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RESEARCH ARTICLE

FORMULATION OF CHOCOLATE ICECREAM USING GERMINATED BROWN RICE MILK

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ABSTRACT

Ice cream is a frozen dessert usually made from dairy products Brown rice milk is a useful dairy substitute. During the process of germination, Gama Amino Butyric Acid (GABA) levels and the amount of important nutrients like calcium, fibre and potassium have been known to increase. The study aimed at formulating Germinated Brown Rice (GBR) milk ice cream as a non-dairy substitute, to be consumed by the people who are lactose intolerant and those who are allergic to soy. The GBR ice cream was primarily prepared by extracting GBR milk and by combining methods of heating, condensation, homogenization and freezing using standard procedures. A variation with a combination of GBR milk and dairy milk in the ratio of 1: 1 was also prepared. The experimental products were analyzed for Physico- chemical tests like TSS, Protein, Fat, SNF and Weight by Volume using standard AOAC methods. Sensory evaluation was conducted with the help of 20 semi-trained panelists for color, flavor, taste, texture, mouth feel, sweetness, after taste and over all acceptability of the product on a standard 9 point hedonic scale. The results for GBR milk ice cream revealed the following: protein 3.8%, TSS 33±5, Fat 10.56%, SNF 25.44%, Weight by volume 535.2. Similarly the content in variation was observed to be: protein 4%, TSS 33±5, Fat 13.88%, SNF 22.12%, Weight by volume 546. The products were well accepted and had an overall acceptability of 8.75 for 100% GBR milk ice cream and 8.5 for 50% GBR milk ice cream. Thus the present study qualifies to identify GBR milk as the best non-dairy substitute in ice cream preparation.

INTRODUCTION

Ice cream is a frozen food, typically eaten as a snack or dessert, usually made from dairy products and often combined with fruits or flavours. It is typically sweetened with sucrose or other sweeteners. Germinated brown rice (GBR) is an unpolished brown rice that has been allowed to germinate in order to alter the flavour and also increase the level of nutrients such as γ- amino butyric acid (GABA). GBR milk has more carbohydrate content when compared to the cow's milk and is often consumed by the people who are lactose intolerant and those who are allergic to soy. The objective of the study was to develop an ice-cream with the incorporation of GBR milk.

MATERIALS AND METHODS

Commercially available Brown rice (Oryzasativa) of Ponni raw rice variety was procured from the local market.

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Germination was done by soaking the rice in warm water for 24 hours at room temperature followed by spreading it over and covering it with a damp cloth with frequent sprinkling of water for 48 hours. The germinated rice was then ground into a paste and milk was extracted by using muslin cloth. The product was formulated in two variations. V1 was formulated using 100% GBR milk. V2 was formulated with 1:1 ratio of GBR and dairy milk. 200 ml of the milk extracted from germinated brown rice was poured into a heavy saucepan and brought to medium heat. It was removed from heat when it starts to bubble around the edges. 200g of sugar was added to the milk along with 25g of cocoa powder and mixed well. 15g of butter was melted and added to 200 ml of milk. This was followed by addition of 400g of chilled whipping cream and 5ml of vanilla essence to the milk. The mixture was stirred constantly and homogenised. The ice cream mixture was poured into a plastic container and cooled. After cooling, it was cling wrapped and allowed to age in the refrigerator for at least 4 to 24 hours. This aging process gave the mixture better whipping qualities and produced ice cream with better body and a smoother texture. The mixture was then frozen for 2 hours. After which it was homogenised to break up the ice

crystals. The mixture was covered and placed back in the freezer to freeze for 2 more hours. Homogenisation process repeated and the ice cream mixture was allowed to freeze. The thickened ice cream mixture was transferred into an air tight container with ½ inch head space. The container was placed inside the freezer and frozen for 24 hours. The variation was termed as V1. The same process was followed and ice cream was obtained by using 100 ml of germinated brown rice milk and 100 ml of dairy milk. This variation was termed as V2. Physico – chemical tests like TSS, Protein, Fat, and SNF, weight by volume were analyzed for both the variations (V1 & V2) using standard AOAC methods. Sensory evaluation was conducted with the help of 20 semi-trained panelists for for color, flavor, taste, texture, mouth feel, sweetness, after taste and over all acceptability of the product on a standard 9 point hedonic scale with 1 being "dislike extremely" and 9 being "like extremely".

Procedures

Determination of Total Solids in the Ice Cream

Apparatus: A. Flat bottomed dishes of Aluminium, Nickel or Stainless steel not affected by boiling water, 7-8 cm in diameter and not more than 2.5 cm deep provided with short stirring rods having a widened flat end. B. Sand which passes through 500 micron I.S sieve and is retained on 180 micron sieve. It shall be prepared by digesting with conc. HCl followed by thorough washing with water. It shall be dried and ignited to red heat.

