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USING PERSIMMONS (*Diospyros kaki L.)* in Making FUNCTIONAL ICE CREAM

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ABSTRACT

The healthy benefits of orange colored persimmons (Diospyros kaki L.) are highly related to their rich contents of total, soluble; and insoluble dietary fibers, total phenols, vitamin A, and C, and some minerals. The aim of this work was to verify the possibility of using persimmons as a natural function food agent in fruit ice cream manufacture. The fresh and boiled persimmons were added at levels of 5, 10, and 15% of ice cream mix. Changes in density, freezing point, viscosity, weight per gallon, titratable acidity, protein stability of ice cream mix as well as the overrun, melting resistance and sensory evaluation of the resultant ice cream were investigated. The obtained results revealed that the increase of the persimmons levels increased the acidity (%), specific gravity, weight per gallon in ice cream mix, as well as the decrease in the freezing point and protein stability of the mix. The overrun of ice cream decreased by the increase of the added persimmons. In general, both of melting resistances and specific gravity were increased by adding kaki fruit in ice cream mixes. From the data obtained, it could be recommended that ice cream can be produced with higher quality by adding 10%of persimmons in ice cream mix.
Keywords: Persimmons (*Diospyros kaki* L.), Functional Ice Cream

INTRODUCTION

The increase in consumer demand for dairy products with functional properties was key factor driving value sales growth in developed markets in 2003 Ayar *et al.,*(2006). The nutritional antioxidants and particularly phenolics are able to prevent oxidation LDL-C and therefore to delay development of atherosclerosis in general and coronary atherosclerosis in particular (Kestaloot and Sons, 2002). Therefore, diets containing these nutritional antioxidants are in demand (Longeril *et al.,* 1994). Such diets are rich in dietary fibers, minerals, essential trace elements and phenolic compounds. Kromheut *et al.,* (2002). The benefical influence of fibers on the lipid metabolism is well known. It was shown that high dietary fiber diets are associated with the preventation and treatment of coronary heart diseases (CAD). A subtropical fruit persimmon, which is rich in bioactive compounds, became a subject for investigation. This fruit possesses plasma lipid lowering and antioxidant properties and can be successfully used in anti atherosclerosis preventing diets Gorinstein *et al.,* (2000). The bioactivity of persimmons is attributed to its water soluble dietary fiber, minerals, trace elements and phenolics which determine total antioxidant activity of the fruit. Hertag *et al.,* (1995). The health benefits of orange coloured persimmon kaki fruits are highly related to their rich contents of total, soluble, and insoluble dietry fibers, total phenols, vitamine A & C and some minerals. The aim of this work was to verify the possibility of the using persimmon as a natural function food agent in fruit ice cream product.

MATERIALS AND METHODS

Raw buffalo's milk was obtained from the herd of Faculty of Agriculture, Ain Shams University and used as an ingredient for preparing the ice cream mixes. Skim milk powder (SMP) made in USA was obtained from Misr for Milk and Food Co., Cairo, Egypt. The persimmons (*Diospyros kaki L.*) and cane sugar was obtained from local market. Carboxymethyl cellulose (CMC) was used as a stabilizer and used as an emulsifier.

The persimmons (*Diospyros kaki L.*) were cleaned carefully by tap water and then divided in two portions. The first one was steam cooked under atmospheric pressure for 3 min then cooled to room temperature; the second portion was used in fresh state. The two portions were mixed well in a laboratory type blender (Brown, Germany) and they stored at –18ºC until used.

The composition of ice cream recipes was shown in Table (1). The milk and cream were heated to 45 ºC, then all solid ingredients, sugar, stabilizer and skim milk powder were gradually added with continues agitation. Mixes were heat treated at 80 ±1ºC to about 30 sec., then rapidly cooled to 4±1ºC. After that the persimmons were added to mixes and then aged four 4 h in refrigerator. The mixes were frozen in horizontal batch freezer (Taylor Co. USA). The resultant ice cream was drawn in plastic cups (120 ml), covered and stored at -18ºC for hardening.

Table 1: Composition of ice cream recipes.

