Zagazig J. Agric. Res., Vol. 36 No. (5) 2009 1071-1084

EFFECT OF DIFFERENT LEVELS OF STRAWBERRY JUICE ON SOME PROPERTIES OF ICE CREAM

Abdel-Fatah, Nada M., A.A. Abdel Baky, A.M. Rabie and F.H. Badr

Food Sci. Dept., Fac. of Agric., Zagazig Univ., Egypt

Accepted 12 /10 /2009

ABSTRACT: The effect of adding different levels of strawberry juice (0.0, 25 and 50%) on the quality of ice cream was evaluated. Control ice cream was made from pasteurized buffalo's milk standardized to 5% fat, 17% saccharose and vanilla. 2Experimental ice cream were prepared form pasteurized buffalo's milk containing 5% fat, 17% saccharose, with added 25% or 50 % strawberry juice, respectively. The obtained results showed that ice cream made with added 25% strawberry juice significantly increased the whipping ability of ice cream mix and increased the ash, protein contents and the overall acciptaptability of ice cream. On the other hand, these additives significantly decreased the colour, Total soluble solids, viscosity, specific gravity, melting resistance, pH, overrun, carbohydrate, total energy and fat of ice cream. Ice cream containing 50% strawberry juice showed a significant increase in colour, protein, specific gravity of ice cream, total soluble solids (T.S.S), carbohydrate, melting resistance, ash and total energy in ice cream and led to a significant decrease in overall acceptability, overrun, fat and viscosity of ice cream, as compared to the control.

Key words: Strawberry juice, ice cream and natural additives, organoleptic properties, chemical composition.

INTRODUCTION

Frozen desserts such as ice cream are valued mainly for their pleasing flavour and their cooling and refreshing effects, Flavoring substances play an important role in the ice cream industry are such as vanilla, chocolate and cocoa, fruits and fruit extracts, nuts, spices and sugars. Using of different flavours in ice cream manufacture depends upon geographical preferences and

season of year (Hussein *et al.* 2001). Martinez-Martin *et al.* (2005) used vanilla, strawberry, chocolate, coffee, wild berry, milk meringue and hazelnut in making traditional and light ice cream. Carbohydrates were the most important nutrients and the highest levels in chocolate, strawberry and wild berry ice creams. The lowest carbohydrate levels were found in the light ice creams. Bajwa *et al.* (2003) have attempted to improve the physical, chemical and particularly sensory properties of strawberry pulp in ice cream. Ice cream with 10, 15, 20 and 25% strawberry pulp was prepared. Strawberry flavour ice cream (without strawberry pulp) was kept as control treatment. They showed that these additives significant affected overrun, standup time, meltdown, moisture, ash, total solids, MSNF, sucrose ascorbic acid, pH and acidity. Ice cream containing 15% strawberry pulp showed the highest score point followed by ice cream with 20% strawberry pulp. The lowest score points was given to control. Guven and Karaca (2002) investigated the physical properties of ice cream produced from yoghurt with varying levels of sugar (18, 20 or 22%) and fruit (strawberry) concentration (15, 20 or 25%). The results of the physical analysis showed that as the amount of sugar and fruit increases, there was an increase in the first dripping time period, viscosity values and the overrun. However, complete melting times decreased with the increase in sugar content and fruit concentration. In strawberry ice-cream-type frozen yoghurt, the structure hardened in parallel with the increase in fruit concentration. In addition, the results showed that frozen yoghurts with high fruit concentrations were the type most preferred by the panelists. Hussein *et al.* (2001) used different concentrations of strawberry and mango flavors in preparing ice cream vanilla powder. All of the examined flavouring substances did not affect specific gravity, weight per gallon, overrun percentage or melting time, while there was a pronounced improvement of the flavor of the final product, especially at higher levels of the added flavors. Flavouring materials did not appreciably affect body and texture and the degree of solution in the mouth of the ice cream compared with the control. There was no effect on the colour of ice cream when using vanilla, while there was a clear improvement of the colour by

increasing the levels of added mango flavor. The effect was more pronounced in the case of the strawberry flavor. The results showed that the mango ice cream was the first followed by the strawberry and vanilla ice cream. Steinitz and Rossi (1979) showed that the most popular amongst fruit-flavoured ice creams, strawberry is popular (category I containing usually more than or equal to 20% strawberries), using fruit produced in the country or imported. Therefore, the present work was conducted to evaluate the effect of adding different levels of strawberry juice on some of physico chemical and organoleptic properties of ice cream.

