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EFFECT OF USING FAT MIMETICS ON THE RHEOLOGICAL AND SENSORY PROPERTIES OF LOW-FAT ICE CREAM

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ABSTRACT

Effect of carbohydrate based fat mimetics (1, 2 and 3% inulin or 0.5, 1.0 and 1.5% pea fiber) on the rheological properties and sensory evaluation of low-fat ice cream containing 3% fat (LF) were studied in comparison with ice cream containing 6% fat (COHF) and low-fat ice cream containing 3% fat (COLF) as controls. Addition of fat mimetics significantly increased the viscosity, adhesiveness, cohesiveness, gumminess, chewiness, melting resistance and overrun, while the hardness, elasticity, specific grarvity and weight per gallon were reduced. The measurements of rheological properties correspondent well with the sensory scores. The COHF and LF ice cream containing 2 or 3% inulin had the greatest creamy mouthfeel and the best texture characteristics. On the other hand, the low-fat ice cream containing 1.5% pea fiber had the lowest level of detrimental flavours.

INTRODUCTION

One of the growing sectors within the food industry is the production of 'light products' i.e. food products with a reduced fat content. Consumers are looking for reduced fat and fat-free products that have acceptable taste and appearance (Christensen, 1989 and International Dairy Foods Association, 1996). Ice cream is characterized by unique physical properties, such as hardness and melting properties, which are influenced by ingredients as fat content. Milk fat is an important determinant of the especially body and texture of ice cream also, the fat is the main carrier of flavour for many compounds (Berger, 1990; Plug & Haring, 1993 and Marshall & Arbuckle, 1996). Fat mimetics continues to be a challenge and the availability of ingredients to assist in the development of fat reduced foods in recent years (Kailasapathy and Songvanich, 1998). In addition, the fat mimetics should match the texture, mouthfeel, and functionality of fat in the food products and should convey the desired flavour profile (Ohmes *et al.*, 1998). Inulin and pea fiber, are currently used in low-fat formulations for fat and sugar replacement as a low caloric bulking agent and because they produced minimal negative effects on ice cream production, rheological properties and price (Schmidt *et al.*, 1993; Kailasapathy & Songvanich, 1998; Ohmes *et al.*, 1998 and Devereux *et al.*, 2003); also, they do not demand any major technological changes in the production process (Blomsma, 1997 and Schaller-Povolny & Smith, 1999). They are preferred for its physiological features of being soluble dietary fiber and having prebiotic properties (Ernst & Feldhein, 2000 and Causey *et al.*, 2000).

The current study was undertaken to investigate the use of inulin and pea fiber as fat mimetics in the manufacture of low-fat ice cream and to determine their effects on the physical, rheological and organoleptic properties of low fat ice cream.

MATERIALS AND METHODS

Materials:

- Spray dried skim milk (Poland), vanillin (China), carboxy methyl cellulose (CMC, El-Naser Pharmaceutical Chemicals Co.), sugar and buter oil were obtained from local markets.
- Fat memitics:

Inulin (FRUTAFIT HD) was obtained from Calleva Limited, England and pea fiber (Exafine) from Cosucra S.A., Chaussee de la Sucrerie, 5, B-7643 Fontenoy (Belgium) England.

Preparation of ice cream:

Skim milk powder was prepared to give 12% milk solids not fat (MSNF) in the mix. Sugar and CMC were added to the mix at the ratio of 16 and 0.5%, respectively with continous agitation. Butter oil was added to prepare a full fat ice cream containing 6% fat (COHF) and low fat ice cream containing 3% fat (COLF). Inulin was added to low fat ice cream (LF) mixes at the level of 1, 2 and 3%, while pea fiber was added at the level of 0.5, 1.0 and 1.5% (the concentration of fat mimetics were recommended from preliminary experiments). Mixes were heated at 80°C for 5 min., then homogenized at two stages (3000 and 500 psi) using homogenizer from ALFA-LAFAL HOYER S.P.A. [Via Monterrato 52-20098 San Jioliano Milanese (ML) Italia]. The mix was rapidly cooled at 5°C and aged at this temperature overnight. Vanilla was added at level of 0.025% for all treatments. Each batch was frozen in ice cream freezing machine (Promage, S.P.A. via Romagna, 12-20098 San Jioliano Milanese (ML) Italia. The resultant ice cream was packed in 100 ml plastic cups, covered and stored at -18°C for hardening. The ingredients of ice cream mixes are shown in Table (1).

