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ICE CREAM LIKE PRODUCT USING CHICKPEA, CARROT JUICE AND GUAVA PUREE

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ABSTRACT

Milk solids not fat (MSNF) were replaced with chickpea flour by 50 and 100%). Carrot juice and guava puree were used as flavours to produce ice cream like product with satisfactory properties. Both substitution levels replacement of Chickpea flour-guava puree led to decrease in the pH of ice cream mixes. The replacement rates had no effect on the specific gravity of ice cream mixes. Substitution of MSNF with chickpea-carrot and guava puree caused a gradual increase in the specific volume of the mix after whipping ability compared with control. Mixture of chickpea-guava puree at substituting level of 50% produced the higher shear stress than other treatments. Substitution of 50% of MSNF by chickpea-carrot led to significant decrease the overrun of resultant ice cream than other treatments. Sensory evaluation indicated that a preferable ice cream can be produced by replacing of MSNF by chickpea-carrot or chickpea-guava. It could be concluded that chickpea- guava puree enhanced the quality and acceptability of ice cream like products.
Keyworks: ice cream, chickpea, carrot juice, guava puree.

INTRODUCTION

Ice cream comprises a number of related products which primarily differ in relative quantities of ingredients rather than in manufacturing technology. In ice cream making, the required milk solid are usually met by adding non fat dry milk (NFDM) to the ice cream mix. However, the relatively high cost of NFDM has caused increased interest in using dry sweet whey, whey protein concentrate, vegetable peanut protein or soya pean protein as an alternative source of milk solids (Magdoub *et al.*, 1992; Hofi,*et al.*, 1993;Youssif *et al.*, 1995and Abbas *et al.*, 1998). From economic point of view, some or all the milk solids not fat in ice cream can replaced by vegetable solids and dietary fibers (Nagar &Kuri, 2001; Hassan *et al.*, 2001; Hui Ru *et al.*, 2002 and Salama& Azzam 2003). The use of tropical fruit to improve the nutritive value of ice cream and advice is given on some points which need particular attention in the manufacturing process (Bray, 1981; Boutang& Richards 1991; Causey *et al.*, 2000; Salem *et al.*, 2003).

Accordingly, the objective of the present study is to develop a low cost ice cream like product, utilizing commercially available vegetable chickpea flour, flavoured with carrot juice or guava puree, as this treatment gained the acceptability quality; and the effects of these vegetable products on the mix and the resultant product.

MATERAL AND METHODS

- Fresh buffalo's milk was obtained from Animal Production Research Institute, Ministry of Agriculture, Cairo, Egypt.

- Stabilizer: Plasgaard 5808, was obtained from Jueisminde, Denmark.
- Skim milk powder, Sucrose and Vanillia were obtained from local market.
- Chick pea flour:Chick pea seeds were obtained from local market and milled to flour according to Abd El-Rahman *et al.*,1980.
- Carrot juice and Guava puree: Carrot juice and Guava puree were obtained from the local market, and then cleaned washed and skin removed. Carrot juice and Guava puree were prepared using home mixture, fibers and seeds were separated from juices and puree. The chemical composition of these ingredients were shown al the following table:

The chemical composition of vegetable products used in ice cream mix.

(%)	Carrot juice	Chickpea flour	Guava puree
Moisture	90.90	3.0	82.4
Protein	0.9	19.6	0.8
Carbohydrate	4.8	48.1	5.7
Fat	0.1	3.3	0.4
SNF	9.0	93.7	17.2

Experimental proceeding:

Control ice cream mix was 15% sucrose, 0.5 % stabilizer,8% milk fat and 12% milk solids not fat(Arbuckle, 1986). The different treatments of ice cream mix formula has been selected for partial substitution of milk solids not fat with solids free fat from chick pea flour by the ratio of 50 and 100%. 5% Carrot juice or guava puree were used as flavours .Ice cream mixes were heated to 85°C and instantly cooled to 5°C; the mixes were aged for 4 hrs in a refrigerator. The mixes were frozen using the Ice Cream Batch Freezing Machine (model F-1 Glacier, USA). The resultant ice cream was packed in PVC cups and held in a deep freezer at -18°c for hardening. Three replicates of each treatment were carried out.

Methods of Analysis:

Ice cream mixes and fresh resultant were tested for specific gravity, whipping ability and overrun (Arbuckle, 1986). The pH values estimated using a glass electrode pH meter (IL60648, Cole Parameter Instrument Co., USA). Organoleptice properties of resultant ice cream were evaluated by using a panel of 10 trained judges of stuff members at Food Techn.& Dairying Dept., NRC to evaluate flavour (50 points); body& texture (40 points); Melting quality(5 points) and colour (5 points).