MATERIALS AND METHODS

Buffalo's Milk

Buffalo's milk was obtained from Dairy Technology Unit, Food Science Department, Faculty of Agriculture, Zagazig University, Egypt. Buffalo's milk was standardized to 5 % fat and 14 % total solids.

Sugar

Commercial grade of granulated sugar was obtained from the local Egyptian markett.

Stabilizer

A stabilizer namely LACTA 90 was obtained from Milky Land Company, Egypt.

Vanilla

Vanilla was obtained from the local Egyptian market.

Fruit juice

Strawberry juice was freshly prepared using an electric juice mixer. The chemical composition of the resultant showed moisture content (91.95%), TSS (8.80%), total sugars (6.95%), protein (0.78%), fat (0.18%), acidity (0.61%), pH (3.50%), and ash 0.57%.

Ice Cream Making

Ice cream making was carried out according to Khlafalla *et al.* (1975). Ice cream mixes containing 5% fat 17% sugar and 0.9% stabilizer were prepared from the different levels of strawberry juice (0.25and 50%). Ingredients were mixed well, heated to 75°C for 30 minutes, cooled to 5°C, aged at this temperature and then frozen in an ice cream machine (Espresso Ev 233. Frigomat 20070 Guardamiglio, Milano, Italia).

Examination of the Ice Cream Mixes

The ice cream mix of each treatment was examined for:

Specific Gravity

The specific gravity was determined at 20°C using the pycnometer according to Winton (1958).

Rheological Measurements of Ice Cream

Viscosity

Viscosity of ice cream samples was determined by the method of Tabias and Tracy (1950) using Rotational Viscometer Type Lab. Line Model 5437. Results were expressed as Centipoises (Cps).

Examination of Physico-Chemical and Sensory Properties of Ice Cream

The whipping ability test, the specific gravity, overrun and melting properties of the resultant frozen ice cream were determined. Also the organoleptic properties of ice cream were examined.

Whipping ability

The whipping ability test of the ice cream mix was carried out using a food mixer according to Hughes (1967).The ice cream mix was placed in stainless steel cylinder and cooled to 0°C in ice and salt mixture. The mix was then whipped using electrical mixer at the maximum speed. The specific volume was measured at different time intervals (i .e. 2, 5, 10 and 20 min.). At each measured the mixer bowl was cooled to maintain the temperature below 5°C.

Specific gravity

The specific gravity of the frozen ice cream was determined as recommended by Bruke. (1947).

The overrun

The overrun of the produced ice cream was calculated according to (Arbuckle, 1986) usinf the following equation:

Overrun % = wt. per unit vol. of mix-wt. per unit vol. of ice cream % 100wt. per unit vol. of ice cream.

The pH value

The pH value of mixtures was measured using pH meter HAN AAPH tester and electrode specification Romgea-ooto-140 Resolution 0.01 pH.

Melting properties

The melting properties of ice cream were determined by allowing a know weight of ice cream sample to melt at room temperature according to Thomas and Comps (1944).The sample was placed on a wire screen which had been placed over a glass funnel

and the dripping were collected in a beaker. The weight of drainage was determined at regular intervals (30, 60, 90 and 120 minutes) until melting was nearly complete. The percentage of the relative melted amount during each period was calculated as follows:

The melting % =

$$\frac{\text{Weight of the melted amount}}{\text{Weight of the sample}} \times 100$$

Chemical Composition

The chemical composition of ice cream namely TSS contents, total sugars, protein, fat, pH and acidity were determined according to (AOAC, 1980).

Organoleptic Properties

The organoleptic properties of the resultant ice cream were scored by a score panel of 5 persons from the Department of Food Science, Faculty of Agriculture Zagazig University, according to (Arbuckle, 1977). The ice cream samples were taken out of the freezer and left at room temperature. The tests were carried out when the samples had a temperature range of -12 to-10°C.Maximum score points were 45, 30, 5 and 5 for flavour, body & texture, melting quality and colour respectively.

Statistical Analysis

The data were statically analyzed by ANOVA one way and LSD (SAS Institute. 2000).

