Open Access

© 2023, Centre for Advanced Research in Agricultural Sciences
Research Journal of Agricultural Sciences

ISSN: 0976-1675 (P)
ISSN: 2249-4538 (E)

International Conference on "Millets- Ensuring Food Security and Sustainable Farming"
Volume 14; Issue 04 (July-Aug 2023); pp 988–991

Full Length Research Article

Physiochemical Characteristics of Finger Millet Incorporated Functional Ice Cream

Revathi P*[1] and Vasantha Esther Rani[2]

[1] Department of Food Science and Technology, Arul Anandar College, Karumathur, Madurai- 625514 and Food Science and Nutrition, Madurai Kamaraj University, Madurai, Tamil Nadu, India
[2] Research Centre of Home Science, Fatima College, Madurai - 625 018, Tamil Nadu, India

Correspondence to: Revathi P, Department of Food Science and Technology, Arul Anandar College, Karumathur, Madurai- 625514 and Food Science and Nutrition, Madurai Kamaraj University, Madurai, Tamil Nadu, India,

Abstract

Functional foods are whole, fortified, enriched, or upgraded foods that, when consumed regularly as part of a varied diet, provide health benefits beyond the provision of essential nutrients (such as vitamins). With the rising cost of healthcare, the consistent rise in life expectancy, and the desire of the elderly for a higher quality of life in their later years, functional foods serve an exceptional purpose, as indicated by the rising demand for them. The plant *Eleusine coracana L.*, also referred to as ragi, is widely grown in India and other parts of the world. This millet is high in flavonoids, phenolic acids, and dietary fibres that are both soluble and insoluble. They are also well known for their anti-tumorogenic, anti-atherosclerogenic, antioxidant, and antibacterial properties. The nutritional value of beverages can be increased by mixing malted ragi with milk. Everyone enjoyed the frozen treat ice cream; thus, this study was designed to create ice cream that included ragi millet, and its physiochemical qualities were examined. According to ISI (IS: 2802, 1964) specifications, ice cream was made. In order to estimate the physical and chemical properties such as energy, carbohydrate, protein, fat, total solids, pH, and acidity, established procedures were used. According to the findings, the Ragi Millet Ice Cream's nutritional value and functional value were improved when compared to the control sample. This means that consumption of ice cream with millet as an ingredient will improve everyone's health in general.

***Key words*:** Functional foods, Finger Millet, Ice cream

Functional food is defined as any fresh or processed food that delivers health advantages beyond typical nutrition and is believed to have a health-promoting or disease-preventing quality in addition to delivering nutrients (Das et al., 2010). Functional food comprises recognized biologically-active chemicals that, when consumed in the appropriate quantity and quality, give a clinically demonstrated and well-documented health benefit. Thus, Functional Foods are essential in the modern prevention, management, and treatment of chronic diseases (Danik, 2011). Their primary objective is to reduce disease risk (Berner and Donell, 1998). Ice cream is a frozen dairy product prepared by freezing and agitating the ice cream mixture. It consists of a mixture of culinary ingredients, including milk products, sweeteners, stabilizers, colours, and flavours, as well as egg products. Originating in Europe, ice cream was eventually imported to the United States, where it blossomed in to an industry (Deosarkar 2016).

Ice creams are unique frozen foods in that they are enjoyed in the frozen state, typically as scooped products or single-serving items, sometimes on a stick, and frequently with other sweets. These items rely on a simultaneous freezing and whipping procedure to provide the necessary structure and texture (Goff 2006). Ice cream is produced by simultaneously freezing and aerating mixture off at, sugar, milk solids, an emulsifier, flavouring, and sometimes colouring. The fat might be derived from milk, cream, or butter, or it can come from a non-dairy source. However, the composition of ice cream is regulated by law innumerous nations. 'Dairy' ice cream must include a minimum of 5% milk fat and a minimum of 2.5% milk protein (from case in or whey solids). 'Standard' ice cream must contain at least 5% milk fat and 2.5% milk protein (from case in or whey solids).

Ice creams are made with a vast assortment of ingredients. Even a single type of ice cream can be created by blending ingredients in a variety of ways. Mixture for ice cream is the unfrozen mixture of ingredients, excluding air and flavourings. Typically, the composition of ice cream is given as a proportion of its elements, such as milk fat, milk solids-not-fat, sugar, egg solids, stabilizers, and total solids. Fats enhance the richness of the ice cream's flavour, provide a silky texture, add "body" to the ice cream, and contribute to its excellent melting capabilities. Non-fat milk solids are incorporated as skim milk powder or whole milk powder. They enhance the body and texture of ice cream, permit a greater overrun (below), and create a thicker, less frosty product. Adding sweeteners to ice cream improves its flavour, texture, and palatability. They

contribute to a lower freezing point, so that some of the water in the ice cream remains unfrozen. Without it, ice cream would be difficult to consume. In addition, they diminish the "fattiness" of ice cream and aid in producing a smooth texture.