Ingredients %	Recipes No.						
	1(control)	2	3*	4	5*	6	7*
Sugar	14	14	14	14	14	14	14
CMC	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Persimmons	-	5	5	10	10	15	15
Fat	5	5	5	5	5	5	5
MSNF	11	11	11	11	11	11	11

CMC: Carboxy methyl cellulose MSNF: Milk solid not fat
*** 3, 5, 7: Heat treated persimmons fruit**

Table 2: Formulation of different ice cream recipes containing levels of persimmons (*Diospyros kaki L.*) Kg/100 kg mix.

Ingredients %	Recipes No.						
	1(control)	2	3	4	5	6	7
Sugar	14	14	14	14	14	14	14
CMC	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Persimmons	-	5	5	10	10	15	15
Skim milk powder	3.82	4.33	4.33	4.89	4.89	5.38	5.38
Raw milk (6% fat)	81.82	75.80	75.80	69.41	69.41	63.23	63.23
Cream (55% fat)	0.16	0.67	0.67	1.52	1.52	2.19	2.19

Values of pH were measured using a digital laboratory pH meter (HI 93 1400, Hanna instruments) with glass electrode. Moisture, fat, ash and total protein, total carbohydrates and crud fiber were determined according to AOAC (2007). The freezing point was tested in the mixes as mentioned in FAO Laboratory manual (1977). The viscosity was estimated by using a

coaxial rotational viscometer (Rheotest II, Medingen, Germany) at shear rates ranging from 1.8 to 1312 sec^{-1} as described by Bencini (1986). Melting resistance of the resultant ice cream was examined according to Segall and Goff (2002). The weight per gallon in kilogram was, calculated as suggested by Marshall *et al.,* (2003). The overrun in the resultant ice cream was calculated according to Marshall *et al.,* (2003) as difference in weight volume between resultant ice cream and original mix. Protein stability was estimated as mentioned by Marshall *et al.,* (2003). Specific gravity was determined at 20ºC as described by Winton (1958).

Samples of ice cream after 24 hr. hardening at -23ºC were judged by 11 panelists of experienced. staff members of Food Sci Dep, Ain Shams Uni, and selected on the basis of their consistency in scoring. The samples scored for flavour (45), Body & texture (35), melting property (10) and colour (10) as suggested by Arbuckle (1986).

The data (mean of three replicates) were analyzed to the general linear models procedure of SAS 1994. Least significant difference test was performed to determined differences in mean at $P<0.05$.

RESULTS AND DISCUSSION

Compositional analysis of persimmon fruit is indicated in (Table 3) show that the persimmon fruit is a good source of dietary fibers, some minerals, protein and carbohydrates. The data are in line with those obtained by Lontoweiz *et al.,* 2008 and Lee ynghook (2006).

Table 3: Composition % of persimmons fruit (*Diospyros kaki L.*)

Moisture	71.06 ± 2.2
Soluble solids	21.23 ± 1.5
Ash	0.72 ± 0.05
Crude fiber	1.6 ± 0.21
Carbohydrate	20.2±1.30
Protein	1.72±0.3
Total fat	0.60±0.1

Effect of persimmon fruit as a functional food on some properties of ice cream mixes is presented in Table (4). The specific gravity of ice cream mixes increased with adding persimmon fruit in the recipes. On the other hand, the specific gravity of mixes containing fresh persimmon was higher than the mixes with heat- treated persimmon fruit. Meanwhile, the weight per gallon in kilograms of all mixes was found to be closely related to their specific gravity. A certain level of viscosity is essential for proper whipping and retention of air cell in ice cream system (Marshall *et al.,* 2003). The addition of persimmon fruit in mixes has a significantly higher effect than the viscosity of mixes (Table 4). The data also indicated that the mixes with the addition of 5% persimmon fruit had a lower viscosity, compared with other mixes. This might be due to the higher fiber content in persimmon, which is responsible for gel forming viscous, as well as particles size and high water holding capacity of fiber (Vani and Zayas, 1995). The control treatment was

of the height freezing points among all the treatment (Table 4). The lowest Freezing points in the treatments might be due to high ash content and fiber of ice cream mixes with persimmon fruit compared, with control treatment**.** The pH values slightly decreased with adding persimmon fruit in ice cream formula. Slight difference in pH values could be due to the lower pH value of persimmon (pH= 5.53). The protein stability decreased with increasing persimmon fruit ratio in ice cream mixes (Table 4). This might be due to the effect of acidity of persimmon fruit. The obtained results revealed that ice cream mixes being made with persimmon fruit at rate 5, 10 and 15% contained of 11, 22 and 35% dietary fiber, respectively (Table 4).

