

Preparation of ice-cream using natural sweetener stevia

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Stevia is a calorie-free sugar substitute and does not increase the blood glucose level, making it a possible alternative for diabetics and dieters. Ice cream was prepared by replacing sugar with two different concentrations of stevia powder 2.25 per cent and 2.50 per cent. Two flavours were used *i.e* coffee flavour and mixed flavour (vanilla, strawberry and pineapple in equal amount). Sugar was fully replaced by stevia powder. Effect of incorporation of stevia powder in both the flavours was evaluated for the sensory characteristics of ice cream and compared with the control containing sugar. Amongst the two flavour the research shown that the coffee flavour ice cream containing 2.25 per cent of stevia powder was found to have good colour, appearance and texture. It contained protein 2.96 per cent, carbohydrates 7.49 per cent, fat 12.08 per cent, energy 151 kcal/100g, reducing sugar 3.94 per cent, non-reducing sugar 0 per cent, calcium 0.13 per cent, total solids 25.88 per cent and free fatty acids 0.71 per cent.

Key Words : Stevia powder, Ice-cream, Milk, Cream, Sugar, Sensory parameters

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INTRODUCTION

Stevia, also referred to as sweet leaf, is a perennial shrub with leaves that are sweet in taste used for centuries around the world. Individuals who use stevia typically are diabetics, the calorie conscious and those concerned with the potentially harmful aspects of sugar. It is available in health food stores. Stevia may be purchased in the form of stevia powder, in packets or in clear liquid extract. Due to its highly sweet taste, the best way to use stevia is by first trying it in small amounts.

Stevia powder is 200-300 times sweeter than sucrose (Kinghorn, 1987). It is anti-bacterial, anti-viral and anti-aging. One gram of stevia powder is equal to two teaspoon of sugar

(one teaspoon sugar equals to 4.2 g). It is being used since years and various research works proved that Stevia can help in management of many ailment including diabetes (activate beta cells of pancreas to secrete more insulin), typically for acne and other skin ailments, hypertension (Jeppesen *et al.*, 2002 and Paul Chan *et al.*, 2000) digestion and acidity, high blood pressure, addictions, anti-tooth cavities. It can also be used as cardiac tonic, anti-oxidant and weight loss aid.

The increasing occurrence of obesity, diabetes, and other health related issues globally have led to the emergence of several healthy trends in the food and beverage (F and B) sector in recent years. Consumer's interest in healthy products has spurred innovation and led to the development of various healthy substitutes for ingredients currently being used by the food industry.

India ranks first in ice-cream production all over the world. The ice-cream production in year 2000-2001 was 80 million tones and in year 2010-2011 it was 155 million tones. At the same time diabetes patient in year 2000 was 31.7 million and in year 2011 it was 62.4 million (ICMR, 2011). Sugar has almost 146 reasons to ruin human health. Sugar increases cholesterol, systolic blood pressure, hypertension etc. Sugar also contributes to diabetes (Nancy, 2012).

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The increase in ice-cream production, diabetic patients and the reasons of sugar for ruining human health it was decided to carry out a research on preparation of sugar free ice-cream using stevia powder which can be consumed by diabetic patients.

After aging, blending was carried out along with flavour addition. The mixture was then kept for final freezing at -4°C. Prepared ice cream was filled into the cups and hardening was carried out at -35°C. After hardening, ice-cream was stored at -23°C temperature.

METHODOLOGY

Collection of raw material:

Raw materials required for the preparation of ice cream were collected from local market of Pune. Stevia powder was bought from Ayurvedic Medical Stores, Pune. Milk, cream, sugar, corn flour, CMC, GMS and flavours were collected from local market of Hadapsar.

Packaging material:

Ice cream cups were obtained from local market of Hadapsar for packaging of ice cream.

Formulation of ice-cream:

Different samples of ice cream were prepared by replacing sugar with stevia powder as shown in Table A.

Ingredients	Coffee flavour			Mixed flavour		
	S ₁ C	S ₁ C ₁	S ₁ C ₂	S ₂ M	S ₂ M ₁	S ₂ M ₂
Milk (g)	100	100	100	100	100	100
Cream (g)	50	50	50	50	50	50
Sugar (g)	21	--	--	21	--	--
Stevia powder (g)	--	2.25	2.50	--	2.25	2.50
GMS (g)	2.50	2.50	2.50	2.50	2.50	2.50
Corn flour(g)	1.75	1.75	1.75	1.75	1.75	1.75
CMC (g)	0.25	0.25	0.25	0.25	0.25	0.25
Coffee powder (g)	0.25	0.25	0.25	--	--	--
Mixed flavour (ml) (vanilla, pineapple, strawberry)	--	--	--	0.15	0.15	0.15

S₁C : Control (coffee flavour), S₁C₁ : Coffee flavour with 2.25 g stevia powder, S₁C₂ : Coffee flavour with 2.50 g stevia powder, S₂M : Control (mixed flavour), S₂M₁ : Mixed flavour with 2.25 g stevia powder and S₂M₂ : Mixed flavour with 2.50 g stevia powder

Preparation of ice-cream using stevia powder:

Flow chart for preparation of ice-cream is given in Fig. A. Ingredients were received and weighed according to recipe. Cream was added to milk as per the recipe and the mixture was heated on low flame. Dry ingredients such as sugar, GMS, stevia powder, coffee were mixed in small quantity of milk. Then this mixture was added to cream and milk mixture before the temperature of mixture reaches to 50°C. The mixture was heated for 30 min at 68°C with constant stirring. Then it was blended for 1 min to form uniform mixture. After that it was cooled to 5°C. Then aging was carried out at 5°C for 3 hours.