RESULTS AND DISCUSSTION

Table 1 shows the effect of adding different levels of strawberry juice on some properties of ice cream mix. The obtained results indicated that the specific gravity values were ranged from 1.09 to 1.10; there are no significant differences between treatments in specific gravity values. The pH value ranged from 6.05 to 4.97; there are a significant difference between treatments in pH values. Samples without strawberry juice had the highest value followed by samples contain 25% strawberry juice then samples contain 50% strawberry juice. The obtained results agreed with those obtained by Bajwa *et al.* (2003) who prepared ice cream with 10, 15, 20 and 25% strawberry pulp. Strawberry flavour ice cream (without strawberry pulp) was kept as control treatment. pH values were affected significantly by ice cream treatments as well as storage. Concerning the viscosity of ice cream mix, Table 1 showed that ice cream samples without

strawberry juice had the highest value followed by samples contain 50% strawberry juice and that contain 25% strawberry juice respectively. There was a significant difference between treatments. Guven and Karaca (2002) produced ice cream from yoghurt with varying levels of sugar (18, 20 or 22%) and fruit (strawberry) concentration (15, 20 or 25%). The results of the physical analysis showed that as the amount of sugar and fruit increases, there was an increase in viscosity values. It was observed that an increase in the amount of sugar in vanilla frozen yoghurt softened the structure. In strawberry ice-cream-type frozen yoghurt, the structure hardened in parallel with the increase in fruit concentration. The results of the sensory analysis suggest that frozen yoghurt can be an alternative to other dairy products such as yoghurt and ice cream.

Table 1 showed that there are no significant differences between treatments in whipping ability in zero time. There are significant differences between treatments in whipping ability after 2 minutes .Samples without strawberry juice had the highest value then samples with 25% strawberry juice then that contain 50% strawberry juice. There are a significant differences between treatments, in whipping ability after 5 minutes; samples which contain 25% strawberry juice had the highest value then samples without strawberry juice and then samples with 50% strawberry juice. There are significant differences between treatments in whipping ability after 10 minutes and samples which contain 25% strawberry juice had the highest value then samples without strawberry juice then samples with 50% strawberry juice. Samples which contain 25% strawberry juice had the highest value in whipping ability after 20 minutes; whereas samples without strawberry juice and samples with 50% strawberry juice had an equal values.

Table 2 shows the effect of adding different levels of strawberry juice on the sensory evaluation of ice cream. The obtained results indicated that samples contain 25% strawberry juice had significant higher score points ($p<0.05$). Addition of 25% strawberry juice to ice cream mix gained the highest score points for flavour and melting properties. But samples with 50% strawberry juice had significant smaller score and

Table 1. Some properties of ice cream mix containing different levels of strawberry juice

Maltrin added %	Specific gravity	pH	Viscosity C.P.S	Before Whipping	Whipping after 2min	5min	10min	20min
0.00	1.10[a]	6.05[a]	425.38[a]	0.90[a]	1.32[a]	1.44[b]	1.86[b]	1.31[b]
25.00	1.09[a]	5.37[b]	340.25[c]	0.93[a]	1.25[b]	1.52[a]	1.98[a]	1.57[a]
50.00	1.10[a]	4.97 [c]	413.93[b]	0.92[a]	1.18[c]	1.33	1.52[c]	1.33[b]
L.S.D	0. 01	0.03	3.88	0.008	0.06	0.04	0.02	0.03

a,b,c: values in the same row with different letters differ significantly

Table 2. Sensory evaluation of ice cream containing different levels of strawberry juice

Added strawberry juice %	Flavour (50)	Body & texture (35)	Colour (5)	Melting properties (10)	Total score (100)
0.00	48.22 [a]	33.36 [a]	4.60 [ab]	9.00 [a]	95.41[ab]
25.00	48.88 [a]	33.13 [a]	4.40 [b]	9.40 [a]	96.00 [a]
50.00	47.55[a]	32.2[a]	5.00 [a]	9.00 [a]	94.00[b]
L.S.D	1.29	1.16	0.39	0.47	2.25

a,b,c: values in the same row with different letters differ significantly

the difference was significant between samples with 25% and that contains 50% strawberry juice. Samples with 25% strawberry juice was more similar to control in body& texture. But samples with 50% strawberry juice was more similar to control in melting properties but had significant difference in colour. The addition of 50% strawberry juice influenced the colour intensity and gained the highest score points for colour. The obtained results agreed with those obtained by Bajwa *et al.* (2003) who found that the highest score were awarded to the ice cream with 15% strawberry pulp followed by ice cream with 20% strawberry pulp. The ice cream samples without strawberry pulp were liked least.