Table 4: Properties of ice cream mixes containing different levels of persimmons fruit (*Diospyros kaki L.*)

Properties	Recipes No.						
	1(control)	2	3	4	5	6	7
Specific gravity	1.091^{e}	1.082^{f}	1.073^{g}	1.163^{c}	1.152^{d}	1.223^{a}	1.211^{b}
Weigh per gallon (lb)	9.10^{e}	9.02^{f}	8.54^{g}	9.71^{c}	9.63^{d}	10.21^{a}	10.11^{b}
Viscosity(CP)	37.21^{e}	30.29^{f}	29.31^{g}	40.92^{c}	40.81^{d}	48.85^{a}	48.50^{b}
Freezing point	-2.10^{a}	-2.15^{b}	-2.17^{c}	-2.30^{d}	-2.30^{d}	-2.5^{e}	-2.5^{e}
Protein Stability*	8^{a}	8^{a}	8^{a}	7^{b}	7^{b}	6^{c}	6^{c}
pH Value	6.55^{a}	6.54^{b}	6.54^{b}	6.42^{c}	6.42^{c}	6.39^{d}	6.39^{d}
Fiber	-	0.11^{c}	0.11^{c}	0.22^{b}	0.22^{b}	0.35^{a}	0.35^{a}

***Milliters of ethanol 95 % necessary to form a slight precipitate.**

Effect of persimmon fruit as a functional food on some properties of the resultant ice cream is presented in Table (5).

Table 5: Properties of ice cream containing different levels of persimmons fruit (*Diospyros kaki L.*)

Properties	Recipes No.						
	1(control)	2	3	4	5	6	7
Specific gravity	0.727^{g}	0.761^{e}	0.750^{e}	0.836^{c}	0.828^{d}	0.944^{a}	0.931^{b}
Weigh per gallon (lb)	6.06^{g}	6.39^{e}	6.258^{f}	6.976^{c}	6.909^{d}	7.877^{a}	7.760^{b}
Overrun%	50.0^{a}	42.0^{c}	43.0^{b}	39.0^{d}	39.0^{d}	30.0^{e}	30.0^{e}
Meltting resistance Loss % at 30 °C							
After 60 min.	56.0^{c}	61.0^{a}	60.0^{b}	47.0^{e}	48.0^{d}	32.0^{g}	37.0^{f}
After 90 min.	42.0^{e}	38.0^{g}	39.0^{f}	53.0^{c}	52.0^{d}	68.0^{a}	63.0^{b}

The specific gravity increased with the addition of persimmon fruit. The specific gravity and weight per gallon of the resultant ice cream with 15% persimmon fruit highly increased in comparison with the control sample. This increase in the specific gravity depends on the formula components as well as mix ability to hold the air pulps and overrun percent in the resultant ice cream (Marshall *et al.,* 2003). The overrun values were affected by increasing the ratio of persimmon fruit in ice cream mixes. The ice cream without persimmon fruit had an overrun of 50%, while it was 42, 39 and 30% for mixes with 5, 10 and 15% persimmon fruit, respectively. The addition of persimmon fruit to the mix improved the viscosity, but decreased the whipping abilities compared with the control. In general as the viscosity increases, the resistance to melting and smoothness to texture increases, but the rate of whipping decreases (Marshall *et al.,* 2003). Melting resistance of ice cream was expressed as the less in weight percent of the initial weight of

the tested samples (Table 5). The melting resistance of ice cream samples increased with increasing amount of persimmon fruit added. This might be due to the addition of persimmon fruit caused soggy body and low overrun. Sogginess is contributed to high melting resistance (Arbuckle 1986).