Table (1): Composition of ice cream mixes.

Components (%)	Treatments							
	Controls		Inulin (%)			Pea fiber (%)		
	6% fat	3% fat	1	2	3	0.5	1.0	1.5
Milk fat	6	3	3	3	3	3	3	3
MSNF	12	12	12	12	12	12	12	12
Sugar	16	16	16	16	16	16	16	16
Fat mimetics	-	-	1	2	3	0.5	1.0	1.5
CMC	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
T.S.	34.5	31.5	32.5	33.5	34.5	32.0	32.5	33.0

Methods of analysis:

The specific gravity, weight per gallon and overrun were determined according to Arbuckle (1986). Apparent viscosity of ice cream was carried out after 24 hr hardening using a Brookfield Rheometer Model-DV-III at 5°C

Spindle DIN-I using a step wise program with 0.1 rpm steps from 0.2 to 2 rpm, readings every 10 sec. Melt-down rate was determined by left the samples to melt (at room temperature) on a 1 cm wire mesh screen above a beaker following methods of Huse *et al.* (1984). The weight of drip was recorded every 2 min. during 66 min.

Texture profile analysis:

All samples were tempered at room temperature. The texture profile analysis was measured using the Instron 4300 series, Universal Testing Machine, Model 4301-5 KN from Instron limited, Coronation Road, High Wycombe, Bucks, HP12 35Y, England. The load cell 10 Neutin (N), load range 0-5 N. A plunger with 6 mm diameter was attached to the moving crosshead. The speed of the crosshead was set at 60 mm/min in both upward and downward directions. The penetration of the plunger into the sample was set 25 mm deformation. By using Instron machine, the following texture measurements could be calculated and recorded as: hardness, elasticity, adhesiveness, cohesiveness, gumminess and chewiness according to Chen *et al.* (1979).

Organoleptic properties:

The organoleptic properties for resultant ice cream were assessed by 15 panelists from the staff members of Food Sci. Dept., Fac. of Agric. Moshtohor, Zagazig Univ., for flavour (50 points), body & texture (30 points), melting properties (10 points) and colour (10 points).

Statistical analysis:

Statistical analysis for the obtained data were done according to the methods described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

-Ice cream properties:

Overrun, specific gravity and weight per gallon:

The results in Table (2) indicated that the overrun of LF ice cream was increased significantly ($P \leq 0.05$) by increasing the level of fat mimetics. The highest overrun was obtained in LF ice cream treated with 3% inulin, while the lowest overrun was noticed in COHF ice cream. This may be due to that the fat mimetics contains hydrophilic groups which are able to interact with water phase (Rolin and De Vries, 1990). However, the use of inulin and pea fibers had slight effect on specific gravity and weight per gallon (Kg), the increase in overrun led to a decrease in specific gravity and weight per gallon. These results are in line with the findings of Mahran *et al.* (1984), Salem & Mowafy (2001), Salem *et al.* (2003) and Salama & Azzam (2003).

Viscosity:

The level of fat mimetics mainly depends on the wanted viscosity in the end product and how much fat should be removed from the product (Christensen, 1989).

Table (2): Effect of fat mimetics on the properties of low-fat ice cream.