-Rheological Examination of Ice Cream Mix:-

The Apparent Viscosity: - The apparent viscosity of the mixes was measured at 15C and shear rate range of 3.67 – 73.42 S^{-1} in ascending and descending directions using a rotational viscometer type Lab-Line Model 5437.

The Shear Stress: - The shear stress was calculated at the same shear rates according to the equation: $r = \gamma \times \eta\, app$ (Muller 1973 and Sherman 1970).

Where r = shear stress γ = shear rate and η app =apparent viscosity .

The Yield Stress: The yield stress was obtained by plotting the square root of shear rate versus the square root of shear stress. The resulted line was extrapolated to zero shear rates. The point of interception with shear stress axis is the square root of the yield stress (Charm 1963).

RESULTS AND DISCUSSION

Ice Cream Mixes:

Data given in Table (1) indicate some properties of the ice cream mixes. From these data it could be seen that the specific gravity values of the mix did not change from that of the control. The pH values of control mix and the mixes treated with chickpea flour–carrot juice mixture did not change while chickpea–Guava puree mixture reduced it. The reduction of the pH was due to the presence of Guava puree. This may be due tot the fact that Guava fruit contains several acidic compounds such as citric acid.

Table (1):The effect of substituting vegetable mixtures on some properties of ice cream mixes.

Mix properties	Control	Chickpea flour/Carrot juice		Chickpea flour/Guava puree	
		50%	100%	50%	100%
Specific gravity (g/cm^4)	1.0773	1.0773	1.0773	1.0773	1.0773
pH	6.02	6.04	6.05	5.38	4.71
Whipping ability specific volume after					
0.0 min	0.9288	0.9282	0.9282	0.9282	0.9282
2.0 min	0.9523	0.9592	0.9600	0.9635	0.9620
5.0 min	0.9610	0.9680	0.9694	0.9659	0.9655
10.0 min	1.0675	1.0699	1.0745	1.0769	1.0755
20.0 min	0.9575	0.9590	0.9620	0.9640	0.9675

The effects of replacing skim milk powder with these vegetable products on the whipping ability of the mix were evaluated by the determination of the specific volume of the mix after whipping the mix for 2, 5, 10 and 20 minutes. The results given in Tables (1) show that these products caused slight increase in the specific volume of the mix after whipping compared with the control. These results may be attributed to the increase of protein percentages of vegetable products that those of milk ingredients products which may enhance the whipping ability of the mix. Goff (1992) stated that proteins contribute to whipping properties and water holding capacity of ice cream.

The apparent viscosity as given in Table (2). It was observed that using mixtures of chickpea flour–carrot juice or Guava puree respectively as a substitute for milk solids not fat at levels of 50% and 100% enhanced the apparent viscosity. The latter mixture was more effective in this respect than the former.

Meanwhile, it is evident from these results that the apparent viscosity of these mixes was relatively higher at low shear rate then declined sharply with the increase of shear rate. Substitution of 50% milk solids in the mix with chickpea-carrot juice or Guava puree may enhance the intermolecular interaction and accordingly the formation and development of a gel– like structure in the mix. This structure built up in the mix is manifested as an increase of the apparent viscosity at low shear rate.

Table (2): The effect of substituting vegetable mixtures on the apperent viscosity of ice cream mixes.

Shear rate S^{-1}	Apperent Viscosity cp.				
	Control	Chickpea flour/ Carrot juice		Chickpea flour/ Guava puree	
		50%	100%	50%	100%
3.67	6.48	12.90	11.16	33.98	69.49
7.34	3.46	9.16	6.22	19.51	41.87
14.68	1.95	4.98	3.66	11.20	25.55
36.71	0.86	2.36	1.79	5.28	12.00
73.42	0.45	1.31	1.08	3.36	7.20

Mixture of chickpea–Guava puree at substituting level of 50% produced the higher shear stress than the level of 100%. The yield stress values obtained for ice cream mix made with chickpea flour–carrot juice or Guava puree given in Tables (3 and 4). The former mixture was more effective when used at a level of substitution of 100% than when it was used at a level of 50%. However, chickpea – carrot juice mixture exhibited the reverse direction.