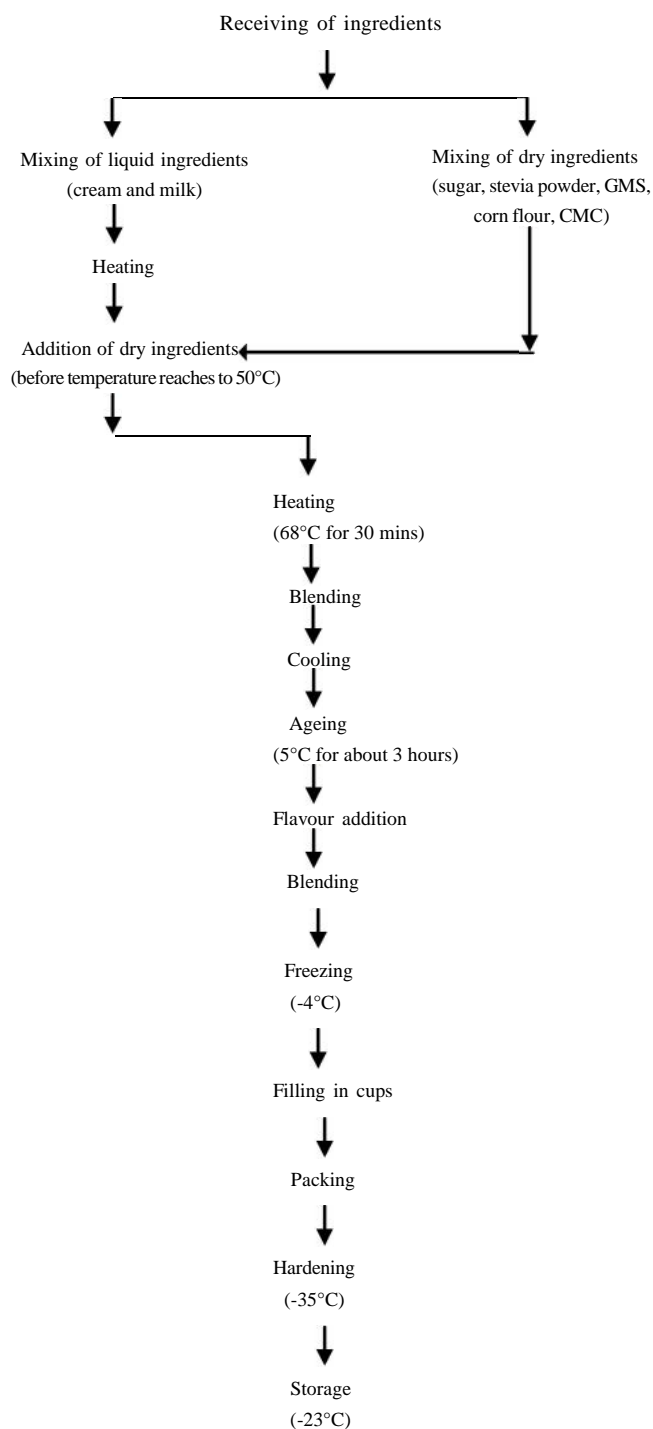


Fig. A : Flow chart for preparation of ice-cream using stevia powder

Chemical analysis:

Chemical analysis of ice-cream products was carried out. Carbohydrate was determined by Anthrone method (Ranganna, 1977), protein by Kjeldhal method, fat by Rose-Gottlieb method, reducing and non-reducing sugar by Lane and Eynon method, calcium by titration method, total solids by gravimetric method and free fatty acids (as oleic acid) by DGHS method (Anonymous, 2012).

Sensory evaluation:

Sensory evaluation was carried out by 10 sensory panel members to evaluate the ice cream samples. Evaluation was made for the sensory parameters like colour, taste, texture, flavour, mouthfeel and after taste. Sensory evaluation was done by 9-point hedonic scale (Anonymous, 1971).

