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A Study on Formulation and Quality Evaluation of Pearl Millet Icecream

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ABSTRACT: Ice cream is a widely consumed food and is a recognized medium to increase the milk intake and a favourite dessert for men and women of all ages. Fortification of ice cream with nutrients or other bioactive substances should be supported. The study was aimed to formulate pearl millet ice cream and analyze its quality for the organoleptic characteristics and physicochemical properties. Four variations [I (25 % pearl millet milk: 75% cow's milk), II (50 % pearl millet milk: 50% cow's milk), III (75 % pearl millet milk: 25% cow's milk), IV (100 % pearl millet milk)] of ice cream was prepared along with 100% cow's milk (standard). The acceptability of the formulated ice cream was evaluated by using five-point hedonic scale. Among different samples prepared the best two were selected for the storage study for a period of one month and analysed once in 15 days of intervals. The selected samples are 100% pearl millet ice cream (V-I) and 50% pearl millet ice cream (V- II). Formulated ice cream was acceptable for its organoleptic characteristics till 30th day of storage. Moisture, total solids, acidity, overrun had an increase on storage and ash content got reduced in both samples. Carbohydrate, protein, fat, fibre, calcium, phosphorus content was decreased in the both sample on storage. The microbial load for the samples increases but they are within the limits as mentioned by the BIS standards. This study reveals that pearl millet milk ice creams possess a higher acceptability, nutritionally rich and functionally superior novel food.

KEYWORDS: Ice-cream, Pearl millet, dessert, novel food.

I. INTRODUCTION

Innovative foods are of great scientific interest towards attaining health-conscious nutrition. Ice cream is considered a food for enjoyment, rather than a basic food. Ice cream is a widely consumed food and is a recognized medium to increase the milk intake. However, ice cream is favourite dessert for men and women of all ages. Therefore, fortification of ice cream with nutrients or other bioactive substances should be supported. In its frozen state ice cream consist of ice crystals, air cells and partially coalesced fat droplets dispersed in a continuous freeze-concentrated aqueous phase which contains sugars, proteins and minerals [1]. It is one of the delicious, nutritious, frozen products, typically eaten as a snack, usually made from dairy products. Ice cream has good potential for use as a probiotic vehicle because of its composition as well as its pleasant taste and attractive texture. Furthermore, probiotics are able to survive over long storage periods in frozen systems such as ice cream matrix that includes nutritive constituents such as milk proteins, fat, and lactose [2]. It is a high cost-value dairy product. Costs are mostly related to ingredients and energy required for frozen storage, distribution, and retail sale. Consumer acceptance of ice cream depends largely on its textural quality and flavour. The energy value and nutrients of ice cream depend upon the food value of the products from which it is made. Ice cream may also contain other food products such as fruits, nuts which enhances its nutritive value. Due to organoleptic characteristics and as a thermoregulatory food in controlling heat [3], ice cream plays an important role of actual food with digestive, metabolic and nutritive qualities. The per capita consumption of ice cream in India is approximately 0.2 liter per annum while the average global per capita consumption is 2 liter. The ice cream industry is very progressive with many new product introductions annually. Some of the current formulation trends in the industry including a growing interest in "reduced" or "no" claims for fat, calories or sugar; the use of nutritionally functional additives (e.g., vitamins or minerals) or flavours showing added nutritional functionality (e.g., high in antioxidants) [4].

Cereal based milk products are popular all over India. Cereals and milk are blended to compensate for deficiency of lysine. Millet has many nutritious and medical functions reported [5]. These are underutilized and neglected crop because of little knowledge to people and some critical problems like lower cooking quality, taste,



and low bioavailability of millets. These problems can be solved and make them valuable as food for poor families to combat malnutrition and important sources of income [6].

Pearl millet (*Pennisetum glaucum*), also known as Bajra and Kambu, is one of the four most important millets grown in tropical semi-arid regions of the world primarily in Africa and Asia. Pearl millet is rich in several nutrients as well as non-nutrients such as phenols. Owing to the benefits of pearl millet, its consumption should be encouraged among the people of all age groups to improve their dietary habits and nutritional status [7]. To restore their lost importance, there is a need to expose these food grains in ready to eat forms and novelty products. The aim of this study was to increase the consumption of pearl millet incorporated ice-cream and analyse their quality characteristics for sensory attributes, physicochemical properties, nutritional value and microbial load.