Hussein *et al.* (2001) used three flavouring substances individually in different concentrations in preparing ice cream: vanilla powder, strawberry and mango flavours. All of the examined flavouring substances resulted in a pronounced improvement of the flavour of the final product, specially at higher levels of the added flavours. Flavouring materials did not appreciably affect body and texture and the degree of solution in the mouth of the ice cream compared with the control. There was no effect on the colour of ice cream when using vanilla, while there was a clear improvement of the colour by increasing the levels of added mango flavour. The effect was more pronounced in the case of the strawberry flavour. With increasing levels of the added flavours, the final product obtained the highest degrees of evaluation. The results showed that the mango ice cream was the first followed by the strawberry and vanilla ice cream.

Table 3 shows the changes in some properties of ice cream made with added different levels of strawberry juice. The results showed that specific gravity values ranged from 0.79 to 0.74; samples which contain 50% strawberry juice had the highest value then samples which contain 25% strawberry juice then samples without strawberry juice. Hussein *et al.* (2001) used three flavouring substances individually in different concentrations in preparing ice cream: vanilla powder, strawberry and mango flavours. All of the examined flavouring substances did not affect specific gravity, weight per gallon. The results showed that the mango ice cream

was the first followed by the strawberry and vanilla ice cream. There are significant differences between treatments in overrun. Samples without strawberry juice had the highest value then samples with 25% then samples with 50% strawberry juice. Bajwa *et al.* (2003) prepared ice cream with 10, 15, 20 and 25% strawberry pulp.

Strawberry flavour ice cream (without strawberry pulp) was kept as control treatment. Overrun values were affected significantly by ice cream treatments as well as storage. Guven and Karaca (2002) produced ice cream from yoghurt with varying levels of sugar (18, 20 or 22%) and fruit (strawberry) concentration (15, 20 or 25%). The results of the physical analysis showed that as the amount of sugar and fruit increases, there was an increase the overrun it was observed that an increase in the amount of sugar in vanilla frozen yoghurt softened the structure. In strawberry ice-cream-type frozen yoghurt, the structure hardened in parallel with the increase in fruit concentration. The results of the sensory analysis suggest that frozen yoghurt can be an alternative to other dairy products such as yoghurt and ice cream. Hussein *et al.* (2001) reported that overrun percentage did not affect by the flavouring substances. Also Table 3 showed that samples which contain 50% strawberry juice had significantly higher value for melting resistance after, 30 min than samples without strawberry juice and samples which contain 25% strawberry juice. There is a significant difference between treatments in melting resistance

Table 3. Some properties of ice cream containing different levels of strawberry juice

Added strawberry juice, %.	Specific gravity	Overrun %	Drainge %			
			30 min.	60min	90 min	120 min
0.0	0.74 ^{c}	39.25^{a}	15.36 a ^{b}	45.52^{c}	76.31^{b}	94.27^{b}
25	0.76 ^{b}	37.55 ^{b}	15.05 ^{b}	46.15 ^{b}	76.35 ^{b}	93.20 ^{c}
50	0.79^{a}	30.40^{c}	15.84^{a}	46.95^{a}	78.88^{a}	95.35^{a}
L.S.D	0.19	0.88	0.69	0.41	1.08	0.68

a,b,c: values in the same row with different letters differ significantly

after, 60 min and samples with 50% strawberry juice had significantly higher value followed by samples with 25% and then samples without strawberry juice.

Samples containing 50% strawberry juice had significantly higher value for melting resistance after 90 min than that contains 25% strawberry juice and samples without strawberry juice.

There are a significant difference between treatments in melting resistance, after 120 min samples which contain 50% strawberry juice had significantly higher value for melting resistance then samples without strawberry juice then samples which contain 25% strawberry juice. Similar results were reported by Bajwa *et al.* (2003) who found that meltdown was affected significantly by ice cream treatments as well as storage. Guven and Karaca (2002) produced ice cream from yoghurt with varying levels of sugar (18, 20 or 22%) and fruit (strawberry) concentration (15, 20 or25%). The results of the physical analysis showed that as the amount of sugar and fruit increases, there was an increase in the first dripping time period. However, complete melting times decreased in parallel with the increase in sugar content and fruit concentration. It was observed that an increase in the amount of sugar in vanilla frozen yoghurt softened the structure. In strawberry ice-cream-type frozen yoghurt, the structure hardened in parallel with the increase in fruit concentration. The results of the sensory analysis suggest that frozen yoghurt can be an alternative to other dairy products such as yoghurt and ice cream. Hussein *et al.* (2001) reported that all of the examined flavouring substances did not affect melting time

Table 4 shows the effect of adding different levels of strawberry juice on total energy of ice cream containing strawberry juice and the obtained results indicated that there are significant differences between energy obtained from protein. Samples contain 50% strawberry juice had significantly higher value then samples which contain 25% strawberry juice then samples without strawberry juice.

