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UTILISATION OF KACHCHHI CAMEL MILK FOR MANUFACTURE OF MEDIUM FAT ICE CREAM

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ABSTRACT

The effect of different flavouring ingredients in medium fat camel milk ice cream (6% fat) on the physico-chemical properties and sensory characteristics were assessed. Camel milk medium fat ice cream was prepared using three different types of flavouring ie Vanilla, Strawberry, and Pineapple. All the three experimental ice creams were compared with control regular ice cream (10% milk fat) with vanilla as flavouring. Compared to control, all the camel milk ice cream mixes had significantly ($p<0.05$) lower viscosity. The experimental ice creams had lower melting resistance and higher overrun compared to control ice cream. The use of pineapple flavour appears to be the most advantageous from all the flavors used. Pineapple flavour helped in enhancing the acceptability of medium fat camel milk ice cream compared to the other two flavours studied viz. strawberry and vanilla.

Key words: Camel, fat ice cream and milk

Value addition of camel milk can be an alternative to make it more important. Camel milk is opaque white in color with normal odor and salty, sweet and sharp taste (Khaskheli et al, 2005). The per cent value of moisture, total solids, fat, SNF, protein, casein, ash, acidity and pH ranges from 88.55-90.15, 9.85-11.45, 2.60-3.20, 7.25-8.25, 3.73-3.89, 2.90-3.02, 0.82-0.85, 0.12-0.14 and 6.36-6.58, respectively (Mal et al, 2006 and 2007). Camel milk contains little fat (2%); which consists mainly of polyunsaturated fatty acids that are completely homogenised and gives the milk a smooth white appearance. Lactose is present in concentrations of 4.8%, but this milk sugar is easily metabolised by persons suffering from lactose intolerance (Yagil, 1985; Beg et al, 1986; Hanna, 2001). Camel milk is also known for its medicinal properties which are widely exploited for human health (Mal et al, 2006). Most of the camel milk is consumed as a raw, or for preparation of tea in India. Goyal and Bishnoi (2007) developed camel milk products like ice creams, paneer, khoa, kheer and rabari in India. Singh (2004) prepared typical Indian market acceptable ice cream named as kesar kulfi which is a candy like presentation on a stick with saffron mixed camel milk. Wernery (2006) opined that camel milk products are consumed commercially as fresh raw or pasteurised camel milk cheese, ice creams with different flavours and milk shakes, puddings and the Arabian dishes as sour milk.

Now a days low-fat dairy products have taken marked share off full-fat products in several markets. Present study is based on utilisation of Kachchhi camel milk for manufacture of medium fat ice cream.

Materials and Methods

Fresh camel milk obtained from Milk Cooperative Society at Dakor village near Anand city, Gujarat was used as the base material for ice cream manufacture. Cream was separated from the milk at 40°C and was used for standardisation of ice cream mix. SagarTM brand skim milk powder (SMP) and whey protein concentrate (WPC) obtained from Mahaan Proteins Ltd., Kosikalan, Uttar Pradesh, India was used. Alginate-S4 of S. Square & Co., Gwalior and Glycerol Mono Stearate (GMS) was obtained from M/s. Brion Fine Chemicals, Mumbai. Vanilla, Strawberry and Pineapple essence were obtained from M/s Bush Boake Allen (India) Ltd., Chennai. Food grade 'Bush' brand pineapple and strawberry colour were obtained from M/s International Flavours and Fragrances India Ltd. and used as colouring agent for pineapple and strawberry ice cream, respectively.

Preparation of Ice Cream Mix

The quantity of camel milk, cream, SMP, WPC, sucrose, sodium alginate and GMS required for a 5 kg batch was calculated using serum point method. SMP, WPC and other dry ingredients were

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mixed with sugar prior to incorporation in mix at about 50°C temperature. The mixes were further heated to 80°C and homogenised in a double stage homogeniser (Goma-make, Model No. H-502, M/S Goma Engineering Pvt. Ltd., Thane, Mumbai) at 2000 and 500 psi pressures in the first and second stage, respectively and pasteurised by holding the mix at 80°C for 5 min. The pasteurised mixes were immediately cooled to 3-4°C and aged overnight at same temperature. The flavouring ingredients were added just prior to freezing.