Properties	Treatments								L.S.D at 0.05
	Controls		Inulin (%)			Pea fiber (%)			
	6% fat	3% fat	1	2	3	0.5	1.0	1.5	
Over run %	45.45	47.11	49.80	51.20	52.6	47.68	48.70	49.60	0.63
Specific gravity (g/cm^3)	0.852	0.811	0.791	0.770	0.744	0.805	0.794	0.782	0.006
Weight/gall (kg)	3.22	3.11	3.00	2.92	2.86	3.02	2.97	2.91	0.04

All fat mimetics significantly ($P \leq 0.05$) increased the viscosity of ice cream as compared to the COLF ice cream. Almost the effect of inulin was more effective than pea fiber. Inulin and pea fiber contributed in the highest viscosity of low fat ice cream (Fig., 1) as a result of its colloidal hydrophilic abilities. In addition, it incorporates water with hydrophobic interactions and hydrogen bonds to gel network (Christensen, 1989; Rolin & De vries, 1990; Vani & Zayas, 1995 and Salama & Azzam, 2003).

In a similar study on yoghurt or sour cream, appearent viscosity increased in samples containing carbohydrate-based fat replacer (Kosikowaska *et al.*, 1979 and Adapa and Schmidt, 1998).

Meltdown:

The COHF ice cream sample (Fig., 2) showed the greatest melting resistance (expressed as the lowest value of meltdown), while COLF ice cream gave the lowest values. This may be due to that the fat content greatly affects the melting properties of the ice cream. Increasing the fat content of ice cream caused an increase ($P \leq 0.05$) in the melting resistance of ice cream. Yackel & Cox (1992), Kailasapathy & Songvanich (1998) and Roland *et al.* (1999) reported that the effect of fat on melting property can be attributed to the higher melting point of animal fat near 38°C.

Unlike the other treatments, the melting resistance of the LF ice cream made with 3% inulin was nearly similar to that of the COHF ice cream. This was a result of its ability to increase the viscosity of the continuous phase, thus, retarding the separation during meltdown (Specter & Setser, 1994). Generally, ice cream made with fat mimetics melted significantly more slowly than the COLF ice cream. These results agree with Kailasapathy & Songvanich (1998) and Ohmes *et al.* (1998). The effect of inulin is based on its ability to hold water into a creamy structure which led to high viscosity of the mix and a slow rate of melting (Giese, 1996; Blomsma, 1997 and Ohmes *et al.*, 1998).

Hardness:

Hardness describes the force necessary to attain a given deformation (Rawson & Marshall, 1997).

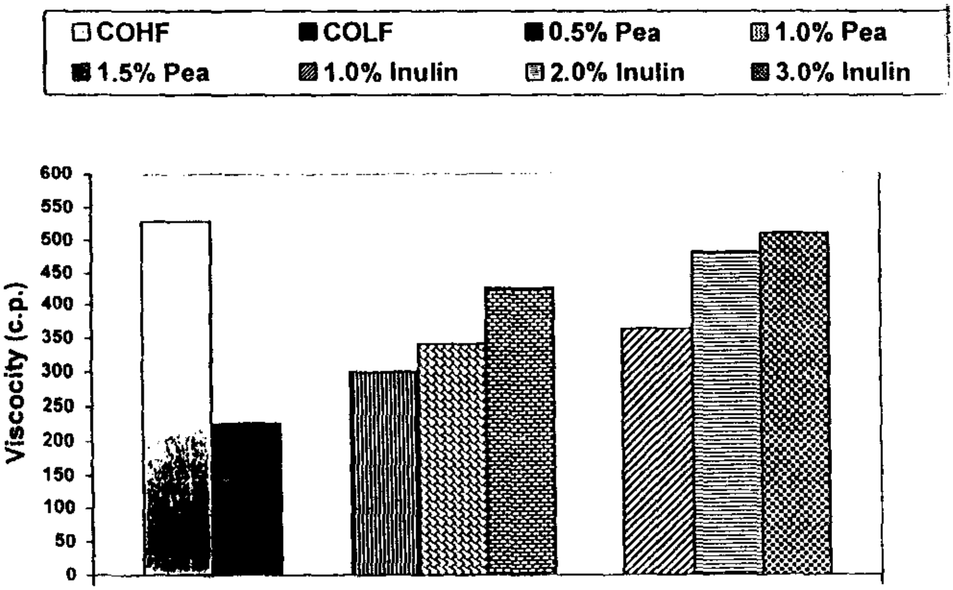

Fig. (1): Effect of fat mimetics on the ice cream viscosity.