There is a significant difference between energy which obtained from fat and samples with 50% strawberry juice, which had significantly higher value than that, contain 25% and samples without strawberry juice. But there are no

significant difference between samples that contain 25% and samples without strawberry juice.

There is a significant difference between energy which obtained from carbohydrate and samples with 50% strawberry juice had significantly higher value then samples which contain 25% strawberry juice then samples without strawberry juice.

Ice cream containing 50% strawberry juice had significantly higher energy value than that contains 25% and then samples without strawberry juice.

Table 5 shows the gross chemical composition of ice cream containing different levels of strawberry juice. The obtained results indicated that T.S.S values ranged from 12.66 to 15.10 and there are significant differences between treatments. Samples contain 50% strawberry juice had significantly higher value then samples without strawberry juice then samples which contain 25% strawberry juice. Bajwa *et al.* (2003) reported that total solids, MSNF were affected significantly by ice cream treatments contain different levels of strawberry pulp as well as storage.

Samples which contain 50% strawberry juice had significantly higher value in fat value then samples which contain 25% strawberry juice then samples without strawberry juice. But there are no significant difference between samples which contain 25% strawberry juice and samples without strawberry juice. Similar results were reported by Bajwa *et al.* (2003). They prepared ice cream with 10, 15, 20 and 25% strawberry pulp. Strawberry flavour ice cream (without strawberry pulp) was kept as control treatment. While fat have shown significant difference among treatments and non-significant difference for storage. Table 5 showed a significant difference between samples in protein value samples which contain 50% strawberry juice had significantly higher value then samples which contain 25% strawberry juice then samples without strawberry juice. Bajwa *et al.* (2003) who prepared ice cream with 10, 15, 20 and 25% strawberry pulp Strawberry flavour ice cream (without strawberry pulp) was kept as control treatment. While protein, lactose have shown significant difference among treatments and non-significant difference for storage.

There is a significant difference between samples in carbohydrate value and samples which contain 50% strawberry juice had significantly higher value then samples which contain 25% strawberry juice then samples without strawberry juice. Bajwa *et al.* (2003) who prepared ice cream with 10, 15, 20 and 25% strawberry pulp Strawberry flavour ice cream (without strawberry pulp) was kept as control treatment. Sucrose was affected significantly by ice cream treatments as well as storage. While lactose have shown significant difference among treatments and non-significant difference for storage.

Samples which contain 50% strawberry juice had significantly higher value in ash value. But samples without strawberry juice had significantly lower value whears there are no significant difference between samples which contain 50% strawberry juice and samples which contain 25% strawberry juice. Similar results

Table 4. Calculation energy of ice cream containing different levels of strawberry juice

Fruit juice added, %	Carbohydrate	Fat	Protein	Total energy
0.0	81.60^{c}	45.90^{b}	14.00^{c}	141.50^{c}
25	88.40^{b}	46.80^{b}	16.80^{b}	151.50^{b}
50	97.00^{a}	49.50a	19.20^{a}	165.70^{a}

a,b,c: values in the same row with different letters differ significantly

Table 5. Chemical composition of ice cream containing different levels of strawberry juice

Fruit juice added, %	T.S.S	Fat	Protein	Carbohydrate	Ash
	%	%	%	%	%
0.0	12.20^{b}	5.10	3.50^{c}	20.40^{c}	0.60^{b}
25	15.10^{c}	5.20	4.20^{b}	22.10^{b}	0.73^{ab}
50	12.66^{a}	5.50	4.80^{a}	24.25^{a}	0.80^{a}
L.S.D	0.05	0.26	0.04	0.60	0.08

a,b,c: values in the same row with different letters differ significantly

were reported by Bajwa *et al.* (2003). They were prepared ice cream with 10, 15, 20 and 25% strawberry pulp. Strawberry flavour ice cream (without strawberry pulp) was kept as control treatment. Ash was affected significantly by ice cream treatments as well as storage.

REFERENCES

A.O.A.C 1980. Analytical Official Methods of Analysis Association of Analytical Chemistry. 12th ed. Washington.