Freezing in direct expansion type batch ice cream freezer

For preparing different batches of ice creams, the aged mixes were frozen in a horizontal batch freezer (M/S. Pal Engg. Pvt. Ltd., Ahmedabad) (cylinder capacity 10 lit.). After freezing the mix to a semi-solid consistency (which took 10-15 min), as inferred from the load on the ammeter (3 amperes) and accumulation of ice on the freezer door, air was whipped at a pressure of 5-10 psi for 2 min. The ice cream was drawn directly into 100 ml High Impact Polystyrene (HIPS) cups and 1.0 lit. wax coated paper board cartons. The surfaces of the cup was leveled and then covered with wax coated paper board lids. The filled ice cream cups/packs were then transferred immediately to a hardening tunnel for 2-3 h. and then transferred to deep freeze maintained at -18 + 2°C. The ice creams were subjected to compositional analysis, melting quality test and sensory evaluation.

Analyses of Ingredients

The fat content of milk and cream were estimated by Gerber method (ISI, 1977). The total solids of milk was determined by the standard procedure using a Mojonnier Milk Tester (Model D, Mojonnier Brothers Co., Chicago, USA) (Laboratory Manual, 1959). The titratable acidity of milk was determined by standard method (ISI, 1961). The total solids content of ice cream mixes were determined by standard method using 2 g of sample (ISI Handbook of Food Analysis, 1989). The fat content of ice cream mix determined by the standard method using 5 g of mix (ISI Handbook of Food Analysis, 1989). The protein content of the ice cream mixes was determined by Kjeldahl method (AOAC, 1980). Overrun in ice cream was determined as per the method given by Marshall *et al* (2003). The method given by Loewenstein and Haddad (1972) was employed for evaluating the melting characteristics of ice cream. The hardened ice creams were tempered to –12 to + 1°C for 1-2 h in retail cabinet before serving. All the samples were coded with a 3 digit random number and samples were served randomly. The ice cream was subjected to sensory evaluation using a 9 point hedonic scale. Fresh samples of ice cream 100 ml cups after 24 h of hardening at -18 ± 2°C in hardening room were tempered to -12 ± 2°C for 1-2 h in a retail cabinet for sensory evaluation. Sensory evaluation was performed in a well-lit and ventilated laboratory. The panel members were selected from among the faculty members on the basis of familiarity with judging ice cream and based on experience and their capacity to distinguish quality variations and other attributes in ice cream. The final selection of panelists (6 in number) was done on the basis of results of triangle test using ice cream. A 9-point hedonic scale score card was used in paper form. The total number of samples evaluated per session was not more than 4. Panelists were asked to rinse their mouth with lukewarm water (containing 1% by wt sodium chloride) before assessing each sample and to expectorate all the ice cream samples. All the samples were simultaneously presented to each panelist in a random order. All the samples were coded with a 3 digit random number.

Statistical analysis

The mean values of each attributes under study were subjected to statistical analysis using Completely Randomised Design with equal number of observations. The ANOVA for the values of each attribute were performed to evaluate the effect of different flavours on physico-chemical and sensory characteristics of ice cream. The means for the data were separated by Least Significant Difference test (Steele and Torrie, 1980). The significance was pre-established at $p < 0.05$.

Results and Discussion

The average fat content of camel milk was 3.2 + 0.2% and the MSNF content was 8.5 + 0.1. The average acidity of camels milk was 0.125% lactic acid. Preliminary trials were conducted for selecting the level of fat, MSNF, sucrose, WPC, stabiliser and emulsifier in a tentative formulation of ice cream. Since the fat content of the camel milk was low, it was decided to prepare medium fat ice cream. Reduced calorie products usually have a low content of total solids compared to standard products (about 30 to 35% TS as against of 38 to 40%), which means that they also make considerable demands on the functional ingredients (e.g. fat replacers, bulking agents, stabilisers and emulsifiers) that they contain. To select the optimum level of fat in the