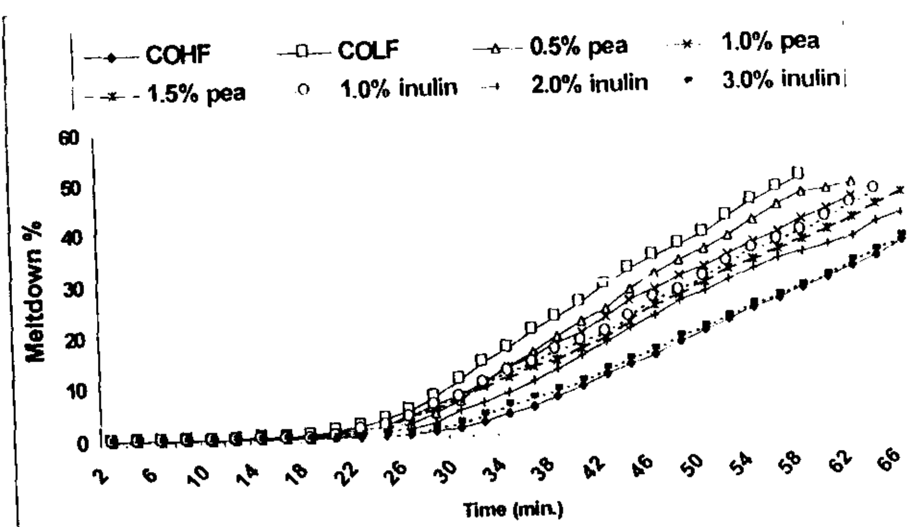

Fig. (2): Effect of fat mimetics on the ice cream meltdown.

Hardness (Fig., 3a) would seem to be negatively influenced by the presence of increased amounts of fat mimetics compared with COLF ice cream ($P \leq 0.05$). These results show that the more fat mimetics there is, the less hard is the product. This decrease in hardness may infer that excess carbohydrate material can interfere with structure development and partly prevents strand formation and protein-protein interactions thereby reducing the strength of the resulting product. This suggests that it is the protein network, which is more important to structure (Rawson and Marshall, 1997).

Reducing fat content in dairy products caused some changes in characteristics, resulting in a much hard and less smooth texture (Fusarpoli, 1989 and Roland *et al.*, 1999).

Elasticity:

Elasticity is the rate at which the deformed material goes back to its undeformed condition after the deforming force has been removed (Rawson and Marshall, 1997).

Figure (3b) shows that all treatments of LF ice cream made with fat mimetics had lower elasticity ($P \leq 0.05$) than COLF ice cream. This may be due to that fat mimetics can provide some physical properties as fat with regards to form a soft structure (Anon, 1994 and Kailasapathy & Songvanich, 1998). Also, reducing fat content may exhibit a firm rubbery texture (Banks *et al.*, 1989 and Anderson & Mistry, 1994). Hardness and elasticity are due to formation of a three dimensional milk protein matrix (Marshall & Rawson, 1999); fat mimetics can improve these properties.

Adhesiveness:

Adhesiveness is the work necessary to overcome the attractive forces between the surface of the product and the surface of other materials with which it comes in contact (Rawson & Marshall, 1997).

Figure (3c) shows that the LF ice cream made with fat mimetics are significantly most 'adhesive' than the COLF ice cream, which indicate a contribution of fat mimetics to the tendency of these samples to become associated with the surfaces of other materials. This an important factor for the description of good 'mouthfeel' for givin food material (Rawson & Marshall, 1997). Similar results were reported by Adapa & Schmidit (1998), Marshall & Rawson (1999), El-Nagar & Brennan (2001) and El-Nagar & Kuri (2001).

Cohesiveness:

Cohesiveness describes the extent to which a material can be deformed before it ruptures (Rawson & Marshall, 1997).