Arbuckle, W.S. 1977. In Ice cream 3rd ed.pp.320, 55, AVI PUB. CO., Inc.

Arbuckle, W.S. 1986. Ice cream second Edition. The AVI publishing company, INC. Westport, Connecticut.

Bajwa, U.A., Nuzhat-Huma, Babar-Ehsan, Kashif-Jabbar and Ayaz-Khurram .2003. Effect of different concentrations of strawberry pulp on the properties of ice cream. International-Journal-of-Agric., and Biology., 5(4): 635-637.

Burke, A.D. 1947. Practical ice cream making. The olsen publishing co. Milwaukee, Wisconsin. C.F. Metwally, M.M.K., 1979. M.SC. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

Guven, M. and O.B. Karaca. 2002. The effects of varying sugar content and fruit concentration on the physical properties of vanilla and fruit ice-cream-type frozen yogurts. International-Journal-of-Dairy-Technology., 55(1): 27-31.

Hughes, E.J. 1967. Stabilizers in ice cream. Confidential, Communication unilever Res. Lab., Welwyn, hertfordshires. England.

Hussein, A.A., Fahmy, M.A. El-Hoda-Hanafy, N., Abd-El Rahim, A.M. 2001. Effect of certain flavouring substances on the properties of ice cream. Assiut-Journal-of-Agricultural-Sciences. , 32(2): 239-248 .

Kalafalla, S.M., G.A. Mahran, L.B. Abdel Hamid and F.M. Fares. 1975. The use of whey solids in ice cream. Egypt. J. Dairy Sci. 3 (1):43.

Martinez-Martin, S., A. Diaz-Marquina and M.T. Orzaez-Villanueva. 2005. Nutritional value of various flavoured traditional and light ice creams. Milchwissenschaft., 60(1):55-58.

SAS Institute. 2000. The SAS System for Windows (Release 8.01). SAS Inst. Inc., Cary, NC.

Steinitz, W.S. and P.F. Rossi. 1979. An overview of flavouring. American-Dairy-Review., 41(5): 16-18, 20.

Tabias, J. and P.H. Tracy 1950.Basic Viscosity of ice cream mixes. Ice cream Trade J.46 : 183 C.F.D.S.A vol. 12 : 428.

Thomas E.L. and W.B. Comps.1944.Observation the use of roller process sweet cream buttermilk powder in ice cream. J. Dairy Sci.27:419.

Winton A.L. 1958. In analysis of foods.3rd ed. pp 6, Jhon wiley 9 sons. Inc .New YORK ,USA.

تأثير استخدام نسب مختلفة من عصير الفراولة علي خواص الآيس كريم

ندا محمد عبد الفتاح- عطية عبد المعطي عبد الباقي

عبد الحميد محمد ربيع- فريد حسن بدر

قسم علوم الأغذية – كلية الزراعة – جامعة الزقازيق

في هذا البحث تم تقييم تأثير استخدام عصير الفراولة علي بعض خواص الأيس كريم. تم استخدام لبن جاموسي معدل (٥%) دهن فى تحضير آيس كريم المقارنة. كما تم تصنيع آيس كريم من لبن جاموسي معدل (٥%) دهن وإضافة عصير الفراولة الطازجة بنسبة (٢٥و٥٠%) على التوالى . وقد أوضحت النتائج المتحصل عليها استخدام عصير الفراولة فى عينات الأيس كريم بنسبة منخفضة(٢٥%) أدي إلي زيادة معنوية في الخواص الآتية القابلية للخفق في مخلوط الأيس كريم و الرماد ونسبة البروتين. في حين هذا الاستبدال أدي إلي نقص معنوي في الخواص الأتية اللون، الزوجة، الوزن النوعي في الأيس كريم، pH، خواص الذوبان، الكربوهيدرات، الدهن، الطاقة الكلية، الجوامد الصلبة الكلية. في حين استخدام عصير الفراولة فى عينات الأيس كريم بنسبة مرتفعة(٥٠%) في عينات الأيس كريم أدي إلي زيادة معنوية في الخواص الآتية الوزن النوعي في الأيس كريم، اللون، خواص الذوبان، الطاقة الكلية الجوامد الصلبة الكلية، الرماد، الكربوهيدرات والبروتين. في حين هذا الاستبدال أدي إلي نقص معنوي في الخواص الآتية القابلية للخفق في مخلوط الأيس كريم، القابلية العامة في الأيس كريم اللزوجة، pH، الدهن والريع.