



QUALITY OF ICE MILK SUPPLEMENTED WITH MANGO'S PEELS POWDER

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ABSTRACT: *The effect of incorporated mango's peels powder on the physical, chemical and sensory properties of ice milk were studied. 5 ice milk batchy were prepared by adding 0.0, 0.5, 1.0, 1.5 and 2.0% mango's peel powder. Obtained results indicated that adding mango's peel powder to ice milk mixes increased the specific gravity and weight per gallon, while did not affect significantly the acidity of ice milk mixes. Supplementing ice milk with mango's peels powder increased the specific gravity, weight per gallon, melting resistances, total solids and protein content of the resultant ice milk. Overrun did not change by adding mango's peel powder up to 1.0%, while increasing the rate of adding mango's peel powder above that decreased the overrun. Although all ice milk treatments were accepted by the panelists ice milk treatments T1, T2 those made by adding 1.0 and 1.5% mango's peel powder gained the highest scores of organoleptic properties and were the most acceptable ice milk treatments. The scores of organoleptic properties of all ice milk did not change during the 8 weeks of storage. Titratable acidity, total solids, fat total protein and ash contents did not change significantly during the storage period.*

Key words: *Ice cream, mango's peel powder.*

INTRODUCTION

Ice cream which is the most popular frozen dessert in Egypt and all the world was made by mixing different ingredients such as milk, cream, milk solids non-fat, sugar, stabilizers, emulsifiers, flavours and calorurs (Arbuckle, 2013). It is highly accepted by children, adolescents, adults and elderly public. The production and consumption of frozen desserts have been increased tremendously recently in Egypt and all over the world because of its significance nutritional value, production of different forms and types, using a wide range of ingredients and flavours, production of low fat, low calories and low lactose products using frozen desserts as a carier for probiotics, prebiotics and nutraceuticals and finally using the frozen desserts as functional

foods (Kebary *et al.*, 2015 and Kebary *et al.*, 2018).

Dietary fiber is naturally present in cereals, vegetables, fruits and nuts. It is not digested by enzymes in the human intestinal tract, but part of it may be metabolized by bacteria in the lower gut. Dietary fibers are classified as soluble and insoluble fibers (Desmedt and Jacobs, 2001; Behall *et al.*, 2006 and Lunn and Buttriss, 2007). Recently dietary fibers have received increasing attention from researchers and industry to incorporate dietary fibers in different foods and dairy products because of then crucial beneficial effects such as reducing of colon and heart related diseases, diabetes incidence, gut neoplasia, reducing the risk of colon cancer, preventing constipation and hemorrhoids, lowering blood cholesterol,

regulating blood glucose levels for diabetes management, producing short chain fatty acids, increasing calcium absorption, stimulating the immune system and acting as prebiotics which enhance the growth of beneficial gut microflora (Pandiyani *et al.*, 2012 ; Ahmadi *et al.*, 2014; Hamed *et al.*, 2014 ; Kamaly *et al.*, 2017; Ayar *et al.*, 2018 and Kebary *et al.*, 2018). The recommended adequate intake of fibers is 25–38 g per day for adults (14 g/1000 kcal/day). Yet, the diet of a substantial number of people in developed countries is insufficient to achieve the recommended daily intake of fibers. (King *et al.*, 2012). In addition dietary fibers can be used as fat replacers, sugar replacers, a low caloric bulking agent, texturizing agent, water and oil binding agents and emulsification and gel formation agents (Meyer *et al.*, 2011; Hamed *et al.*, 2014; Kebary *et al.*, 2015; Kamaly *et al.*, 2017 and Kebary *et al.*, 2018).

Mango is one of the most cultivated fruit in the world. The world production of mango fruits was 35 million tons, while in Egypt it was 450 thousand tons in 2009 (FAO, 2009). There are several varieties grown in Egypt such as alphonse, zebda, mabroka, balady and succary (El-Soukkary *et al.*, 2000). Mango is a seasonal fruit; therefore 20% of fruit are processed for products such as puree, nectar, juice, pickles and canned slices. Peel, which is a major by-product during processing of mango contributes about 15-20% of the fruit (Beerh, 1976). In Egypt mango's peel and pulp fibers are discarded as a waste and become a source of pollution. It has been reported that mango's peel is a good source of polyphenols, carotenoids, vitamin E and C and dietary fibers. Also, it exhibited good antioxidant properties (Ajila *et al.*, 2007; Kim *et al.*, 2010).

