Ginger shreds as flavouring in ice cream

Suneeta Pinto[1], A K Rathour[2]*, A H Jana[1], J P Prajapati[1] and M J Solanky[1]

[1]Department of Dairy Technology, S.M.C. College of Dairy Science, Anand Agricultural University, Anand-388 110, Gujarat, India

[2]Mahaan Proteins Ltd. Kosi-Kalan-281 403, Mathura, Uttar Pradesh, India

*Correspondent author, E-mail: ashwanikumar@mahaanfoods.com

Received 19 March 2005; Accepted 24 October 2005

Abstract

Ginger ice cream was prepared in an "ice and salt" type hand freezer using ginger shreds at 4, 6 and 8% levels of ice cream mix and compared with control made by using vanilla flavouring. The basic ice cream mix had 12% fat, 11% MSNF, 15% sucrose, 0.25% sodium alginate and 0.15% glycerol mono-stearate. Addition of ginger shreds resulted in decrease in all the compositional attributes (fat, protein, sugars and total solids) and *p*H and an increase in acidity, which was significant especially at higher levels of shred addition. The ginger shreds tended to increase the viscosity of ice cream mixes and melting resistance of ice cream significantly, especially at higher levels of its addition. The shreds had an adverse effect on overrun in ice cream. Ice cream containing 4% ginger shreds was found suitable for preparing 'Ginger ice cream'; it had an edge over control with regard to sensory perception. The body and texture score of such ice cream increased significantly up to 6% addition, beyond which the score tended to decrease.

Keywords: Ginger shreds, Overrun, Melting resistance, Flavouring, Viscosity, Whipping ability.

IPC code; Int. cl.[7] — A23G 9/00, A23G 9/02

Introduction

Spice such as ginger is being used to a limited extent as flavouring in ice cream by small-scale ice cream manufacturers. However, there is a need to standardize certain parameters involved in manufacture of 'Ginger ice cream'. The medicinal properties of ginger are well documented, for instance, in preventing cough and cold (Buchman, 1980). Some people refrain from consuming ice cream because of fear of catching cold. Incorporation of ginger can probably make such people less susceptible to cold. Lately, people have focused on the wholesomeness and safety of natural foods and natural flavours, rather than consuming food based on artificial additives (Heath, 1978). The present investigation proposes to evaluate the suitability of ginger shreds as a flavouring agent in ice cream and evaluate its effect on the physico-chemical and sensory characteristics of product.

Materials and Methods

***Ginger shreds*:** Fresh ginger procured from local market was washed, peeled and then shredded (5-10 × 1-2 × 1-2 mm; length × width × thickness) in a sanitized Kitchen Machine (Model–super deluxe, Gopi Manufacturers, Ambala).

***Ice cream preparation*:** Ice cream was prepared in an 'ice and salt' type ice cream freezer (5 kg capacity) using ginger shreds at three different levels, viz. 4 (S1), 6 (S2) and 8 (S3)% by weight of ice cream mix. Vanilla essence No.1 [M/s Bush Boake Allen (India) Ltd., Chennai] was used as flavouring in control (C) @ 1 ml/kg of ice cream mix. The mix had 12% fat, 11% SNF, 15% sucrose, 0.25% sodium alginate and 0.15% glycerol mono-stearate. The mixes were homogenized at 75°C and 100 kg/cm^2 pressure and pasteurized at 70°C/ 30 minutes. It was then cooled to 5°C and aged at same temperature overnight.

At a time, 2.5 kg mix was frozen per batch using ice and coarse salt (30% of ice). Ginger shreds were added to the ice cream mix at the time of freezing. Total time taken for freezing was 30-35 minutes. The ice cream was allowed to harden for 1 hour in the same freezer and then served for judging. Each treatment was replicated thrice. In all, 12 batches of ice cream were prepared. The drawing temperature of ice cream ranged between –4.0 and –5.0°C.

***Analyses*:** The ice cream mixes were analyzed for fat, reducing sugars, non-reducing sugars, total solids and titratable acidity as per BIS method (BIS, 1989).