II. RELATED WORK

Orange fibre was used as a novel fat replacer in light lemon ice cream. Nine ice cream formulations were compared: standard control ice cream (IC); ice cream with fibre (F1) from the peel, bagasse, and orange seed (ICA and ICB); ice cream with fibre (F2) from the orange peel alone (ICC and ICD); ice cream with fibre (F3) from the peel, bagasse, and orange seed pre-treated with hydro-distillation (ICE and ICF); and ice cream with fibre (F4) from the orange peel pre-treated with hydro-distillation (ICG and ICH). Crizel et al [8] reported that the orange fiber proved a promising food ingredient since it can be used to decrease the fat content and increase bioactive compounds content, such as fiber and carotenoids. A study was conducted by Sivakumar [9] to develop a nutrient rich foxtail millet incorporated sugar-free ice cream. 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.

III. METHODOLOGY

1) 3.1 Formulation of Pearl Millet Ice Cream

Selection of Ingredients

Pearl millet - Pearl millet was procured from the super market in Coimbatore. The millets were cleaned manually to remove broken seeds, dust and other extraneous materials

Pearl millet milk extraction - The pearl millet was soaked in water over night for a period of 12 hours, drain off excess water and grind the millets in wet grinder by adding water and filtered the pearl millet milk by muslin cloth.

- 2) **Milk** - Milk is the major constituent in ice cream preparation. It is a suitable substrate for the growth and metabolism of microorganism. Milk boiled for 20 minutes as this will eliminates pathogens and increases the total solids content of milk.
- 3) **Fat** - Fat is used in the form of milk cream which imparts a rich creamy flavour and improves the texture of the ice cream.
- 4) **Sugar** - Addition of sugar improves viscosity, melting characteristics and texture and lowers the freezing point of mix.
- 5) **Flavours** - Flavour increases the acceptability of ice cream. Hence ice cream was prepared using papaya, grape, and pine apple pulp as flavours.
- 6) **Formulation**

Take a small bowl and add milk & corn flour to it. Mix well and keep the mixture aside. Heat it over moderate flame and allow it to boil for 7-8 minutes, while stirring occasionally. Now add the sugar & cook on a medium flame for 5 minutes, while stirring continuously & cool completely. Once the mixture is cooled, add the fresh cream and flavours (papaya pulp / pineapple pulp/ grape juice). Using an electric beater or hand beater blend it well. Pour the mixture into an aluminium container and cover with an aluminium foil. Freeze it for 6 hours or till set. Variations were carried out with respect to the milk (Standard -100% cow's milk; Variation I - 25% pearl millet milk:75% cow's milk; Variation II - 50% pearl millet milk: 50% cow's milk; Variation III -75% pearl millet milk: 25% cow's milk; Variation IV- 100% pearl millet milk).

Papaya flavoured pearl millet ice cream formulation - Addition of 50g of papaya pulp for flavour. The ice cream is prepared using the standard procedure.

Pine apple flavored pearl millet ice cream formulation - Addition of 50g of pine apple pulp for flavour. The ice cream is prepared using the standard procedure.

Grape flavoured pearl millet ice cream formulation - Addition of 25ml of grape juice for flavour. The ice cream is prepared using the standard procedure



3.2 Sensory Evaluation of Formulated Pearl Millet Ice Cream

Sensory evaluation is defined as a scientific approach used to evoke, measure, analyze and interpret those responses to products as perceived through the senses of sight, smell, touch, taste and hearing. The formulated pearl millet milk ice cream was evaluated by semi trained panel members. The ice cream samples were randomly coded and presented to the panel members. Water was provided to rinse their mouth in between evaluation. Score cards were distributed and the samples were rated for appearance, consistency, taste, flavour and overall acceptability using on a five point hedonic scale.

3.3 Storage Stability of the Formulated Pearl Millet Ice Cream

Shelf life is the length of time that a commodity can be stored without becoming unfit for consumption. Based on the sensory evaluation of the formulated icecream, the best two icecream with highest score is selected for the storage study and analysed for sensory quality, physico chemical properties, nutrient content and microbial load initially and at fifteen days interval for a period of 30 days.

3.4 Physico Chemical Properties of Formulated Pearl Millet Ice Cream

The physio chemical properties were determined initially and at fifteen days interval for a period of 30 days. Formulated icecream is analysed for its Over run, total solids, acidity, moisture and ash content according to the standard procedure of Bureau of Indian Standards (BIS).

3.5 Nutrient Analysis of Formulated Pearl Millet Ice Cream

Nutrient analysis refers to the process of determining the nutritional content of foods and food products. Formulated pearl millet ice cream were analyzed for its carbohydrate, protein, fat, fibre, calcium, phosphorus, sucrose according to the procedure of AOAC (2005).