Values for cohesiveness (Fig., 3d) were significantly higher for LF ice cream made with fat mimetics compared to COLF ice cream. This finding is supported by the earlier work of Toba *et al.* (1990), who found that cohesiveness increases when carbohydrate-based fat replacers used. The fat mimetics must impart cohesiveness to the product without reducing the capability of the ice cream to be scooped (Roland *et al.*, 1999). The instrumental values for viscosity and cohesiveness had high correlation, while hardness correlated only with elasiticity (Rawson & Marshall, 1997 and Marshall & Rawson, 1999).

Gumminess and chewiness:

It is also noticeable from (Fig., 3e and f) that gumminess and chewiness are significantly greater for LF ice cream made with fat mimetics than the COLF ice cream ($P \leq 0.05$). This may be due to that the fat mimetics enhanced gumminess and chewiness for the dairy products (Waller, 1993; Adapa & Schmidt, 1998; Kailasapathy & Songvanich, 1998 and Ohmes *et al.*, 1998).

Generally, reducing fat from dairy products has an adverse effect on the body and texture of the resultant products. The addition of inulin and pea fiber (in the range of used levels) can be remedy these defects, thus, the resultant low fat ice cream took the same trends with COHF ice cream. The fat mimetics should match the texture and functionality of fat in the food products (Ohmes *et al.*, 1998).

Organoleptic properties:

Table (3) shows the effect of fat mimetics on organoleptic properties of LF ice cream compared with COHF ice cream. The results obtained show that the addition of fat mimetics especially inulin significantly ($P \leq 0.05$) improved, flavour, body & texture, melting properties and colour. COHF ice cream and LF ice cream treated with 2 or 3% inulin had the highest scores, while the LF ice cream treated with 1.5% pea fiber recorded the lowest scores. This is due to the negative effect of high concentration of pea fiber on the taste and colour of final product. These results are in agreement with the findings of Tungland (2000), who reported that inulin had functional properties to act as a fat replacer without adversely affecting flavour. Causey *et al.* (2000) reported that acceptable low-fat vanilla ice cream could be made by incorporating inulin. El-Nagar and Kuri (2001) also reported that addition of inulin improved all sensory characteristics of frozen yoghurt. Moreover, Salem *et al.* (2003) reported that the addition of Jeursalem Artichoke (JA) paste which containing 9.76% inulin to replace up to 50% of the fat in ice cream improved the scores of flavour, body & texture and melting properties of the obtained product.

Table (3): Effect of fat mimetics on the organoleptic properties of low-fat ice cream.

Properties	Treatments								L.S.D. at 0.05
	Controls		Inulin (%)			Pea fiber (%)			
	6% fat	3% fat	1	2	3	0.5	1.0	1.5	
Flavour (50)	47.2	41.8	46.0	49.2	49.3	44.2	42.7	36.2	0.92
Body & texture (30)	28.8	25.6	27.8	29.5	29.6	27.4	28.0	28.3	0.66
Melting quality (10)	9.0	7.8	8.3	9.2	9.1	8.0	7.4	6.0	0.46
Colour (10)	8.6	8	8.1	9.1	9.2	8.0	7.3	6.0	0.41
Total (100)	93.6	83.2	90.2	97.0	97.2	87.6	85.4	76.5	1.14