C. Oven: Well ventilated and maintained at 100 ± 2°C.

Procedure: Heat the moisture dish containing 20 g of prepared sand and glass stirring rod in the oven for 1 hour. Cool and weigh. Add about 5 g of sample into the dish. Add a few drops of water to assist in spreading the sample with glass rod. Place dish on a boiling water bath for 29 - 30 minutes. Wipe bottom of dish and transfer to the air oven. Dry for about 4 hours, remove dish to an efficient desiccator, allow to cool and weigh. Replace dish in oven for a further period of 1 hour, transfer to desiccator, allow it to cool and weigh. Repeat the process of heating and cooling till consecutive weighing agree within 0.5 mg. Calculate total solids from loss in weight observed.

(Ref:- IS 2802 – 1964 – Specification for Ice cream. Bureau of Indian Standards, New Delhi.; Pearson's Composition and analysis of foods,9th edn,1991 page 604).

Quantitative Analysis of Proteins- Biuret Method

Considerations for use: The principle of the biuret assay is similar to that of the Lowry, however it involves a single incubation of 20 min. There are very few interfering agents (ammonium salts being one such agent), and Layne (1957) reported fewer deviations than with the Lowry or ultraviolet absorption methods. However, the biuret assay consumes much more material. The biuret is a good general protein assay for batches of material for which yield is not a problem. The Bradford assay is faster and more sensitive.

Principle: Under alkaline conditions substances containing two or more peptide bonds form a purple complex with copper salts in the reagent.

Equipment: In addition to standard liquid handling supplies a visible light spectrophotometer is needed, with maximum transmission in the region of 450 nm. Glass or polystyrene cuvettes may be used.

Reagent: A formula for biuret reagent is (per liter final volume) 9 gm Sodium potassium tartrate (f.w. 282.22), 3 gm Copper sulfate x 5 H2O (f.w. 249.68), 5 gm Potassium iodide (166.0), all dissolved in order in 400 ml 0.2 M NaOH (f.w. 40.0) before bringing to final volume. The volume can be scaled up or scaled down of course. Discard if a black precipitate forms. BSA Standard - 100 mg of bovine serum albumin in 100 ml distilled water (Concentration= 1mg/ ml)

Comments

The color is stable, but all readings should be taken within 10 min. of each other. As with most assays, the Biuret can be scaled down for smaller cuvette sizes, consuming less protein. Proteins with an abnormally high or low percentage of amino acids with aromatic side groups will give high or low readings, respectively. For Bovine serum albumin we typically obtain a linear relationship between absorbance and amount protein over a range of 0.5 to 20 mg protein. The assay has not been reliable for amounts below 0.5 mg, however the actual sensitive range may extend beyond the upper limit.

Procedure

- Label 9 test tubes as (1 to 9) and place them in a test tube rack.
- Add to each tube the solutions in the following table:

Amount of each solution by (ml)	Test tubes								
	Standard						Sample		Blank
	1	2	3	4	5	6	7	8	9
Standard BSA	0.1	0.2	0.4	0.6	0.8	1	-	-	-
Distilled water	0.9	0.8	0.6	0.4	0.2	0	0	0	1
Sample	-	-	-	-	-	-	1	1	-
Biuret reagent	4	4	4	4	4	4	4	4	4

- Mix well by vortex mixer and allow standing for 20 min.
- Read the absorbance for each tube against the blank at 540 nm.
- Calculate the protein concentration in each tube of standard.
- Record your result in the following table:

Test tube	BSA conc. (g/l)	Absorbance at 540 nm
1		
2		
3		
4		
5		
6		
7		
8		
9		

- Plot the standard curve using concentration of standard tubes of BSA (g/l) against the absorbance at 540 nm.
- Calculate the mean of absorbance of the duplicate sample and obtain the concentration of protein in the sample from the standard curve.

Find the mean of Sample (test tube 7 and 8)

0.05 ml of diluted serum corresponds to _____OD
0.05 ml of diluted serum contains _____ µg of protein
50 ml of diluted serum contains _____ µg of protein
1 ml of undiluted serum contains _____mg of protein
100 ml of undiluted serum contains _____ mg of protein= _____g of protein

Determination of Fat in Ice-Cream (Rose-Gottlieb method)

Accurately weigh 4-5 g of the thoroughly mixed sample directly into fat extraction flask or Mojonnier tube, using free flowing pipette, dilute with water to approximately 10 ml, working sample into lower chamber and mix by shaking. Add 2 ml ammonia; mix thoroughly, heat in water bath for 20 min at 60°C with occasional shaking, cool and proceed as in Section 1.3.4.2.2 (beginning "Add 10 ml alcohol and mix well"). Identify the clear extracted fat to confirm whether it is dairy fat or not by checking refractive index at 40°C and GLC composition as per clause 1.2.11.

(Ref :- Pearson's Composition and analysis of foods 9th edn,1991 page 604).