Sensory panel evaluation is an important indicator of potential consumer preferences. The sensory quality attributes of ice cream samples with persimmon as a functional food presented in Table (6).

Table 6: Sensory evaluation of ice cream samples made with different levels of persimmons fruit (*Diospyros kaki L.*).

	Recipes No.						
Characteristics	**1(control)**	**2**	**3**	**4**	**5**	**6**	**7**
Flavour (45)	40 ^{b}	30 ^{c}	30 ^{c}	40 ^{b}	40 ^{b}	41 ^{a}	41 ^{a}
Body& texture (30)	28 ^{a}	20 ^{c}	20 ^{c}	27 ^{b}	27 ^{b}	20 ^{c}	20 ^{c}
Melting properties (15)	13 ^{a}	10 ^{c}	10 ^{c}	12 ^{b}	12 ^{b}	12 ^{b}	12 ^{b}
Colour (10)	9 ^{a}	8 ^{b}	8 ^{b}	9 ^{a}	9 ^{a}	7 ^{c}	7 ^{c}
Total Scor (100)	**90** ^{a}	**68** ^{d}	**68** ^{d}	**88** ^{b}	**88** ^{b}	**80** ^{c}	**80** ^{c}

In general, as the control treatment showed the highest score (90 out of 100 points) among all treatment, it seemed that the manufactured ice cream with 10%persimmon fruit had higher scores (88 out of 100 points) compared with the other treatments (5 and 15%). Treatment with 5% persimmon fruit ranked the lowest scores (68 out of 100 point). Finally, it may be concluded that recipe containing 10 % persimmon fruit is recommended for manufacturing functional ice cream with persimmon fruit (kaki fruit).

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استخدام ثمار الكاكى فى صناعة ايس كريم وظيفي

زكريا محمد رزق حسن و جيهان على حسين

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تهتم الدراسات الحاليه بالاغذيه الوظيفيه لما لها من أهميه غذائيه وصحيه . وفى هذة الدراسة تم أضافة ثمار الكاكى سواء المعاملة حراريا أو غير المعاملة حراريا كمصدر للالياف والعناصر المعدنية الى مخلوط الايس كريم حيث أستخدم ثمار الكاكى بنسبة ٥% ، ١٠ % و ١٥ % من جوامد المخلوط .وأثر ذلك على خواص كل من المخلوط والناتج النهائي.

وتم دراسة كل من الوزن النوعى – اللزوجة- وزن الجالون – الثبات الحرارى والريع وخواص الانصهار والتحكيم الحسى لكل من المخلوط والايس كريم الناتج.

وقد أظهرت النتا ئج الى أن أضافة ثمار الكاكى أدى الى زيادة فى الحموضة ونقطة التجمد ونقص فى الثبات البروتينى للمخلوط.كما أدى أستخدام ثمار الكاكى الى زيادة نسبة الالياف فى الايس كريم مما أدى الى رفع قيمتة الغذائية.كما أظهرت النتائج أنة بزيادة نسبة ثمار الكاكى فى مخاليط المثلجات أدى الى زيادة كل من الوزن النوعى و وزن الجالون كذلك اللزوجة.

أما بالنسبة للمثلجات الناتجة فقد أظهرت خفض فى نسبة الريع كما أظهرت مقاومة عالية للانصهاربزيادة نسبة ثمار الكاكى. أما بالنسبة الى نتائج التحكيم الحسى فقد حصلت المثلجات الناتجة من المخاليط المحتوية على ١٠% ثمار الكاكى على أعلى درجات فى التقييم الحسى كما أدى ذلك الى زيادة نسبة الالياف فى الايس كريم الى(22. ٠ %) يليها المحتوية على 15 % وتحتوى على نسبة من الالياف(35. ٠ % ثم المحتوية على ٥% فقد حصلت على أقل الدرجات من حيث القوام والتركيب مقارنة بالكنترول لذلك توصى الدراسة أنة يمكن أستخدام ثمار الكاكى بنسبة ١٠ % من جوامد المخلوط للحصول على منتج مرتفع القيمة الغذائية وذو خواص طبيعية وحسية جيدة.

قام بتحكيم البحث

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