Table (3):The effect of substituting 50% of milk solids not fat with vegetable solids mixtures in ice cream mix on the shear stress and yield stress of the mixes

Shear rate S^{-1}	Shear stress (dyne/cm^2)					
	Control		Chickpea flour/ Carrot juice		Chickpea flour/ Guava puree	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
3.67	23.78	6.09	62.02	29.87	124.71	75.05
7.34	25.40	11.52	67.23	39.49	143.20	99.53
14.68	28.36	21.73	73.11	52.10	164.42	129.62
36.71	44.05	39.74	86.74	68.28	193.83	188.32
73.42	69.75	69.75	96.22	96.22	246.69	246.69
Yield stress	19.36	3.24	53.29	17.64	100.0	45.56

Inc: Increase Dec: Decrease

Table (4):The effect of substituting 100% of milk solids not fat with vegetable solids mixtures in ice cream mix on the shear stress and yield stress of the mixes

Shear rate S^{-1}	Shear stress (dyne/cm^2)					
	Control		Chickpea flour/ Carrot juice		Chickpea flour/ Guava puree	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
3.67	23.78	6.09	40.96	24.59	255.03	158.62
7.34	25.40	11.52	45.70	30.25	307.33	227.91
14.68	28.36	21.73	53.73	33.32	375.07	280.68
36.71	44.05	39.74	65.71	53.96	440.89	433.91
73.42	69.75	69.75	79.29	79.29	528.62	528.62
Yield stress	19.36	3.24	31.36	12.21	225.00	132.25

Inc: Increase Dec: Decrease

Properties of Resulted Ice Cream:

Table (5) presents the specific gravity, overrun, melting resistance of resultant ice cream as affected by substituting milk solids not fat with chickpea flour –carrot juice or Guava puree. The mixture of chickpea flour–carrot juice or Guava puree reduced the specific gravity of the resultant ice cream except that made with 50% of the first mixture which increased it over that of the control. However, replacing milk solids not fat with chickpea–carrot juice or Guava puree at level of 100% showed relatively higher over run percentage than these made with 50% chickpea–carrot juice.

However, the effects of these ingredients on the overrun or specific gravity may be attributed to their influence on the apparent viscosity of the ice cream mix. These results were similar to that obtained by Youssif, *et al.*, (1995)and Abbas, *et al.*, (1998).

The melting rates of ice cream with the previous ingredients are given in the same Table(5). The former mixture increased the melting rate more than the control. The chickpea–guava mixture enhanced the melting resistance more than chickpea – carrot mixture, these results may be due to the differences between these ingredients, according to the numbers of small molecules presented in each one as well as their water binding capacity. These results were similar to that obtained by Abd El-Rahman, (2003)

Table(5) : The effect of substituting milk solids not fat with vegetable mixtures on some properties of resultant ice cream .

Ice cream properties	Control	Chickpea flour/ Carrot juice		Chickpea flour/ Guava puree	
		50%	100%	50%	100%
Specific gravity (g/cm^2)	0 6162	0.6324	0.6022	0.6064	0.6045
Overrun %	86.62	70.35	78.90	77.65	78.22
Melting resistance after					
30 min	25.22	38.22	30.67	15.05	13.16
60 min	61.90	64.29	56.00	22.58	36.84
90 min	79.81	71.03	61.33	27.96	39.47
120 min	84.92	74.77	62.67	31.18	42.11

Sensory Evaluation:

The average score points of the organoleptic properties of the ice cream manufactured from different treatments are presented in Table (6). The chickpea– guava mixtures enhanced the flavour of the resultant ice cream like product more than chickpea–Carrot mixture particularly when it was used at relatively high level. The high quality of the products made with chickpea- guava puree may be due to the high acceptability of these ingredients. On the other hand product with chickpea-carrot had a total score less than the control.

CONCLUSION

It could be concluded that chickpea -guava puree enhanced the quality and acceptability of ice cream like products.

Table (6): Effect of substituting milk serum solids with vegetable solids on the organolyptic properties of resultant ice cream

Organolyptic properties	Score	Control	Chickpea flour/ Carrot juice		Chickpea flour/ Guava puree	
			50%	100%	50%	100%
Flavour	50	43.5	43.3	35.8	44.0	44.7
Body & Texture	40	37.6	35.7	34.2	35.6	36.5
Melting resistance	5	3.6	3.0	3.1	3.5	3.58
Colour	5	4.0	2.8	2.5	3.8	3.8
Total	100	88.7	84.8	75.6	86.9	88.6

REFERENCES

Abbas, H.M.; N.S. Mehanna; N.S. Abd-Rabou and A.K. Enab.(1998). Ice cream like product using peanut and whey protein concentrates. Menofiya J. Agric. Res., 23: 1563-1573.