Stabilizers are used to assist combine the complex mixture of fats, carbohydrates, air, and microscopic ice crystals present in ice cream and give it a smooth consistency. They enhance the viscosity of the unfrozen water in order to make an ice cream that is more solid and resistant to melting by increasing the viscosity of the unfrozen water. Emulsifiers produce a silky consistency and excellent melting properties. For the manufacturing of ice cream, both synthetic and natural flavours are utilized. Generally, the colouring complements the flavour (e.g., green colour with mint flavour or orange with mango). The flavours and colours must meet "food grade" specifications.

Millets are cereal crops and exotic berries that have traditionally been regarded as dietary staples and the primary source of protein throughout the majority of the developing world. Millets are superior in terms of their nutritional value since their grains are rich in proteins, minerals, flavonoids, polyphenols, and vitamins. Therefore, legal usage can aid in the eradication of malnutrition among the bulk of our Indian population. Due to their nutritional benefits, these grains are currently referred to as nutria millets / nutria-cereals. Millets are distinctive among cereals due to their abundance of calcium, dietary fibre, polyphenols, and protein. Millets typically contain adequate amounts of essential amino acids, including Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Valine, Histidine, and Tryptophan, as well as non-essential amino acids Alanine, Arginine, Aspartic acid, Cystine, Glutamic Acid, Glycine, Serine, Tyrosine, and Proline. Millets are abundant in phytochemicals and micronutrients. Millets contain phytochemicals such as phenolics (ferulic acid bound, protocatechuic acid free), lignans, -glucan, inulin, resistant starch, phytates, sterols, tocopherol, dietary fibre, and carotenoids. The principal polyphenols are phenolic acids and tannins, whereas flavonoids are present in minute amounts; they operate as antioxidants and perform numerous roles in the immunological system of the body (Moreno *et al*. 2014).

Finger millet is superior to other grains in terms of its nutritional value (Manay and Shadaksharaswamy 2001). Ragi is rich in protein of the highest quality and contains vital amino acids, vitamin A, vitamin B, and phosphorus (Gopalan *et al*. 2004). The regular intake of functional foods are the effective way of improving health status for all the age groups, the investigator has selected low cost, locally available ingredients and foods familiar to the community to formulate functional foods. Considering all the health benefits of functional food ingredients Milk, Palm Jaggery and Ragi were selected for the development of the functional Ice cream.

The present study was carried out with the following objectives:

- Development of Finger millet incorporated functional Ice cream.
- Estimation of the physical characteristics of the formulated functional ice cream.

MATERIALS AND METHODS

Procurement of raw materials

For the formulation of Ice cream, Fresh standard milk (Fat 4.5 & SNF 8.5), Palm jaggery, Sugar, Butter, Skim Milk Powder and Ragi flour were procured from the departmental store located in Madurai.

Table 1 Quantity of ingredients used in the preparation of functional ice cream

Ingredients (g)	TC	T_1
Milk	711.67	711.67
Sugar	150	-
Palmsugar	0	150
Butter	89	89
Skim milk powder	46	26
Stabilizer and emulsifier	3.33	3.33
Ragi flour	-	20
Total	1000	1000

Formulation and standardization of ice cream

Ice cream mix was prepared to comprise a final composition of 10% fat, 36%total solids, 15% sugar, and 0.5% stabilizer and emulsifier, in accordance with ISI (IS:2802, 1964) specification (Sukumar De, 1980). Table 1 displays the amounts of ingredients, such as palm jaggery, Sugar, Butter, Skim milk powder and ragi flour, necessary to prepare ice cream mix. The milk was heated to a boil. Add all the other ingredients and homogenized according to Arbuckle's (1986) method and then pasteurized at 80 °C for30 seconds, as advised by Rothwell (1976). The mixtures were cooled to 5°C and matured at the same temperature for four hours and the ice cream mixture was moved to a batch freezer and frozen individually. After freezing, 50 ml food quality paper cups were filled with ice cream, capped with food grade lids, and stored at -18°C to -23°C until further usage.