tentative formulation which would not have much adverse effect on sensory properties of the frozen product, preliminary screenings were undertaken. It was decided to use milk fat at a level of 6% was in the formulation while the MSNF content 11.5% (w/w) and WPC 1.5%, respectively. Whey protein concentrate (WPC) has been included in ice cream mix formulations for its contribution to favourable sensory and textural qualities (Parsons *et al,* 1985; Hofi *et al,* 1993; Tirumalesha and Jayaprakasha, 1998). Therefore it was decided to incorporate WPC in the mix. The tentative levels of fat as well as MSNF were based on the preliminary investigations and reported literature (Garcia *et al,* 1995; Kebary and Hussein, 1997; Marshall *et al,* 2003). The formulation given in Table 1 was chosen and used for preparation of medium fat camel milk ice cream. The camel milk had a sharp taste (mineral like) and predominant grassy flavour, with a slightly salty taste. It also had a pronounced fat aftertaste. Therefore, with a view to improve the acceptability of camel milk ice cream, three flavours were used to ascertain the acceptability of flavour for preparation of camel milk ice cream. Camel milk medium fat ice cream was prepared using three different types of flavours i.e Vanilla (V), Strawberry (S), and Pineapple (P). All the three experimental ice creams were compared to control (C). The composition of control ice cream mix was 10.0% milk fat, 11.0% MSNF, 15% sugar, 0.15% stabiliser and 0.2% emulsifier. All the flavouring ingredients, i.e. Vanilla, strawberry and pineapple essence were added at the rate of 3 ml/kg mix. The freshly hardened control (C) and experimental samples viz. V, S and P of ice cream were analysed for their chemical composition. The average values of compositional attributes are presented in Table 2. It can also be observed from the table that the protein content of all the experimental samples were higher than control. This is quite obvious as WPC was rich in protein content (i.e. 71.09% on dry matter basis). The fat content and total solid content of experimental camel milk ice cream were significantly lower as compared to control. This is due to the lower fat of experimental samples which leads to reduction in total solids of ice cream mixes. No data is available in literature for camel milk ice cream for comparison. Viscosity has been considered as an important property of ice cream mixes and up to a certain extent it seems essential for proper whipping and retention of air cells. The viscosity of mix is also affected by the composition, especially, fat, protein and stabiliser and the quality of ingredients used. Hence, the aged mixes were subjected to viscosity test. The overrun of a frozen dessert is an important property since it directly has relation with the yield and profit. It also affects the body, texture and palatability of the final product. The major physical characteristics of frozen desserts that concerns regulatory agencies is weight per unit volume of the product, and this is affected by the overrun developed in the product. Ice cream should melt down to a liquid of smooth consistency, suggestive of a rich cream. Meltdown is an important property of ice cream affecting its sensory quality. It is important from at least two main points of view – eye appeal and mouth feel – which may differ according to the type of ice cream (Flack, 1988). It is also important that the ice cream is not too hard or should not melt quickly. Deviation in the melting property from ideal condition either

Table 1. Formulation of medium fat camel milk ice cream.

S. No.	Ingredient	Per cent level of addition
1.	Milk Fat	6.0
2.	MSNF	11.0
3.	Sucrose	15.0
4.	Sodium Alginate	0.20
5.	GMS	0.15
6.	WPC-70	1.50
	Total solids	33.85

Table 2. Chemical composition of medium fat camel milk ice cream mixes.

Type of flavours	Constituents (%)			
	Fat	Protein	Total solids	Acidity (% LA)
Control (Vanilla)	10.13	3.98	36.36	0.198
Vanilla	6.05	4.95	33.90	0.220
Strawberry	6.13	4.98	33.85	0.223
Pineapple	6.13	5.05	33.95	0.220
Statistical analysis				
CD(0.05)	0.34	0.12	0.19	0.004

Table 3. Physical properties of medium-fat camel milk icecream/mixes.

Type of Ice cream	Viscosity (mPas)	Wt./vol. (g/lit)	Melting resistance*
Control (Vanilla)	184.75	575.0	24.1
Vanilla	161.25	552.5	25.4
Strawberry	161.25	550.0	25.5
Pineapple	161.25	556.3	26.1
Statistical analysis			
CD(0.05)	8.973	16.30	1.84

*g of ice cream melted at 37.50C in 40 min.

Table 4. Sensory evaluation of medium fat camel milk ice creams.