Determination of total solids (TS) and solids-not-fat (SNF) in milk

The total solids content of milk is the total amount of material dispersed in the aqueous phase, i.e.

SNF = TS – % fat.

The only accurate way to determine TS is by evaporating the water from an accurately weighed sample. However, TS can be estimated from the corrected lactometer reading. The results are not likely to be very accurate because specific gravity is due to water, material less dense than water (fat) and material more dense than water (SNF). Therefore, milk with high fat and SNF contents could have the same specific gravity as milk with low fat and low SNF contents.

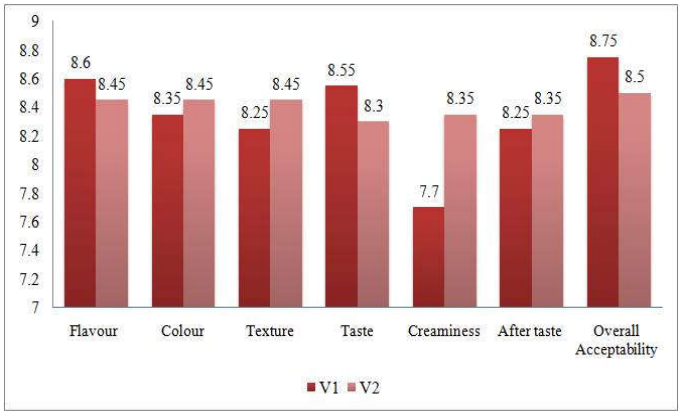
TS = (Lc)/ 4 + (1.22 × fat %) + 0.72
SNF = TS – fat %
Or = Lc / 4 + (0.22 × fat%) + 0.72

It should be noted that the relationship between Lc and TS varies from country to country depending on milk composition. The above formulae are called the Richmond formulae

Determination of Weight per Unit Volume or Over-run in Ice Cream: Over-run is usually defined as the volume of ice-cream obtained in excess of the volume of the mix. It is usually expressed as a percentage. This increased volume is composed mainly of the air incorporated during the freezing process.

Test	V1	V2
Tss	33±5	33±5
Protein	3.8%	4%
Fat	10.56%	13.88%
Snf	25.44%	22.12%
Weight by volume	535.2	546

SENSORY ANALYSIS



The amount of air which is incorporated depends upon the composition of mix and the way it is processed. In this test, the volume of water and alcohol used corresponds with the volume of air originally contained in the ice-cream and the difference between the sum of these two and capacity of the flask is equivalent to the volume occupied by the sample.

Apparatus

A. Beaker: 400 ml.
B. Volumetric flask: 250 ml.
C. Glass funnel.

Reagent: *n*-Amyl alcohol (sp. gr. 0.817).

Procedure

- Weigh a unit of ice-cream and from it calculate the weight of ice-cream per litre. For example, 200 ml of a full carton of ice-cream can be obtained, the ice-cream carefully removed and the empty dry carton weighed. The difference in weights between the carton when filled and when empty is, therefore, the weight of 200 ml of frozen ice-cream. Five times this weight would then equal the weight of a litre. To determine the weight of the mix, proceed as below (B):
- Weigh and record the exact weight of a clean, dry 400 ml beaker. Into the beaker, weigh exactly 130 g of the frozen ice-cream.
- Place the beaker in water bath warmed to 49°C and melt.
- Weigh and record the exact weight of a 250-ml volumetric flask.
- Using a glass funnel, transfer 130 g of melted ice-cream into the 250 ml volumetric flask.
- Add exactly 10 g of *n*-amyl alcohol to the flask and mix to break the surface tension of the melted ice-cream and

release the incorporated air. 10 g of n-amyl alcohol occupies a volume of 12.24 ml.

- Cool the flask with contents to 15.5°C using a cold water or ice water bath.
- Rinse the beaker containing melted mix with several small rinsing of water, adding each rinse to the 250 ml flask.
- Again cool the flask with contents to 15.5°C and using the final rinse water, bring the volume to 250 ml mark. The bottom of the meniscus should correspond with the mark when temperature is exactly 15.5°C. Dry the outside of the flask and reweigh.
- Calculate the weight in g of the contents. Calculate the weight in g of the water added to the flask. Calculate the volume in ml occupied by the sample of ice-cream. Determine the sp. gr. of the mix by dividing its weight (130 g) by the volume in ml, which it occupied. Determine the weight in g per litre of mix by multiplying by the specific gravity.

(Ref:-IS:2802: 1964 (Reaffirmed 1995) Specification for ice-cream. Bureau of Indian Standards, New Delhi).

RESULTS AND DISCUSSION

The ice cream was analysed for its physico-chemical and sensory characteristics. The results are discussed below.

Conclusion

The products were well accepted and had an overall acceptability of 8.75 for 100% GBR milk ice cream and 8.5 for 50% GBR milk ice cream. Thus the present study qualifies to identify GBR milk as the best non-dairy substitute in ice cream preparation.

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