Ginger

The protein content was determined by Kjeldahl method (Menefee & Overman, 1940). The *p*H was determined using digital *p*H meter (Model 335, Systronics Ltd., Ahmedabad) at 25°C. The viscosity and whipping ability of ice cream mix were determined by the method of Loewenstein and Haddad (1972a) and Neshawy *et al* (1988), respectively. The melting characteristics of ice cream were evaluated by the method given by Loewenstein and Haddad (1972b) with modifications adopted by Upadhyay *et al* (1978).

Sensory quality: The sensory characteristics of ice cream were assessed by a panel of 6 judges using the scorecard (Arbuckle, 1986). Statistical analysis of the data was carried out as per Steel and Torrie (1980).

Results and Discussion

Compositional attributes: There was a significant decrease in fat, reducing sugars, non-reducing sugars and TS content; a marginal increase in acidity was evident with increase in the level of ginger shred addition (Table 1). The experimental ice creams conformed to the PFA and BIS requirements for ice cream.

Viscosity and whipping ability of ice cream mix: Viscosity is considered an important aspect for proper whipping and retention of air cells. The average values of viscosity ranged from 174.2 (for C) to 302.5 (for S3) centipoise(Cp). The viscosity of experimental mixes progressively increased with increase in the level of ginger shred addition; the effect was significant at each level of addition. The viscosity of ice cream mixes is reported to be between 50 and 300 Cp (Arbuckle, 1986). Polysaccharides such as starch are reported to increase the mix viscosity and restrict ice crystal growth during storage of ice cream (Cottrell *et al*, 1980).

The whipping ability of ice cream mixes is represented as specific volume (cm^3/g). The specific volume of experimental unwhipped samples was marginally higher than that of control (Table 2). The specific volume of mixes increased after whipping the mixes for 3 min, beyond which (> 5 min) it tended to decrease. However, the specific volume of mixes after 5 minutes whipping period was higher than that prevailing in unwhipped mixes.

The specific volume of the mixes varies with the composition of the mix. The initial increase in the specific volume of experimental samples may be ascribed to the difference in density of milk solids and ginger solids. The differences in whipping ability of mixes could be due to the higher viscosity of mixes containing ginger and the differing composition of the mixes. The higher acidity of experimental mixes might have been partly responsible for the increased viscosity of the mix, which in turn might have resulted in decrease in the specific volume at 3 and 5 minutes of whipping (Table 2).

The slight rise in the temperature of mix during continued whipping might be responsible for weakening the air cell lamellae, resulting in lower whipping ability (Arbuckle, 1986; Neshawy *et al*, 1988).

Overrun and melting resistance of ice cream: The overrun in ice cream is directly related with the yield and profit and has a bearing on the body & texture and palatability of the product. Control ice cream had the maximum (i.e. 42.6%) overrun whereas S3 had the least overrun (i.e. 37.97%). Incorporation of ginger shreds in ice cream decreased the overrun; the effect being significantly marked with higher levels of addition (Table 3). The higher viscosity of experimental mixes and the presence of shreds, in itself, might be partly responsible for exerting deleterious effect on overrun by weakening the air

Table 1 : Influence of ginger shreds on the compositional characteristics of ice cream

Samples	Ice cream constituents (%)					Titratable acidity (% LA)	*p*H
	Fat	Protein	Reducing sugars	Non-reducing sugars	Total solids		
C	11.90	4.07	5.24	14.91	38.18	0.197	6.38
S1	11.62	3.98	5.16	14.83	37.50	0.199	6.38
S2	11.42	3.95	5.07	14.77	37.12	0.204	6.38
S3	11.18	3.89	4.99	14.71	36.73	0.207	6.37
C.D. (0.05)	0.11	NS	0.1	0.07	0.19	NS	NS

cell lamellae, as is the case with nut pieces in nut-ice cream. Ice cream mixes containing potato pulp were more viscous than control and thus had an adverse effect on overrun (Das *et al*, 1989).

