaturated fatty acids. J. of Dairy Sci., 59,6:1222-1226.

Kapadia, G.J., M.A. Azuine, H. Tokuda, M. Takasaki, T. Mukainaka, T. Konoshima and H. Nishino. (2002). Chemopreventive effect of resveratrol, sesamol, sesame oil and sunflower oil in the epstein-barr virus early antigen activation assay and the mouse skin two-stage carcinogenesis. Pharmacol. Res., 45: 499-505.

Kaul, J. and K.B.Mathur. (1982). Development and assessment of unfermented ice containing Lactobacillus acidophilus Indian. J. Dairy Sci.35:3

Kouane, D., G. Zhang., and J.Chen. (2005). Peanut milk and peanut milk based products production. A review. Critical Reviews in Food Science and Nutrition, 45, 405–423.

Ling, E.R. (1963). A textbook of Dairy Chemistry practical 4th Ed. Chapman and Hall, Ltd London.

Lunn, J. (2007). Monounsaturates in the diet. Nutr. Bull. 32, 378–391.Wiley Online Library

Marshall, R. T., H. D Goff and R. W. Hartel. (2003). Ice Cream. 6th ed Kluywer Academic/plenum publishers, New York.

Marshall,R.T. and W.S. Arbukle. (1996). Ice cream, Fifth Edition. Chapman and Hall. Int. Thomson Pub.

Marta. M-Suárez., P.J.García-Moreno., M.Padial-Domínguez., A. Guadix and E.M.Guadix. (2016).Production and characterization of ice cream with high content in oleic and linoleic fatty acids. European J of Lipid Sci and Tech.C.F Willy online library.

Méndez-Velasco, C and H.D. Goff. (2011). Enhancement of fat colloidal interactions for the preparation of ice cream high in unsaturated fat. Int. Dairy J. 21, 540–547.

Méndez-Velasco, C and H.D.Goff. (2012). Fat structures as affected by unsaturated or saturated monoglyceride and their effect on ice cream structure, texture and stability. Int. Dairy J., 24, 33–39.

O'Brien,R.D. (2003). Fats and Oils: Formulating and Processing for Application Editions: 2, illustrated Published by CRC press.

Report of a Joint WHO/FAO. (2003). Expert Consultation, Diet, Nutrition and the Prevention of Chronic Diseases, Geveva .

Sun, Z. (2010). Quality assessment and improvement in diabetes care-an issue now and for the future. Diabetes. Metab. Res. Rev, 26, 446–447.

Toma, R.B. and M.M. Tabekhia. (1979). Phytate and oxalate contents in sesame seed. Nutr. Rep. Int., 20: 25-31. http://www.scribd.com/doc /5340623/Handbook-of- Herbs-and-Spices-V olume-2

Vafeiadou, K., M. Weech., V.Sharma and P. Yaqoob. (2012). A review of the evidence for the effects of total dietary fat, saturated, monounsaturated and n-6 polyunsaturated fatty acids on vascular function, endothelial progenitor cells and microparticles. Br. J. Nutr. 107, 303–324.

Walstra, P. and R.Jnness. (1984). Dairy Chemistry and Physics. John Willey and Sons, New York U.S.A.

Wiley Online Library WHO. (2010). Set of recommendations on the marketing of foods and non-alcoholic beverages to children,

Zulim Botega, D. C. (2013). Marangoni, A. G., Smith, A. K., Goff, H. D., Development of formulations and processes to incorporate wax oleogels in ice cream. J. Food Sci., 78, 1845–1851.

Zulim Botega, D. C., A. G. Marangoni., A.K. Smith and H. D. Goff. (2013). The potential application of rice bran wax oleogel to replace solid fat and enhance unsaturated fat content in ice cream. J. Food Sci., 78, 1334–1339.

مشابه صحى جديد للمنتجات اللبنية المثلجة

وفاء بديع السبع و كريمة أبو العينين مصطفى

قسم كيمياء بحوث الالبان، معهد بحوث الانتاج الحيوانى، مركز البحوث الزراعية

إنتاج مشابة صحى جديد للمنتجات اللبنية المثلجة باستخدام أنواع جديدة من االلبن النباتي: لبن السمسم ولبن الفول السوداني، ومقارنتة مع المنتج من اللبن البقرى. تم توحيد مخاليط شبية المنتجات اللبنية المثلجة على اساس 29٪ إجمالي المواد الصلبة. أشارت النتائج إلى أن مخلوط شبية المنتجات اللبنية المثلجة سجل قيم أقل فى اللزوجة 42.2، 34.94 cP للسمسم والفول السوداني على التوالي مقارنة بالكنترول 61.55 cP. ' وسجل مخلوط شبية المنتجات اللبنية المثلجة لكل من الفول السودانى والسمسم قيم أعلى فى الوزن النوعي والوزن / جالون. نقطة التجمد لمزيج السمسم والفول السوداني والكنترول سجلت (-1.8، -1.9 و -2.1 درجة مئوية) على التوالي. وبلغت نسبة الريع لشبيه المنتجات اللبنية المثلجة الفول السوداني والسمسم (44.2 و 40.2 على التوالي)، و 52.83٪ للكنترول. اظهرت النتائج زيادة مقاومة الآنصهار لشبيه المنتجات اللبنية المثلجة الفول السوداني والسمسم بعد 120ق مقارنة بالكنترول .حيث سجل الكنترول أعلى انصهار 93.75% بعد 120ق يلية السمسم 86.75 ثم الفول السودانى 25.52% . التقيم الحسى اظهر اعلى درجات كانت على التوالى لشبية المنتجات اللبنية المثلجة الفول السودانى يلية الكنترول ثم السمسم (90و89و86) على التوالى. عموما أثبت التقييم الحسي أمكانية انتاج مشابة صحى جديد للمنتجات اللبنية المثلجة ذو خصائص جيدة باستخدام البان نباتية مختلفة مثل لبن الفول السوداني و لبن السمسم .