Abd El-Rahman, H.A.(2003). The use of barley extract in the manufacture of ice cream. Egypt. J. Dairy Sci., 31: 411-419.

Abd El-Rahman, N. R.; Y.H. Foda; A.G. El-Warraky; M.H. Abd-Allah and W.H. El-malki. (1980). Suggested baby food formulas as compared with local and imported products. Ain Shams J. Agric. Res., Bull. No. 1300.

Arbuckle, S.W. 1986. Ice cream 4th ed. AVI publishing company. Inc.,West Port connecticut. USA. 256-258.

Boutang, J.J.M. and J.B. Richards.(1991). Treatment of fruits. European patent Application. Unilever NV 3000 DK Rotterdam, Netherland. (DSA 54: 6606).

Bray, F.(1981) Use of tropical fruits in ice cream production. Industrieal Alimentari. 20: 171-173.(FSTA 14:0565).

Causey, JL.; J.M. Feirtag; D.D. Gallaher; BC. Tungland and JL. Salavin.(2000). Effects dietary inulin on serum lipids, blood glucose and the gastroin-testinal environment in hyper cholesterolemic men. Nutrition Research. 20: 191.

Charm, S.E. (1963). The direct determination of shear stress-shear rate behavior of foods in the presence of yield stress. J. Food Sci., 28:107-117.

Goff, H.D. (1992). Examining milk solids not fat in frozen dairy products. Modern Dairy 71 (3) 16-17 (DSA 53 : 7887).

Hassan, F.A.M.; S.S. Mohamed and A. Enab.(2001). Preparation of dairy products enriched with sesame seed protein. Egypt. J. Dairy Sci., 29: 79-88.

Hofi, M.; A. Fayed; Z. El-Awamry and A. Hofi. (1993). Substitution of non fat milk solids in ice cream with ultrafiltration whey protein concentrate. Egypt. J. Food Sci., 21: 139-145.

Hui Ru, Y.; H. Shaoh ua and Y. Yingli.(2002). The extraction and purification of inulin. National Product Research and Development. 14: 65.

Magdoub, M.N; L.F.Hamzawi; E.O. Fayed and A.M. Eliwa.(1992). Technological aspects on the use of whey solid in manufacture of ice cream. Egypt. J. Dairy Sci., 20: 159-168.

Muller, H.G. (1973). in "An introduction of Food Rheology" pp28. Hein man, London.

Nagar, G.F. and V. Kuri.(2001). Rheological quality and stability of yog-ice cream with fibers. Proc. 8th Egypt. Conf. Dairy Sci. &Techn. 525-536.

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

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

Sherman, P. (1970). in "Industrial Rheology" pp. 9 Ap, New York, USA.

Youssif, E.I.; A.I. Metwaly and M.M. El-Sayed.(1995). Functional properties of some plant protein isolates and its utilization in ice cream making. Annals of Agric. Sci. Moshtohor. 33: 317-332.

إنتاج مشابه المثلجات القشدية باستخدام دقيق الحمص وعصير الجزر والجوافة

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تم استخدام دقيق الحمص المطعم بعصير الجزر أو الجوافة كبدائل لجوامد اللبن اللادهنية وذلك بنسب استبدال ٥٠ و ١٠٠ % بالإضافة الى المعاملة المقارنة لإنتاج مشابه المثلجات القشدية.

وقد أظهرت النتائج أن الاستبدال بدقيق الحمص المطعم بالجوافة أدى الى خفض درجة ال pH لمخاليط المثلجات. لم تؤثر نسب الاستبدال المختلفة على الوزن النوعي للمخاليط المختلفة. كما أظهرت النتائج أن نسب الاستبدال كان لها تأثير على زيادة القابلية للخفق عن عينة المقارنة، وان استبدال ٥٠% بدقيق الحمص المطعم بالجوافة أدى الى ارتفاع اللزوجة وزيارة shear stress عن باقي المعاملات. بينما تأثر الريع تأثيرا معنويا مع نسب استبدال ٥٠% بدقيق الحمص المطعم بالجزر . وقد أوضح التقييم الحسي انه يمكن إنتاج مشابة المثلجات القشدية ذات جودة مرغوبة وذلك باستبدال ١٠٠% من جوامد اللبن اللادهنية بدقيق الحمص المطعم بالجوافة.