Dairy products are not a good source of fibers however, they could provide an alternative vehicle for the development of fibers enriched foods (Ozcan and Kuituldu, 2014).

The objectives of this study were investigating the effect of supplementing ice milk with mango's peel powder on physical, chemical and sensory attributes of ice milk and monitoring the changes of ice milk quality during storage.

MATERIALS AND METHODS

Materials:

Fresh bulk buffalo's milk and cream obtained from the herd of Faculty of Agriculture, Minoufia University, Shibin El. Kom, Egypt. Cream was obtained by separating fresh buffalo's milk in the pilot plant of Department of Dairy Science and Technology.

Stabilizer was obtained from Meer Corporation, North Bergen, NJ, USA. Sucrose and cocoa powder was obtained from the local markets. Skim milk powder was obtained from Hoogwegt international BV, Arnhem, the Netherlands (Fat: 1.25% max, Lactose: 56% max, Ash 8.2 % max, Moisture: 4% max, Protein in MSNF: 34% min).

Preparation of mango's peel powder:

Mango's fruits were obtained from the local market. Mango's fruits were washed by distilled water, then peeled and their edible portions were carefully separated. The healthy and fully ripe mango's peel were collected immediately after peeling, washed with distilled water to remove any foreign particles and blanched at 83°C for 5 min to avoid a browning reaction. The peels were spread out on trays and dried at 50°C ± 2 for 18 hr. using a conventional air oven (Hassan *et al.*, 2011). The dried peels were ground carefully to pass through a 250 Mm mesh, size sieve. The powder designated

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mango's peel powder (MPP) was packaged into air tight jars and kept at 4°C until analysis and use. The

composition of mango's peel powder is shown in Table (1).

Table (1). The gross compositions of mango's peel powder (MPP).

Composition	Percentage (%)
Moisture	5.2
Protein	5.2
Fat	3.8
Ash	2.5
Total dietary fiber	48.1
Carbohydrate	35.2

Manufacture of ice cream:

Chocolate ice milk mixes were prepared according to the method of Khader *et al.*, (1992) with the following composition: 4% fat, 13% milk solid not fat, 15% sugar, 0.5% stabilizer, 3% Cocoa. Control ice milk treatment was made as described above, while the other four ice milk treatments were supplemented with 0.5, 1, 1.5 and 2 % mango's peel powder respectively. Chocolate ice milk mixes were heated at 69°C for 30 min, cooled and then aged over night at 4°C. All ice cream mixes were frozen in an experimental ice cream batch freezer (Cattabriga, Bologna, Italy). The resultant frozen ice milk was packaged in plastic cups and kept in deep freezer at -18°C for 24 hrs. for hardening. Frozen ice milk was stored at -20°C ± 2 for 10 weeks.

Physical and chemical analysis:

Overrun of the ice milk was determined according to the method of Arbuckle (1986). The specific gravity of ice milk mixes and ice milk samples were determined according to Omar (2014). Weight per gallon of ice milk mixes in kilogram (kg) was directly calculated

according to Arbuckle (1986). The melting resistance of ice milk was determined as described by Omar (2014).

Chemical analysis:

pH values, titratable acidity and fat content were determined according to Ling (1963). Total solids, ash and Total protein were determined according to the methods described by A.O.A.C, (2010).

Sensory evaluation:

Ten panelists from the staff members and graduated students at the Department of Dairy Science and Technology, Department of Food Science and Technology, Faculty of Agriculture, Minoufia University evaluated the organoleptic properties of each batch of chocolate ice milk at zero time and every two weeks of storage period according to score sheets described by Kebary and Hussein (1997).

Statistical analysis:

Data were analyzed using the completely randomized block design and 2 x 3 factorial design. Newman-keuls.

Test was used to make the multiple comparisons (Steel and Torrie, 1980) using Costat program. Significant differences were determined at $p \leq 0.05$.

RESULTS AND DISCUSSIONS

Properties of Ice milk mix:

Titratable acidity of ice milk mixes is shown in Table (2). The obtained results revealed that there were no significant ($p > 0.05$) differences among ice milk mixes which means adding mango's peel powder to chocolate ice mixes did not have significant ($p > 0.05$) effect on the titratable acidity of chocolate ice milk mixes (Table 2).