7) 3.6 Microbial Analysis of Formulated Pearl Millet Ice Cream

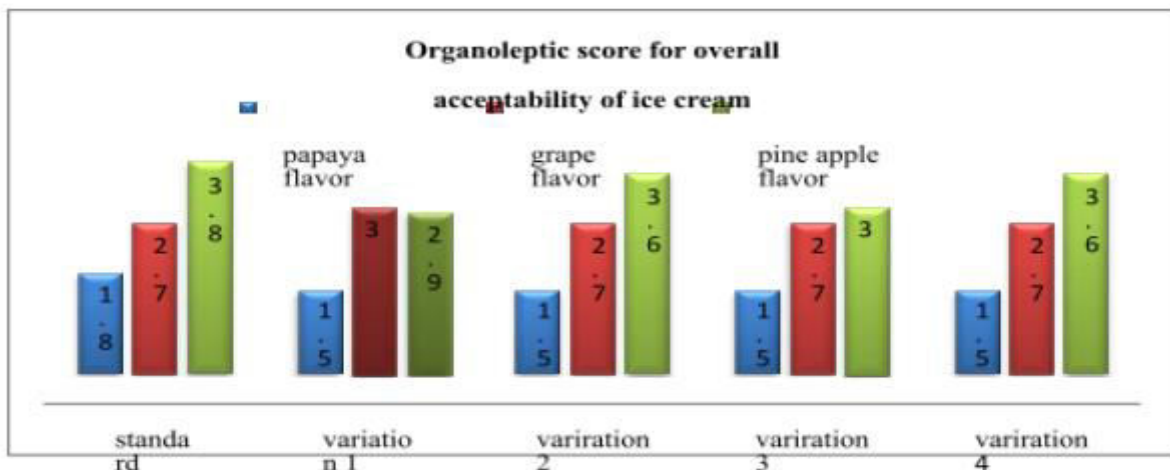
To ensure that microbial hazard is under control, total count was enumerated in the formulated icecream. **Total plate count** - To find the total microbial load, standard plating in nutrient agar was carried out using standard plate count method.

IV. EXPERIMENTAL RESULTS

4.1 Sensory Evaluation of Ice Cream

The Overall acceptability of the formulated ice cream are presented as Mean ± SD in the Fig 1. Off all the variations the Pine apple flavored pearl millet ice cream had the highest score in standard (3.8±0.63) > variation II, IV (3.6±0.69) > variation III (3.0±0.81) > variation I (2.9 ±0.73). Grape flavored pearl millet ice cream for standard and variations II, III, IV (2.7±0.56) < variation I (3.0 ±0.47). The papaya flavored pearl millet ice cream had highest score in standard (1.8 ±0.91) < variation I, II, III, IV (1.5 ±0.31).

Figure 1
Organoleptic score for Overall acceptability of Formulated ice cream





4.2 Physicochemical properties of formulated pearl millet ice cream

Formulated 100% pearl millet ice cream				Formulated 50% pearl millet ice cream		
Parameters	Initial Value	Fifteenth Day	Thirtieth Day	Initial Value	Fifteenth Day	Thirtieth Day
Moisture(%)	21.89	24.80	25.07	25.93	30.50	36.46
Ash (g)	5	5	5	5	5	5
Total solids (%)	32.6	37.7	43.6	34.7	37.7	48.6
Acidity (% as lactic acid)	0.45	0.45	0.63	0.36	0.36	0.54
Over run	62.49	61.58	60.81	54.07	53.23	52.62

4.3 Nutrient content of formulated Pearl Millet Ice Cream

Parameters	Formulated 100% Pearl Millet Ice Cream			Formulated 50 % Pearl Millet Ice Cream		
	Zeroth Day	Fifteenth Day	Thirtieth Day	Initial Day	Fifteenth Day	Thirtieth Day
Carbohydrate (g)	72	56	56	88	64	68
Protein (g)	3.7	3.6	3.5	2.5	2.4	2.3
Fat (g)	10.2	9.9	9.7	8.3	8.1	7.9
Fiber (g)	0.81	0.86	0.78	1.7	1.6	1.5
Calcium (mg)	145	65	80	175	110	140
Phosphorous (mg)	180	145	50	100	200	20
Sucrose (%)	20.5	18.4	16.8	18.6	17.8	17.4

4.4 Microbial load of formulated pearl millet ice cream

Days	100% pearl millet ice cream (cfu/g)	50% pearl millet ice cream (cfu/g)
1 st day	6.0×10^1	11×10^1
15 th day	10.0×10^2	8.5×10^2
30 th day	51×10^2	$40. \times 10^2$



V. CONCLUSION

This study revealed that the formulated pearl millet ice cream were good sources of essential nutrients and organoleptically accepted. 100% pearl millet milk ice creams had higher nutrient content than 50% pearl millet milk ice cream. This signifies that 100% pearl millet milk ice cream possess a higher acceptability, nutritionally rich and functionally superior. These novel ice creams can be used for further study.

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