OBSERVATIONS AND ASSESSMENT

The results of the present study as well as relevant discussions have been presented under following sub heads:

Chemical composition:

Chemical composition of ice cream was performed and tabulated in Table 1. Protein content was found in the range from 2.70 per cent to 2.96 per cent. There was no marked effect on protein content due to stevia powder. It was seen that there was marked effect of stevia powder on carbohydrates. Carbohydrate content in stevia samples was found in the range from 7.49 per cent to 7.97 per cent whereas in control samples of sugar it was found 20.39 per cent (coffee flavour) and 19.98 per cent (mixed flavour). Fat content in sample was found in the range from 11.89 per cent to 12.36 per cent. The energy value of ice-cream samples containing stevia was found lesser (150kcal/100g and 151kcal/100g) than that of control samples *i.e* 202kcal/100g. Reducing sugar in sample was found in the range from 2.59 per cent to 3.94 per cent. Non-reducing sugar in stevia samples was found 0.0 per cent and in control it was 12.43 per cent to 12.49 per cent. Calcium content in all ice-cream samples was found in the

range from 0.12 per cent to 0.14 per cent. Total solids in stevia ice-cream samples were found in the range from 24.96 to 25.88 per cent whereas in control sample it was found more (35.80% in coffee flavour and 36.21% in mixed flavour). Free fatty acid content in stevia samples was in the range from 0.70 to 0.73 per cent and in control samples it was 0.54 per cent to 0.58 per cent.

Organoleptic properties:

Results obtained by sensory evaluation of ice-cream samples are shown in Fig. 1 and Fig. 2. Sensory score for all ice-cream samples was found in the range from 6.4 to 8.1. The

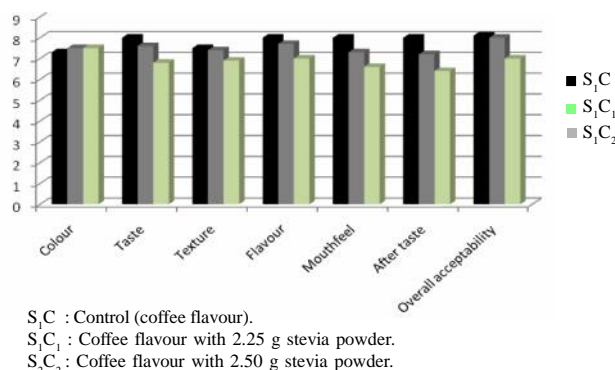


Fig. 1: Effect of stevia powder on sensory score of coffee flavour ice-cream

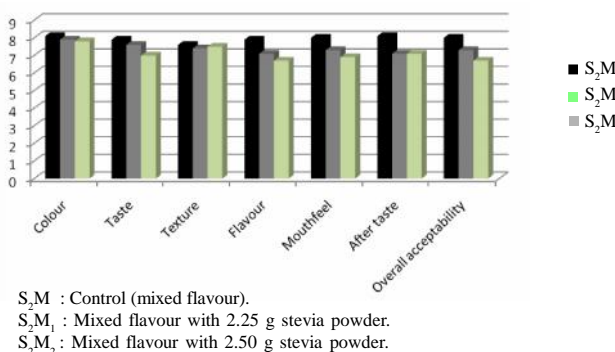


Fig. 2: Effect of stevia powder on sensory score of mixed flavour ice-cream

Table 1: Chemical composition of ice-cream samples

Parameters	S ₁ C	S ₁ C ₁	S ₁ C ₂	S ₂ M	S ₂ M ₁	S ₂ M ₂
Protein	2.74%	2.96%	2.85%	2.70%	2.89%	2.86%
Carbohydrates	20.39%	7.49%	7.93%	19.98%	7.52%	7.97%
Fat	12.14%	12.08%	11.95%	12.36%	11.99%	11.89%
Energy (kcal/100g)	202	151	151	202	150	150
Reducing sugar	2.65%	3.94%	3.28%	2.59%	3.01%	3.54%
Non-reducing sugar	12.43%	0.0%	0.0%	12.49%	0.0%	0.0%
Calcium	0.12%	0.13%	0.13%	0.12%	0.14%	0.13%
Total solids	35.80%	25.88%	24.96%	36.21%	25.09%	25.01%
Free fatty acids	0.54%	0.71%	0.73%	0.58%	0.70%	0.72%

overall acceptability of stevia ice-cream samples was found in the range from 6.7 to 8.1. By sensory evaluation it was found that sensory scores for taste, flavour, texture and after taste were more with coffee flavour ice-cream and for colour it was more with mixed flavour ice-cream. The score for mouthfeel was same for both the flavours. Overall acceptability was found more in ice-cream containing 2.25 per cent stevia powder than ice-cream containing 2.50 per cent stevia powder.

Conclusion:

From this study it can be concluded that addition of stevia powder (2.25% and 2.50%) instead of sugar reduces the non reducing sugar to 0.0 per cent and improves the nutritional quality with respect to protein, calcium and fat content. Ice-cream with 2.25 per cent stevia powder had highest overall acceptability *i.e* 8 which contains protein 2.96 per cent. The increase in percentage value of stevia powder decreased the overall acceptability of ice-cream. Therefore, the ice-cream with 2.25 per cent stevia powder was found more acceptable.

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