Specific gravity and weight per gallon followed similar trends (Table 2) (Hamed *et al.*, 2014 and Kebary *et al.*, 2018). Specific gravity and weight per gallon increased by adding mango's peel powder and this increase was proportional to the rate of adding mango's peel powder (Table 2). These results might be due to the increase of total solids of chocolate ice milk mixes (Hamed *et al.*, 2014 and Kebary *et al.*, 2018). Chocolate ice milk mix that made with the highest amount of mango's peel powder had the highest specific gravity and weight per gallon and were significantly ($p \leq 0.05$) different from

those of control chocolate ice milk mix that made without adding mango's peel powder (Table 2).

Properties of chocolate ice milk:

Overrun is evident from the data in Table (3) that overrun decreased by increasing the amount of added mango's peel powder. This trend was also assured by the finding of Dervisoglu and Yazici (2006), and Deosarkar *et al.*, (2016).

Chocolate ice milk treatments C,T1 and T2 were not significantly ($p > 0.05$) different from each other, which means adding mango's peel powder up to 1% did not have significant ($p > 0.05$) effect on the overrun of the resultant chocolate ice milk, while increasing the amount of added mango's peel powder above 1.0 % caused a significant ($p \leq 0.05$) reduction of the overrun of chocolate ice milk (Table 3). This decrease of overrun might be due to the increase of viscosity (Fuentes-Alventosa *et al.*, 2009 and Elleuch *et al.*, 2011), which subsequently suppress the ability of chocolate ice milk to retain air (Chang and Hartel 2002, Sofjan and Hartel 2004 and Meyer *et al.*, 2011).

Table (2). Effects of supplementing ice milk with mango's peel powder on some properties of ice mix.

Treatments	Specific gravity	Weight per gallon	Acidity
C*	1.1134 ^E	4.2153 ^E	0.241 ^A
T1	1.1236 ^D	4.2539 ^D	0.232 ^A
T2	1.1341 ^C	4.2937 ^C	0.231 ^A
T3	1.1446 ^B	4.3334 ^B	0.234 ^A
T4	1.2148 ^A	4.5992 ^A	0.235 ^A

• Each value in the table was the mean of three replicates.

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For each effect the different letters in the same column means the multiple comparisons are different from each other, letter A is the highest mean followed by B, C, ...etc. Significant at 0.05 level ($p \leq 0.05$).

* C: control, chocolate ice milk without any additives.

T1, T2, T3 and T4: chocolate ice milk treatments made by adding 0.5, 1, 1.5 and 2% of mango's peel powder, respectively.

Table (3). Effects of supplementing ice milk with mango's peel powder on some properties of ice milk.

Treatments [*]	Specific gravity	Weight per gallon	Overrun	Melting resistance		
				first 60 min	Next 30 min	Last 30 min
C*	0.7835 ^D	2.4362 ^D	70.54 ^A	38.4 ^A	45.6 ^A	15.8 ^E
T1	0.8040 ^{CD}	2.8546 ^{CD}	70.22 ^A	37.6 ^{AB}	42.3 ^B	19.6 ^D
T2	0.8343 ^C	3.2344 ^C	68.81 ^{AB}	36.4 ^B	40.5 ^C	22.3 ^C
T3	0.8943 ^B	3.3858 ^B	60.23 ^C	36.5 ^{BC}	37.8 ^D	24.9 ^B
T4	0.9556 ^A	3.6179 ^A	55.19 ^D	35.1 ^C	36.3 ^{DE}	27.6 ^A

• Each value in the table was the mean of three replicates.

For each effect the different letters in the same column means the multiple comparisons are different from each other, letter A is the highest mean followed by B, C, ...etc. Significant at 0.05 level ($p \leq 0.05$).

* C: control, chocolate ice milk without any additives.

T1, T2, T3 and T4: chocolate ice milk treatments made by adding 0.5, 1, 1.5 and 2% of mango's peel powder, respectively.

Effect of mango's peel powder on specific gravity and weight per gallon of ice milk are presented in Table (3). Both Specific gravity and weight per gallon followed similar trends (Hamed *et al.*, 2014 and Kebary *et al.*, 2018). Supplementing chocolate ice milk with mango's peel powder caused a significant increase ($p \leq 0.05$) of specific gravity and weight per gallon of the resultant ice milk. There was no significant difference ($p > 0.05$) between control ice milk and treatment T1 that was made with adding 0.5% mango's peel powder. On the other hand treatment T4 that was made with adding the highest amount (2.0 %) of mango's peel powder exhibited the highest specific gravity and weight per gallon and was significantly

different ($p \leq 0.05$) from those of other chocolate ice milk (Table 3). These results might be due to the increase of total solids and / or the reduction of the overrun of the resultant chocolate ice milk, where there is negative correlation among specific gravity and weight per gallon and the overrun. These results are in accordance with those of (Hamed *et al.*, 2014; Kebary *et al.*, 2015; Kamaly *et al.*, 2017 and Kebary *et al.*, 2018).

