

SENSORY EVALUATION OF FOXTAIL MILLET INCORPORATED SUGAR FREE ICE CREAM

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Abstract: A study was conducted to develop a nutrient rich foxtail millet incorporated sugar-free ice cream. Foxtail millet is a good source of protein, dietary fiber and low in carbohydrate content. Foxtail millet also has good thickening and water binding properties. Ice cream was prepared using foxtail millet at 2%, 3% and 4% levels and sugar was replaced by stevia calorie free sugar substitute at 3% level and subjected to sensory evaluation. Various sensory parameters like flavor, body and texture, color and appearance, sweetness and overall acceptability were analyzed for the samples S1, S2, S3 and S4. It was found that the sample with 4% foxtail millet (S4) gained highest scores and was liked the most when compared to other samples. The Statistical analysis of data revealed that highly significant difference ($P \leq 0.01$) was observed in flavor, body and texture, color and appearance and overall acceptability between samples.

Keywords: Foxtail millet, Ice cream, stevia, sensory analysis.

Introduction

Ice cream is an appealing, delicate and nourishing food which is adored by all groups of people and is a popular dessert throughout the world. Ice cream is a mixture of milk, cream, and sugar. Ice cream is a rich source of energy providing about 100-120 kcal/100 g of ice cream. The exploding popularity of ice cream has led to a number of ice cream variations including frozen custard, frozen yogurt, and even nondairy versions made with ingredients like coconut milk. Cereal based milk products are popular all over India. Cereals and milk are blended to compensate for deficiency of lysine. (Aneja *et al.* 2002).

Foxtail millet (*Setaria italica*) is known as Thinai in southern states of India. It has good nutritional profile and is comparable to staple cereals as rice and wheat in terms of protein, fiber, minerals and vitamins but its potential role as low GI food has remain unrealized and unexploited. Foxtail millet, in particular, has good thickening and water binding properties due to its high amount of starch and fiber content. Fox tail millet is gluten-free and can be useful for people on a gluten-free diet since it promotes digestion, increases energy levels and helps in emending the cholesterol levels. Foxtail millet releases glucose steadily without

affecting the metabolism of the body. Foxtail millet is widely recognized as a diabetic food. Millets are also good source of energy, protein, vitamins and minerals (Ravindran, 1991). Millet foods are also known for their low glycemic index (Itagi, 2003 and Singh *et al.* 2010). Among the millets, foxtail millet is a good source of protein (12.3 g/100g) and dietary fiber (14 g/100g). The carbohydrate content is low (60.9 g/100g). Besides, it is rich in minerals (3 g/100g) and phytochemicals. Foxtail millet is a good source of β carotene 126-191 μ g/100g, Goudar *et al.* (2011). This millet has been proved to be suitable for people suffering from metabolic disorders (Itagi,2003).

Materials and methods

Ice cream formulation and production

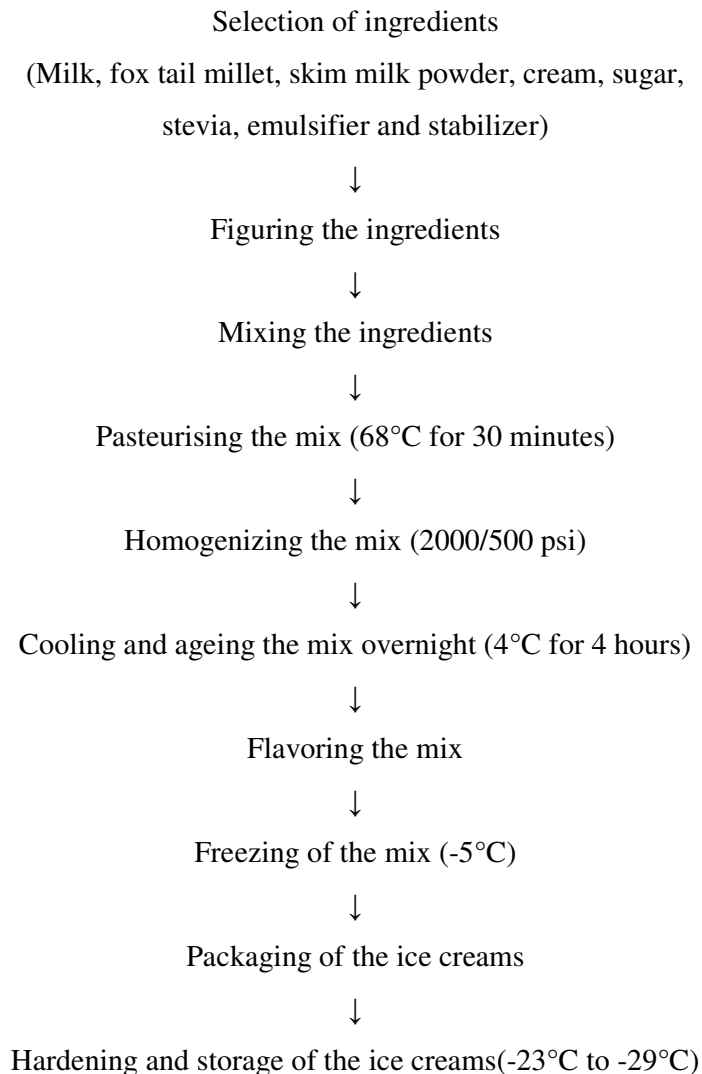
The milk and cream was procured from Dairy Plant, Department of Livestock Products Technology (Dairy Science), Madras Veterinary College, Chennai. The foxtail millet, stevia, sugar, skim milk powder and other ingredients were purchased from local market in Chennai. Foxtail millet is selected based on its nutritional profile such that it has a high fibre and mineral content. Ice cream was prepared by incorporating foxtail millet at 2, 3 and 4% in the ice cream mix. Sugar was replaced by stevia the natural sweetener in the treatment.