Type of Ice cream	Flavour score	Colour and appearance score	Body and Texture score	Overall acceptability score
Control (Vanilla)	8.55	8.50	8.30	8.23
Vanilla	6.88	7.30	7.43	7.43
Strawberry	7.31	8.20	7.63	7.45
Pineapple	8.19	8.20	7.68	8.08
Statistical analysis				
CD(0.05)	0.37	0.47	0.45	0.21

extremes can make the ice cream defective (Sommer, 1951). Hence, the melting resistance of control as well as experimental samples were monitored. Table 3 depicts the average values some physical properties of camel milk ice cream. It is evident from the Table 3 that compared to control all the camel milk ice cream mixes viz. V, S an P had significantly lower viscosity. The experimental icecreams had higher overrun as revealed from the wt/volume data. Incorporation of WPC in the all the experimental ice creams was found to improve the overrun significantly ($P \leq 0.05$). From the pertaining statistical analysis it can be seen that all the experimental samples had significantly ($P \leq 0.05$) lower melting resistance compared to control. The experimental samples in spite of decreased melting resistance values, were statistically at par with each other ($P > 0.05$). No data is available in literature for comparison of the above physical properties of medium fat camel milk ice cream with regular ice cream.The fate of any food product has always rested on the acceptance of the product by the consumers. The quality of the ice cream judged by consumers rests on its sensory characteristics, viz. flavour, colour and appearance, body and texture and overall acceptability. Keeping in view these aspects, the sensory quality of the ice cream samples were adjudged by a panel of 6 judges using 9-point hedonic scale score card. The results are presented in Table 4 and illustrated in Figure 1. It can be seen from the table that the flavour score of control and P were at par ($P>0.05$) with each other, whereas samples V and S had significantly lower flavour scores compared to control. The colour and appearance scores of camel milk vanilla ice cream, i.e. V was significantly lower than all the other experimental samples. This was due to the dull /less attractive colour as criticized by the judges. The body and texture scores of all the experimental samples were significantly lower than

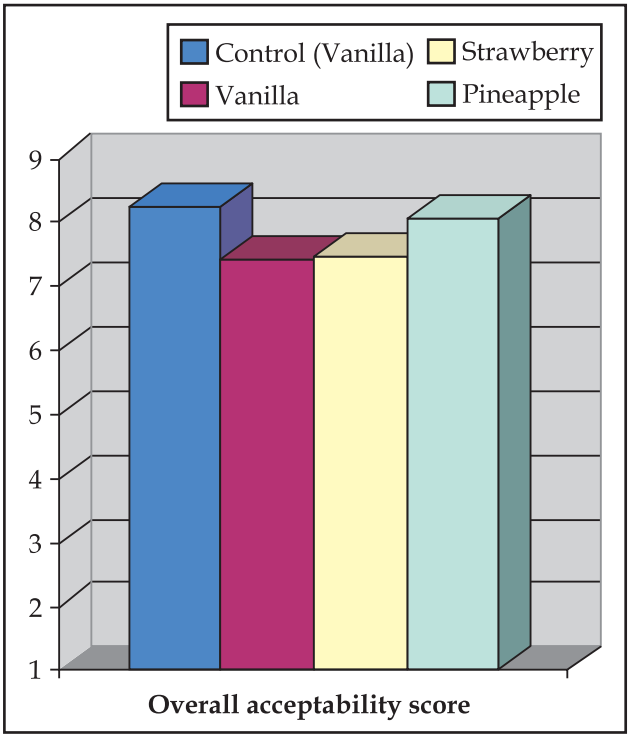

Fig 1. Overall acceptability scores of camel milk ice cream with different flavours.

control ($P<0.05$). This could be attributed to the lower total solids and fat content and faster meltdown as seen in Table 2 and Table 3, in the experimental samples. However, the overall acceptability of sample P was at par with control. Pineapple flavour reduced the negative impact of the flavour characteristics of camel milk. This could be due to the masking effect of pineapple flavour. The use of pineapple flavour appears to be the most advantageous from all the flavours used which helped in enhancing the acceptability of medium fat camel milk ice cream compared to the other two flavours studied viz. strawberry and vanilla.

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