The melting resistances of chocolate ice milk that was expressed as the rate of melting shown in Table (3). Supplementing chocolate ice milk with mango's peel powder caused a pronounce ($p \leq 0.05$) reduction of the rate

of melting, which means increase the melting resistance of the resultant chocolate ice milk at 60 min and the next 30 min (Table 3). There was positive correlation between the amount of added mango's peel powder and the melting resistance of the resultant chocolate ice milk at 60min and the next 30min (Table 3). These results could be attributed to the higher dietary fiber content of mango's peel powder (Dervisoglu and Yazici, 2006; Temiz and Yesilsu 2010; Crizel *et al.*, 2014; Hamed *et al.*, 2014) that increase the viscosity and the water holding capacity (Fuentes-Alventosa *et al.*, 2009; Elleuch *et al.*, 2011; Baddi 2012 and Akbari *et al.*, 2016) which binds higher amount of water and left lowest amount of free water that can be melted faster than bound water, therefore increase the melting resistance. These results could be supported by the finding of (Temiz and Yesilsu 2010; Akalin *et al.*, 2017, Kamaly *et al.*, 2017, Kebary *et al.*, 2018). On the other hand melting resistance of all chocolate ice milk treatments after the last 30min decreased significantly ($p \leq 0.05$) and this decrease was proportional to the rate of adding mango's peel powder (Table 3). These results are in agreement with these reported by Kebary *et al.*, (2015); Kamaly *et al.*, (2017) and Kebary *et al.*, (2018).

All ice cream treatments were not significantly ($p > 0.05$) different from each other in titratable acidity and pH value which means that supplementation of chocolate ice milk with mango's peel powder did not have significant effect on the titratable acidity of ice milk treatments (Table 4). Titratable acidity and pH value of all ice milk treatments did not change significantly during the storage period ($p > 0.05$). Similar results were reported by Kebary *et al.*, (2018).

Total solids and total protein contents of ice milk treatments made with supplementation with mango's peel powder increased significantly ($p \leq 0.05$) (Table 5) by adding mango's peel powder. There was positive correlation between the rate of adding mango's peel powder and total solids content of the resultant chocolate ice milk (Table 5). (Abdullah *et al.*, 2003; Soukoulis *et al.*, 2009; Hamed *et al.*, 2014; Ayar *et al.*, 2018). On the other hand total solids content of all chocolate ice milk treatments did not change significantly ($p > 0.05$) during the storage period (Table 5). These results are in agreement with those reported by Hamed *et al.*, (2014); kamaly *et al.*, (2017) and Kebary *et al.*, (2018).

Fat and ash contents of ice milk treatments made with supplementation with mango's peel powder were not significantly different from that of control ice milk which means that supplementation with mango's peel powder did not affect significantly fat and ash contents ($p > 0.05$). Fat and ash contents of ice milk treatments did not change significantly during storage period (Table 6).

The scores of flavor, body and texture and total scores followed similar trends (Tables 7, 8). On the other hand there more no significant ($p > 0.05$) differences among all chocolate ice milk treatments of the scores of colour and melting quality, which means adding mango's peel powder did not have significant ($p > 0.05$) effect on the colour of the resultant ice milk (Tables 7, 8). The most acceptable chocolate ice milk treatments were T2 and T3 those made with adding 1.0 and 1.5% mango's peel powder. These treatments (T2 and T3) were not significantly ($p > 0.05$) different from each other, while they were significantly ($p \leq$

0.05) different from the other treatments (C, T1, T4). These results indicate that supplementing of chocolate ice milk with mango's peel powder up to 1.5% improved significantly the organoleptic properties of chocolate ice milk (Tables 7, 8). The score of organoleptic properties (flavor, colour, melting quality, body and texture and total score) did not change significantly ($p > 0.05$) during the first 8 weeks of storage period then decreased during the last two weeks (Tables 7, 8). These results are in agreements with those reported by Kebary *et al.*, (2004), Hamed *et al.*, (2014), Kamaly *et al.*, (2017) and Kebary *et al.*, (2018).