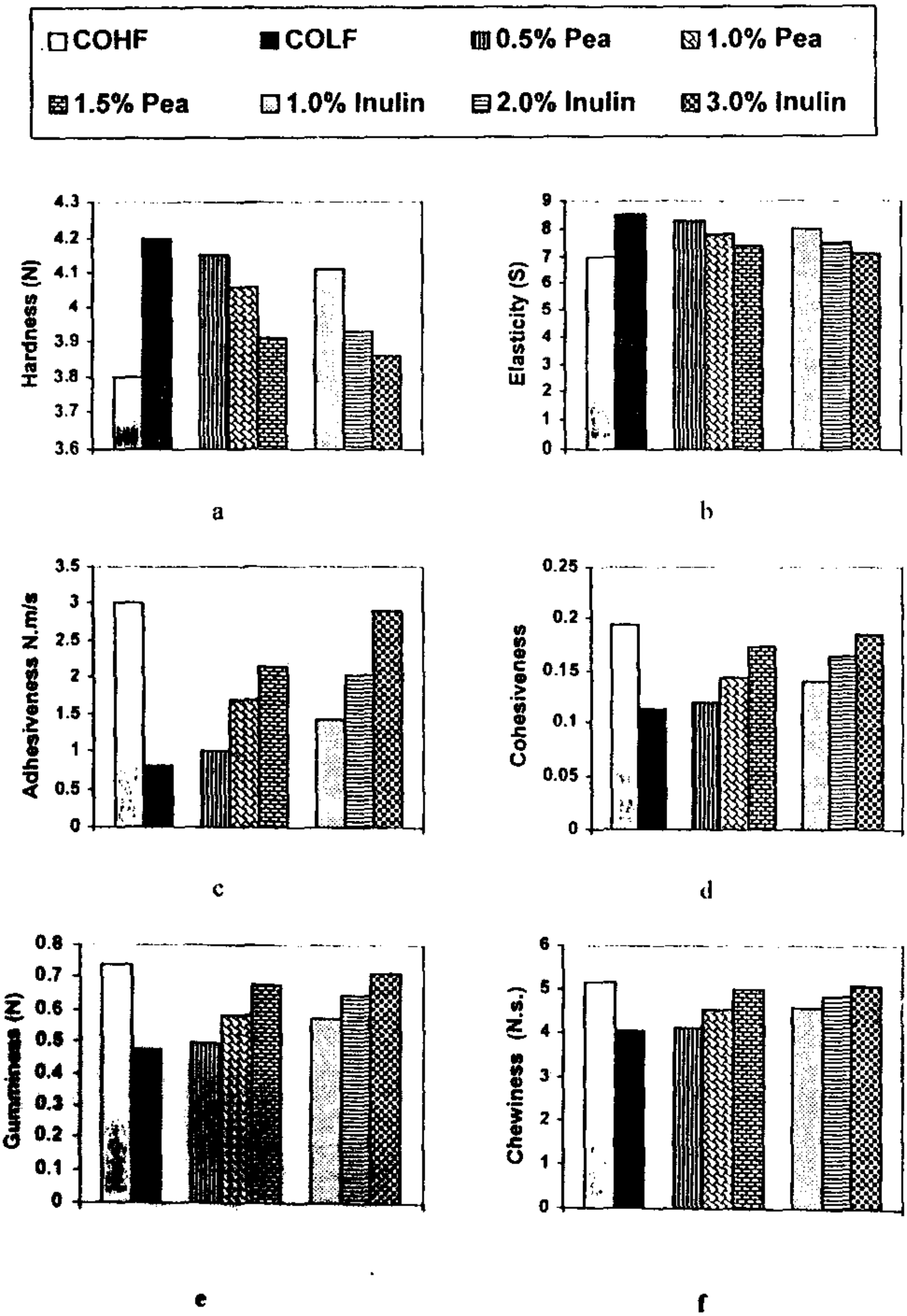

Fig. (3): Effect of fat mimetics on rheological properties of ice cream

CONCLUSIONS

The results obtained showed the importance of using fat mimetics (inulin and pea fiber) in LF ice cream, not only for enhancing texture characteristics but also for improving organoleptic properties such as mouthfeel and taste. It can be recommended that we can manufacture LF ice cream with good quality by using 2 or 3% inulin in the mix.

REFERENCES

Adapa, S. and Schmidt, K.A. (1998): Physical properties of low-fat sour cream containing exopolysaccharide-producing lactic acid bacteria. J. of Food Sci., 63(5): 901-903.

Anderson, D.L. and Mistry, V.V. (1994): Reduced fat Cheddar cheese from condensed milk. 2-Microstructure. J. Dairy Sci. 77(1): 7-15.

Anon (1994): Slendid-Background information and user guidelines. Copenhagen Pectin A/S, DK-4623 Lille Skensved. Denmark.

Arbuckle, W.S. (1986): Ice cream, 4th Ed., the AVI publishing Co. Inc. West Port. Connecticut, U.S.A.