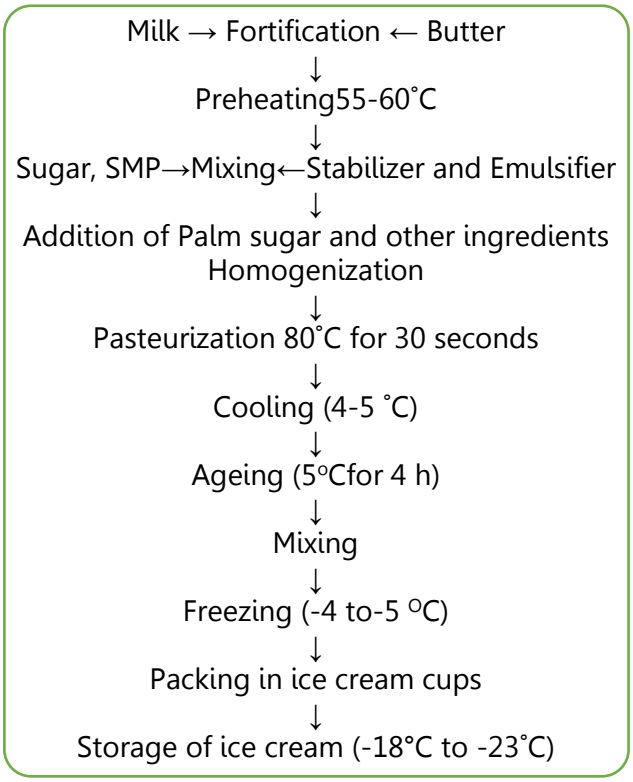

Fig 1 Flowchart for the preparation of ice cream samples

Physio-chemical properties of millet incorporated ice cream

Estimation of ice cream melting quality

The melting quality of ice cream was determined by placing a spoonful of ice cream sample on a sieve and recording the time at room temperature when the first drop of melted ice cream fell through the sieve (Khillari *et al*. 2007, Muse and Hartel 2004).

Estimation of titratable acidity of ice cream

The titratable acidity of ice cream was measured according to the method described in (Fabro *et al*. 2006).

Estimation of ice cream's pH

The pH of the ice creams was measured using an electronic digital pH metre (Systronics digital pH metre 335, India) in accordance with the AOAC procedure (2010).

Estimation of ice cream's total solids percentage

The percentage of total solids in the ice cream samples was determined according to the IS: 2802-1964 procedure.

Estimation of Fat percentage of ice cream

The percentage of fat in the ice cream samples were determined as per theproceduredescribedinIS:2802-1964.

Protein content estimation for ice cream

The protein content of the ice cream samples was tested using the method outlined in IS: 1479 part II -1961. Micro Kjeldhal Apparatus was utilized to determine the protein content of the diet ice cream samples.

Estimation of ice cream's energy content

The energy value composition of the ice cream samples was evaluated using a digital bomb calorie metre in accordance with the method outlined in the manual off in fish biology by Venkataramanujam and Ramanathan (1994).

Estimation of ice cream carbohydrate

The carbohydrate content of the ice creams was tested according to the IS1656 technique.

RESULTS AND DISCUSSION

The physical properties like melting quality and firmness of the finger millet incorporated ice cream were analyzed. Meltdown is an important property of ice cream affecting its sensory quality. Ice cream should melt down to a liquid of smooth consistency, suggestive of a rich ice-cream. It is also important that the ice cream is not too hard or should not melt quickly. The melting quality of the finger millet incorporated sample is 6.33 where the control ice cream had 6.18. Our findings of melting quality of the ice cream samples are in accordance with those of Pandiyan *et al*. (2010), Anisa and Nurfitri (2020) and at par with the opinion of Roland *et al*. (1999).

Firmness defined as penetration depth within the defined time, consistency the distance at which the breaking takes place, Cohesiveness is how well the product with stands a second deformation relative to how it behaved under the first deformation. Cohesiveness depends upon the strength of the internal bonds (Uprit and Mishra 2004). The firmness of the ragi flour incorporated ice cream was 1144.65. The chemical properties like acidity, pH, total solids, carbohydrate, protein, fat and energy of the formulated functional ice cream were analyzed by using the standard procedure and the results were given in (Table 2).

Table 2 Chemical properties of the finger millet incorporated ice cream

S.No.	Properties	Control	Sample
1	Acidity	0.235	0.247
2	pH	6.50	6.45
3	Total Solids	36.30	36.35
4	Carbohydrate	17.12	18.48
5	Protein	4.57	4.37
6	Fat	10.35	10.37
7	Energy	180.67	161.67

The average value of acidity of control ice cream was 0.235 and ragi incorporated ice cream was 0.247. The mean pH value of control and sample was 6.50 and 6.45 respectively. The total solid is 36.30 in control sample and 36.35 in finger millet incorporated ice cream. The carbohydrate was higher in finger millet sample than control and the value was 17.12 and 18.48. The protein value was 4.57 in control and 4.37 in sample. The control sample had the energy value 180.67 and the fat value was 10.35 where Ragi flour incorporated ice cream had the energy value161.67and fat value 10.35.