Table 4 and 5

Table 6 , 7

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Table 8

It could be concluded that supplemented chocolate ice milk with mango's peel powder up to 1.5% improved the melting resistance and the acceptability of the resultant chocolate ice milk, while did not have significant effects ($p > 0.05$) on acidity, fat and protein content. Therefore, it could be recommended that it is possible to make a good quality chocolate ice milk by adding up to 1.5% mango's peel powder without determinantal effects on chocolate ice milk quality.

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جودة الأيس كريم المدعم بقشر المانجو المجفف

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المُلخَص العَرَبِي

إهتم البحث بدراسة تأثير تدعيم الأيس كريم بقشر المانجو المجفف وذلك بنسب مختلفة على بعض الخواص الكيميائية والريولوجية والحسية للأيس كريم ، ولقد تم تصنيع 5 معاملات وكانت معاملة الكنترول (بدون إضافة قشر المانجو المجفف) أما المعاملات T1، T2، T3، T4 فقد تم بنسب إضافة 0,5 ، 1 ، 1,5، 2% على الترتيب وتم تخزين المعاملات فى الفريزر -20 م° لمدة 10 أسابيع حيث أخذت عينات وهى طازجة وبعد 2،4،6،8،10 أسابيع وذلك لإجراء باقى التحليلات الكيماوية والريولوجية والحسية عليها.

ولقد اوضحت النتائج المتحصل عليها بعد تحليلها احصانيا ما يلى :

- 1- لم تختلف نسب الحموضة لمخاليط الأيس كريم فى العينة الكنترول عن باقى العينات المضاف لها قشر المانجو المجفف معنويا . مما يدل على أن إضافة قشر المانجو المجفف لم يؤثر على حموضة مخلوط الأيس كريم.
- 2- أدى إضافة قشر المانجو المجفف إلى زيادة ملحوظة فى الوزن النوعى والوزن بالجالون لمخاليط الأيس كريم وهذه الزيادة تتناسب طرديا مع معدل الإضافة.
- 3- حدث انخفاض فى الريع للأيس كريم بإضافة قشر المانجو المجفف.
- 4- أدى إضافة قشر المانجو المجفف إلى زيادة معنوية فى الوزن النوعى والوزن بالجالون للأيس كريم بزيادة معدل الإضافة.
- 5- أدى إضافة قشر المانجو المجفف إلى زيادة معنوية فى المقاومة للانصهار خلال 90 دقيقة الأولى ثم قلت المقاومة للانصهار فى آخر 30 دقيقة من التقدير.
- 6- لم تختلف نسب الحموضة و pH فى العينة الكنترول عن العينات الأخرى المضاف إليها قشر المانجو المجفف معنويا وهذا يدل على أن إضافة قشر المانجو المجفف لم يؤثر على نسب الحموضة و pH للأيس كريم ولم تختلف أيضا أثناء فترة التخزين.
- 7- لم تختلف نسب الدهن والرماد فى العينة الكنترول عن العينات الأخرى المضاف إليها قشر المانجو المجفف معنويا مما يدل على أن إضافة قشر المانجو المجفف لم يؤثر على نسب الدهن والرماد للأيس كريم ووجد أنه لم تختلف نسب الدهن والرماد أثناء فترة التخزين.

8- أدى إضافة قشر المانجو المجفف لآيس كريم إلى زيادة الجوامد الكلية معنويا وعلى الجانب الآخر لم تتغير الجوامد الكلية أثناء فترة التخزين.

9- أضافة قشر المانجوالمجفف أدى الى زيادة معنوية فى البروتين الكلى ولكن البروتين لم يتاثر اثناء التخزين.
10- إتخذت الخواص الحسية (النكهه ، القوام والتركييب ، المقاومة للانصهار ، اللون ، المجموع الكلى) نفس الاتجاهات تقريبا. فقد حصلت المعاملة T3 المصنعة بإضافة 1.5% قشر المانجو المجفف على أعلى الدرجات. لم تتغير الدرجات الممنوحة لكل المعاملات معنويا أثناء 6 اسابيع الاولى من التخزين ثم بدأت فى الإنخفاض حتى نهاية فترة التخزين.

السادة المحكمين

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Table (4). Effects of supplementing ice milk with mango's peel fibers powder on titratable acidity and pH value.