Banks, J.; Brechany, M.E.Y. and Christie, W.W. (1989): The production of low fat Cheddar type cheese. J. of the Society of Dairy Technol. 42(1): 6-9.

Berger, K.G. (1990): Ice cream. Page 367 in Food Emulsions. 2nd Ed. K. Larsson and S.E. Friberg, Ed. Marcel Dekker, Inc., New York, NY.

Blomsma, C.A. (1997): A review of commercial application. International Food Ingredient. March/April pp. 22-23.

Causey, J.L.; Feirtage, J.M.; Gallaher, D.D., Tungland, B.C. and Slavin, J.L. (2000). Effects dietary inulun on serum lipids, blood glucose and the gastrointestinal environment in hypercholesterolemic men. Nutrition Research, 20: 191.

Chen, A.H.; Larkin, J.W.; Clark, C.J. and Irwin, W.E. (1979): Textural analysis of cheese. J. Dairy Sci. 62: 901-907

Christensen, L.C. (1989): The use of pea fiber as fat replacement. Food Ingredients Euro-Conf. Proc. 206-210.

Devereux, H.M.; Jones, G.P.; Mc Cormack, L. and Hunter, C. (2003): Consumer acceptability of low fat foods containing inulin and oligofructose. J. of Food Sci. 68(5): 1850.

El-Nagar, G.F. and Brennan, C.S. (2001): The influence of fiber addition on texture and quality of stirred yoghurt. Proc. 8th Egyptian Conf. Dairy Sci. and Technol., 505-523.

El-Nagar, G.F. and Kuni, Y. (2001): Rheological quality and stability of yog-ice cream with added fibers. Proc. 8th Egyptian Conf. Dairy Sci. and Technol. 525-536.

Ernst, M. and Feldhein, W. (2000): Fructions higher plants and in human nutrition. Angewondte. Botanic. 74(1/2): 5-9.

Fusarpoli, F. (1989): Study on rheological characteristics in low fat Mozzarela cheese. Thesis, universita Degli State Milano, pp 38-39.

Giese, J. (1996): Fats, oil and fat replacers. Food Technol., 50-78.

Huse, P.A.; Towler, C. and Harper, W.J. (1984): Substitution of non-fat milk solids in ice cream with whey protein concentrate and hydrolyzed lactose. New Zealand J. of Dairy Sci. and Techol., 19: 255-261.

International Dairy Foods Association (1996): Page 21 in The Latest Scoop. Int. Dairy Foods Assoc., Washington, D.C.

Kailasapathy, K. and Songvanich, W. (1998): Effects of replacing fat in ice cream with fat mimetics. Food Australia 50(4), April.

Kosikowska, M.; Lipenska, E.; Jakubezyk, E.; Bijok, F.; Lucznska, M.; Wajnert, T.; Kazimieczak, W. and Lipiewska, D. (1979): Influence of slime forming bacterial strains on the rheological properties of yoghurt. Dairy Sci. Abstr., 41: 110.

Mahran, G. A.: El-Ghandour, M.A.; El-Bagoury, E.H. and Sayed, A.F. (1984): Effect of skim milk powder storage on ice cream quality. Egypt. J. Dairy Sci., 12: 267.

Marshall, R.T. and Arbuckle, W.S. (1996): Ice cream. 5th Ed. Chapman & Hall, New York, NY.

Marshall, V.M. and Rawson, H.L. (1999): Effects of expopolysaccharide-producing strains of thermophilic lactic acid bacteria on the texture of stirred yoghurt. International J. of Food Sci. and Technol., 34: 137-143.

Ohmes, R.L.; Marshall, R.T. and Heymann, H. (1998): Sensory and physical properties of ice cream containing milk fat or fat replacers. J. dairy Sci., 81: 1222-1228.

Plug, H. and Haring, P. (1993): The role of ingredient-flavour interactions in the development of fat-free foods. Trends Food Sci. Technol., 4: 150-152.

Rawson, H.L. and Marshall, V.M. (1997): Effect of 'ropy' strains of *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus* on rheology of stirred yoghurt. International J. of Food Sci. and Technol., 32: 213-220.