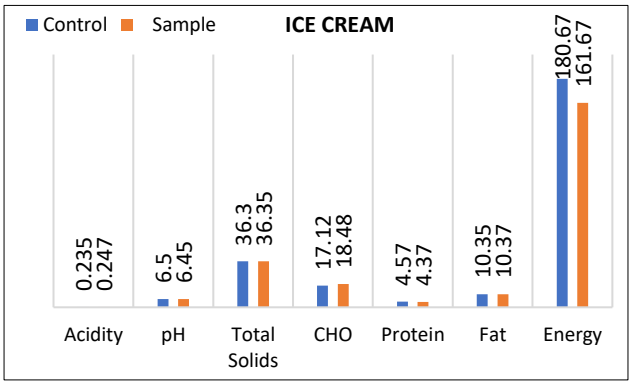

Fig 2 Chemical properties of formulated ice cream

CONCLUSION

Ice cream is being one of the nutritious and delicious frozen dessert also it was favourite to everyone which was chosen to incorporate the finger millet flour and palm jaggery. In this present study finger millet flour incorporated ice cream was formulated and the physiochemical properties were analyzed by using the standard procedure. Thus, it could be concluded that the formulated delicious functional ice cream developed will meet the needs of the consumer by providing both nutritional and functional value.

LITERATURE CITED

1. Berner LA, O'Donnell JA. 1998. Functional foods and health claims legislation: applications to dairy foods. *Int. Dairy Journal* 8: 355-362.
2. Danik. 2011. Functional foods and chronic Diseases, Science and Practice, Functional food center. www.studymore.com/essays/1342236.html
3. Das D.R, Vimala and Nilanjana Das. 2010. Functional foods of natural origin– An overview. *Indian Journal of Natural Products and Resources* 1(2): 136-142.
4. Deosarkar S.S., Kalyankar S.D., Pawshe R.D. and Khedkar C.D. (2016) Ice Cream: Composition and Health Effects. In: Caballero, B., Finglas, P., and Toldrá, F.(Eds.) The Encyclopedia of Food and Health, vol. 3, pp. 385- 390. Oxford: Academic Press.
5. Goff. H.D. (2006), Ice Cream, Advanced Dairy Chemistry, Volume 2 Lipids, 3rdEdition, Edited by P.F.Fox, pp441–450.

6. Moreno, M. D. L., Comino, I., Sousa, C. "Alternative grains as potential raw materialfor gluten-free food development in the diet of celiac and gluten-sensitive patients. *Austin Jr. Nutr Food Sci*. 2(3).1016.2014.
7. Manay NS, Shadaksharaswamy M (2001) Cereals. In: Foods, facts and principles, 2nd edn. New Age Int. (Pvt). Ltd. Pub. New Delhi.
8. Gopalan C, Ramasastri BV, Balasubramanian SC. *Nutritive value of Indian Foods. National Institute of Nutrition (NIN)* Hyderabad: Indian Council of MedicalResearch;2004. pp. 59–67
9. De Sukumar (1980) Outlines of Dairy Technology. Oxford University Press, ISBN, 0195611942, 9780195611946 ;
10. Rothwell J. 1976. Ice Cream-its Present Day Manufacture and Some Problems. *International Journal of Dairy Technology*. https://doi.org/10.1111/j.1471-0307.1976.tb00442.
11. Arbuckle, W.S. (1986) Ice Cream. 4th Edition, AVI Publishing Co. Inc., WestportMoreno, M. D. L., Comino, I., Sousa, C. "Alternative grains as potential rawmaterial for gluten-free food development in the diet of celiac and gluten-sensitive patients," *Austin Jr. Nutr Food Sci*. 2(3).1016.2014.
12. Khillari, S.A and P.N. Zanjad, K.S.Rathod and M. Raziuddin. 2007. Quality of lowfatice cream made with incorporation of whey protein concentrate. J. Food.SciTechnol., 44 (4): 391-393.
13. Muse, M. and Hartel, R. 2004. Ice cream structural elements that affect melting rate and hardness. *Jr. Dairy Sci*., 87, 1–10.
14. Pandiyan, C., Annal Villi, R., Kumaresan, G., Murugan, B. and Rajarajan, G. 2012. Effect of incorporation of inulin on the survivability of Lacto bacillus acidophilus in symbiotic ice cream. *International Food Research Journal* 19(4):1729-1732.
15. Anisa Nada Farhah and Nurfitri Ekantari. 2020. Combination of sodium alginate and kappa carrageenan increases texture stability of spirulina platensis ice cream. *E3SWeb of Conferences* 147: 03006
16. Uprit S, Mishra HN. 2004. Instrumental textural profile analysis of soy fortified pressed chilled acid coagulated curd (Paneer). *International Journal of Food Properties* 7(3): 367-378.