Treatments	Titratable acidity (%) of ice milk samples (Weeks)										pH value of ice milk samples (Weeks)				
	0	2	4	6	8	10	0	2	4	6	8	10			
C*	0.241	0.236	0.234	0.233	0.232	0.231	6.55	6.56	6.58	6.61	6.62	6.64			
T1	0.242	0.241	0.235	0.234	0.233	0.233	6.56	6.58	6.59	6.64	6.65	6.66			
T2	0.239	0.237	0.235	0.233	0.232	0.231	6.55	6.56	6.58	6.63	6.64	6.65			
T3	0.243	0.242	0.239	0.237	0.236	0.234	6.53	6.54	6.56	6.60	6.62	6.63			
T4	0.245	0.243	0.241	0.236	0.234	0.233	6.99	6.51	6.53	6.59	6.61	6.64			

See Table (2)

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Table (5). Effects of supplementing ice milk with mango's peel fibers powder on total solids and total protein during the frozen storage for 10 weeks.

Treatments	Total solids						Total protein					
	0			5			10			Storage period (weeks)		
	0	5	10	0	5	10	0	5	10	0	5	10
C*	32.32	32.82	33.15	5.79	5.81	5.84	5.79	5.81	5.87	5.81	5.85	5.9
T1	33.21	33.65	33.91	5.81	5.85	5.87	5.81	5.85	5.92	5.9	6.1	6.2
T2	33.31	33.92	34.16	5.92	5.9	6.1	5.9	6.2	6.1	6.2	6.2	6.2
T3	34.33	34.74	34.98	6.1	6.2	6.2	6.1	6.2	6.2	6.2	6.2	6.2
T4	34.62	34.93	35.12	6.1	6.2	6.2	6.1	6.2	6.2	6.2	6.2	6.2

See Table (2)

Table (6). Effects of supplementing ice milk with mango's peel fibers powder on fat and ash during the frozen storage for 10 weeks.

Treatments'	Fat percent			Ash percent		
	Storage period (weeks)					
	0	5	10	0	5	10
C*	5.4	5.4	5.5	1.20	1.19	1.21
T1	5.3	5.4	5.5	1.22	1.21	1.23
T2	5.2	5.3	5.4	1.23	1.22	1.24
T3	5.2	5.1	5.3	1.24	1.23	1.25
T4	5.3	5.4	5.4	1.24	1.25	1.27

*See Table (2)

Table (7). Effects of supplementing chocolate ice milk with mango's peel fibers powder on organoleptic properties.

Treatments*	Flavor (45)										Body and texture (35)										Melting quality(10)										Colour (10)										Total score (100)									
	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10	0	2	4	6	8	10																				
C*	40	39	38	36	33	31	30	29	28	27	26	8	8	7	6	5	4	9	9	8	8	7	6	90	87	83	80	75	69																					
T1	40	38	37	35	32	31	29	28	27	26	25	8	8	7	6	5	5	9	9	8	7	6	6	89	86	81	77	72	68																					
T2	41	40	39	38	36	31	30	28	27	26	25	9	8	7	5	4	4	9	9	8	8	7	6	91	88	83	79	75	71																					
T3	41	40	39	38	35	32	31	30	29	28	27	9	8	7	6	5	4	9	9	8	8	7	6	92	89	85	82	78	72																					
T4	38	37	36	35	34	30	29	28	27	26	25	8	7	6	5	5	4	8	8	7	7	7	6	86	82	78	75	73	69																					

*See Table (2)

Table (8). Statistical analysis of chocolate ice milk properties.

Chocolate ice milk properties	Mean Squares	Effect of treatments				Mean Squares	Effect of storage						
		Multiple comparisons ^a					Multiple comparisons ^a						
		C	T1	T2	T3		T4	0	2	4	6	8	10
Titration acidity	0.007	A	A	A	A	A	A	A	A	A	A	A	A
pH values	0.109	A	A	A	A	A	A	A	A	A	A	A	A
Flavor	25.350 ^x	B	BC	A	A	C	100.42 ^x	A	A	A	A	AB	B
Body and texture	12.100 ^x	B	B	B	A	B	60.720 ^x	A	A	A	A	AB	B
Melting quality	1.40	A	A	A	A	A	42.16 ^x	A	A	A	A	AB	B
Colour	1.600	A	A	A	A	A	18.34 ^x	A	A	A	A	AB	B
Total score	90.25 ^x	B	B	A	A	B	816.340 ^x	A	A	A	A	AB	B
								0		5		10	
Total solids	6.763 ^x	C	CB	B	A	A	2.160	A	A	A	A	A	A
Fat	0.077	A	A	A	A	A	0.078	A	A	A	A	A	A
Ash	0.037	A	A	A	A	A	0.066	A	A	A	A	A	A
Protein	0.547 ^x	B	B	B	AB	A	0.756	A	A	A	A	A	A

* See Table (2)