Meltdown is an important property of ice cream affecting its sensoric (i.e. eye appeal and mouth feel) quality (Flack, 1988). The melting resistance of ice cream containing ginger shreds increased progressively with increasing level of shreds addition (Table 3). The control had the least melting resistance. The meltdown values (g ice cream melted in 40 min. at 37.5°C/100 g) varied from 42.82 in C to 21.28 in S3 (maximum melting resistance). Generally the resistance to melting and smoothness of ice cream increases with increase in the viscosity of mix (Arbuckle, 1986; Das *et al*, 1989). Ginger contains some hydrocolloids, which might be contributing to the increase in viscosity and thus melting resistance.

Sensory quality of ice cream

The fate of any food product has always rested on the acceptance of the product by the consumers. Considering the variations expected in the sensory scores, the root-x scale was employed in statistical analysis of the data.

Table 2 : Influence of ginger shreds on the viscosity and whipping ability of ginger ice cream

Samples	Viscosity (Cp) at 7°C	Whipping ability (cm^3 /g) after whipping for		
		0 min	3 min	5 min
C	174.2	0.918	1.222	1.173
S1	269.2	0.922	1.167	1.142
S2	283.3	0.927	1.145	1.110
S3	302.5	0.929	1.122	1.047
C.D. (0.05)	14.81	NS	0.016	0.021

Table 3 : Influence of ginger shreds on the overrun and melting characteristics of ginger ice cream

Samples	Overrun in ice cream (%)	Melting rate of ice cream*
C	42.58	42.82
S1	40.86	30.58
S2	39.66	23.68
S3	37.97	21.28
C.D. (0.05)	1.73	3.52

* Quantity of ice cream melted in 40 min at 37.5°C per 100 g

Flavour: Ginger ice cream made by using shreds added at 4% level was found to be sensorily very acceptable (Table 4). Ice cream containing shreds at higher levels (viz. 6, 8%) were criticized for being chewy, fibrous and pungent.

The aroma of ginger is mainly due to its volatile essential oil and the pungency is attributed to gingerols, shogoal, paradol, etc. (Narayanan, 1988).

Body and texture: Incorporation of the shreds up to 6% level in ice cream improved the body and texture. Beyond this level it adversely affected the score, making them even inferior to control. S1, S2 and C had smooth body, whereas S3 had a chewy and gummy body, which was not liked by the judges.

Melting quality: The melting score for control was maximum (4.72 out of 5.00). Samples S1 and S2 had statistically similar scores, which were lower than that of control; sample S3 had significantly lower score than rest of the samples (Table 4). The experimental samples were criticized for their delayed meltdown.

Colour: The judges did not object to the presence of shreds in ice cream. The colour scores of all the samples were at par with each other.

Conclusion

In preparation of ginger ice cream, use of 4% shreds is recommended. Incorporation of such flavouring led to decrease in fat, reducing sugars, non-reducing sugars and a marginal increase in acidity. Use of ginger shreds improved the melting resistance, but decreased the overrun in ice cream.

Table 4 : Sensory quality of ice cream as influenced by ginger shreds incorporation

Samples	Sensory score for				
	Flavour (45)*	Body and texture (30)	Melting (5)	Colour (5)	Total (100)
C	6.06 (36.83)**	5.61 (26.66)	2.17 (4.72)	2.20 (4.83)	8.57 (73.05)
S1	6.20 (38.44)	5.24 (27.50)	2.08 (4.33)	2.21 (4.89)	8.67 (75.16)
S2	6.08 (37.00)	5.32 (28.28)	2.03 (4.14)	2.20 (4.83)	8.62 (74.25)
S3	6.05 (36.61)	5.13 (26.34)	1.96 (3.83)	2.20 (4.86)	8.46 (71.64)
C.D.(0.05)	0.027	0.037	0.052	NS	0.058

* Maximum score; ** Squared values of sensory score i.e. actual average score

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