Roland, A.N.N.M.; Phillips, G.L. and Boor, J.K. (1999): Effects of fat replacers on the sensory properties, color, melting and hardness of ice cream. J. Dairy Sci., 82: 2094-2100.

Rolin, C. and De Vries, J. (1990): Pectin. In: "Food gels" P. Harris (Ed.). Elsevier App. Sci., New York.

Salama, F.M.M. and Azzam, M.A.A. (2003): The use of wheat germ in the manufacture of ice milk. Egypt. J. Dairy Sci., 31: 389-398.

Salem, A.S. and Mowafy, A.R. (2001): Production of ice cream fortified with antioxidants (lycopene and B. carotene) as a functional food. Annals of Agric. Sci. Moshtohor, 39: 2103.

Salem, A.S.; Abd El-Salam, A.M. and El-Shibiny, S. (2003): Preparation and properties of low fat and low sugar functional ice cream varieties. Egypt. J. Dairy Sci., 31: 399-409.

Schaller-Povolny, L.A. and Smith, D.E. (1999): Sensory attributes and storage life of reduced fat ice cream as related to inulin content. J. of Food Sci., 64(3): 555-559.

Schmidt, K.; Lundy, A.; Reynolds, J. and Yee, L. (1993): Carbohydrate or protein based fat mimicker effects on ice milk properties. J. Food Sci., 58: 761-763.

Snedecor. G.W and Cochran, W.G. (1980) Statistical methods 17th Ed. Iowa State Univ. Press Ames., Iowa, USA.

Specter, S.E. and Setser, C.S. (1994) Sensory and physical properties of a reduced-calorie frozen dessert system made with milk fat and sucrose substitutes. J. Dairy Sci., 77(3): 708-717

Toba, T., Nakajima, H.; Tobitani, A. and Adachi, S. (1990): Scanning electron microscopic and texture studies on characteristic consistency of Nordic ropy sour milk. International J. of Food Microbiology, 11: 167-172.

Tungland, B. (2000): A call for dietary fiber status for inulin. Cereal Food World, 45: 415.

Vani, B. and Zayas, J.F. (1995): Wheat germ protein flour solubility and water retention. J. Food Sci., 60: 845.

Walter, T. (1993): New application specific fat replacers for the dairy industry. Int. Food Ingredients, No. 4: 29-32

Yackel, W.C. and Cox, C. (1992): Application of starch-based fat replacers. Food Technol., 46(6): 146-147

تأثير استخدام مقلدات الدهن على الخواص الريولوجية والحسية للأيس كريم منخفض الدهن

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تهدف هذه الدراسة إلى إنتاج ايس كريم منخفض في نسبة الدهن (٣%) وعلى درجة عالية من الجودة ويشابه في خواصه الريولوجية والحسية الأيس كريم المرتفع في نسبة الدهن (٦% دهن) وذلك باستخدام مقلدات الدهن من أصل كربوهيدراتى حيث أضيف inulin بتركيزات ١، ٢ و ٣% بينما أضيف pea fiber بنسبة ٠,٥، ١,٠ و ١,٥% للأيس كريم منخفض الدهن وقد اوضحت الدراسة أهم النتائج التالية:

١. إضافة الألياف إلى مخلوط الأيس كريم منخفض الدهن أدى إلى زيادة معنوية فى كل من اللزوجة والريع ومقاومة الإنصهار، Adhesiveness, Cohesiveness, Chewiness, Gumminess, بينما انخفضت كل من Elasticity, Hardness والوزن النوعى والوزن بالجالون.

٢. أظهرت نتائج التحكيم الحسي وجود تغيرات معنوية للمعاملات خاصة الأيس كريم المعامل بالأنيولين حيث سجلت النتائج أن الأيس كريم منخفض الدهن والمضاف إليه ٢ أو ٣% أنيولين حصل على أعلى الدرجات ومقارب تماما للأيس كريم مرتفع الدهن. بينما أدت زيادة pea fiber إلى ١,٥% إلى انخفاض درجات التحكيم الحسي خاصة بالنسبة للطعم واللون