Table 1: shows the composition of ingredients for Ice cream mix Composition of Ingredients for Ice cream mix (per 1000g)

INGREDIENTS	S1 (Control)	S2(2% foxtail millet+ stevia)	S3(3% foxtail millet+ stevia)	S4(4% foxtail millet+ stevia)
Milk (in ml)	750	750	750	750
Foxtail Millet Powder (in g)	-	20	30	40
Stevia (in g)	-	30	30	30
Sugar(in g)	150	-	-	-
Cream (in g)	100	100	100	100
Skimmed Milk Powder (in g)	80	80	80	80
Sodium Alginate (in g)	3	3	3	3
Glycerol Mono Sterate (in g)	2	2	2	2
Gelatin (in g)	2	2	2	2
Cocoa powder (in g)	15	15	15	15

Figure -1 shows the steps involved in production of ice cream. Ice cream produced is subjected to sensory evaluation using 9-point hedonic scale. The frozen product samples were tempered to -12 ± 2 °C for 1–2 h before judging. Sensory parameters including flavor, body and texture, color and appearance, sweetness were compared among the samples. Among the three millet ice creams samples (2%, 3%, 4%), one concentration was chosen the best based upon the acceptability scores obtained from sensory evaluation.

Figure -1 Schematic representation of steps involved in production of Ice Cream



Results and Discussion

Table 2 shows the sensory evaluation scores of the S1 control and three millet ice creams(2%,3%, and 4%) using 9 - point hedonic scale

FLAVOR

The flavor score of S4 was 8.78 ± 0.21 which was ranked the highest among the variations. This was higher than the scores of S1, S2 and S3. Highly significant difference ($P \leq 0.01$) was found between treatments. Thus, the flavor of sample S4 was more liked than the flavors of other samples among the panelists. This is similar to the observations made by Patel *et al.* (2015) that addition of ragi millet (9 % level) in ice cream improved the flavor.

BODY AND TEXTURE

The body and texture of samples S1 and S2 had a score of 6.82 ± 0.30 and 7.00 ± 0.26 which were ranked lowest among the variations. The score of sample S3 was 7.36 ± 0.21 which indicated that the body and texture was moderately liked by the panelists. The sample S4 gained a score of 8.70 ± 0.21 and thus its body and texture was liked the most by the panelists. Proper processing and mixing of ingredients are the factors responsible for better body and texture of the product.

COLOR AND APPEARANCE

The color and appearance of S1, S3 and S4 was almost similar and they gained a same score of 8 which were ranked highest among the variations. S2 gained a score of 7 for color and appearance which was ranked lowest among the variations. In this parameter, the samples S1, S3 and S4 were more liked by the panelists than S2.

SWEETNESS

The sample S4 had gained a score of 8.75 ± 0.21 for its sweetness which was ranked the highest among the variations. This was higher than the scores of S1 and S3, which gained similar score of 8. Thus, the sweetness of sample S4 was extremely liked by the panelists when compared to other samples. This was due to the proper blending of stevia and a higher concentration of millet in sample S4. This is in accordance with observation made by Yogiraj *et al.* (2014) that addition of stevia improved sweetness, colour, appearance and texture

OVERALL ACCEPTABILITY

The overall acceptability score for S4 was 8.71 ± 0.22 which was ranked highest among the sample variations. This was higher than the scores of S1, S2 and S3. Highly significant difference ($P \leq 0.01$) was found between treatments. Ice cream samples with incorporation of millets at 4% was liked by the panelists than other ice cream samples. Addition of fox tail millet improved the overall acceptability of ice cream.

Conclusion

The present study was done to develop nutrient rich foxtail millet incorporated sugar-free ice creams. In this it was concluded that addition of foxtail millet at 4 percent and stevia at 3 percent level in ice cream was found to be acceptable by sensory evaluation. Addition of millet improved the flavour, appearance, body and texture, overall acceptability of the ice cream.

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Table 2: Sensory evaluation scores of millet ice creams using 9 - point hedonic scale

Sensory Parameters	SCORE CARD				‘F’ value
	S1	S2	S3	S4	
Flavor	6.70±0.22	6.51±0.22	6.85±0.31	8.78±0.21	17.46**
Body and texture	6.82±0.30	7.00±0.26	7.36±0.21	8.70±0.21	19.96**
Colour and appearance	8.34±0.21	6.75±0.16	8.20±0.16	8.52±0.22	15.49**
Sweetness	8.16±0.17	7.67±0.21	8.22±0.16	8.75±0.21	4.62*
Overall acceptability	7.33±0.21	7.12±0.16	7.67±0.21	8.71±0.22	8.44**