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EFFECT OF STORAGE PERIOD ON PHYSICOCHEMICAL PROPERTIES OF FORTIFIED ICE CREAM

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Abstract
Iron deficiency is considered to be the commonest worldwide deficiencies. Nowadays peoples are affected due to anaemic mainly children's and young adolescents. The aim of our present study is to fortify the Iron in Ice cream using Spinach Powder, Chickpea powder and Pistachio powder to avoid the deficiency. The fortified Ice cream was prepared by literature recipes. The ingredients used for the preparation of fortified Ice cream was optimized by using Minitab 16. There was no changes in Protein and Fat, slight difference occurs in the minerals like (Na, K, Ca, P, Mg, Fe, Zn). The increase in Total solid was due to the loss of moisture. The titratable acidity of sample was increased significantly while there was a decrease in pH during storage. The decrease in overrun occurs during cold storage. The optimum conditions for the best sensory score of the two outputs were obtained are: Milk-1000 ml, Spinach powder-7 g, Chickpea powder-7 g, and Pistachio Powder-5.98 g. From the study it was concluded that there was a slight difference occurs in presence of Iron during cold storage.

Keywords: Iron, Ice cream, Anaemic, Cold storage.

Introduction

By description, "ice cream is a liquid mixture that turns into a paste after shaking and cooling at the same time" (Corvitto, 2011). The liquid mixture, which has been processed into ice cream, will have specific taste, structure and texture characteristics, determined by the quality of the ingredients used, the mixture composition and the manufacturing process, the normal parameters for the milk base ice cream are 64 per cent water, 18 per cent sugar, 10 per cent non-fat milk solids and 8 per cent milk solid fats, all of which are required to have a stab. (maintain his characteristics at serving temperature) (Corvitto, 2011). According to other authors a standard ice cream is about 30% ice, 50% air (the main role is to make it soft), 5% fat and 15% sugar solution by volume. The composition for a standard ice cream is; Fat 7–15%, Milk protein 4–5%, Lactose 5–7%, Other sugars 12–16%, Stabilizers, emulsifiers and flavors 0.5%, Total solids 28–40%, Water 60–72% (Clark, 2012). The aim of our experiment is to Fortify Iron and Fiber in Ice cream using Spinach, Chickpea and Pistachio powder and the Physicochemical analysis of the product is evaluated.

Materials and Methods

Materials

Full cream milk is purchased from the Aavin Center, Chidambaram. Baby spinach leaves are purchased from the market. Chickpea and Pistachio nuts are purchased from the local market.

Methods

Preparation of Spinach powder:

Spinach leaves are washed with water to remove the stones, dirt and then, the spinach leaves are soaked in sodium hypochlorite solution for 30 min to remove the dead tissue in the leaves. Then, the leaves are dried in a tray drier at 55±2 °C for 8 h. Dried spinach leaves are grinded into fine powder by using a high-speed mixer. The flour was sieved to 80 mesh screens. Finally, stored in the airtight container (Narsing Rao galla et al., 2017).

Preparation of Chickpea powder:

Chickpea seeds are washed with water to remove foreign materials and then soaked in distilled water for 12 hr. Dehulled process takes place. After that, the seeds are crushed into smaller fragments with a blender. The flour was dried in a tray drier for 60℃ for 12 hours. Sieved to 80 mesh screens. Finally, the flour is stored in the airtight container (Zar Zar Oo et al., 2017).

Preparation of Pistachio powder:

The raw dehulled pistachio nuts were purchased from the local market, Chidambaram. The pistachio nuts are roasted with the use of open pans at 110 ℃ for 16 min. Roasted nuts are grinded by using the grinder. The flour is dried at 60 ℃ for 6 hrs with the use of tray dryer. Sieved to 80 mesh to get the fine powder. Stored in airtight container.

Preparation of Ice cream:

Milk is heated at a pasteurizing temperature of 74 ℃ for 15 min. After that, the milk is continuously stirred for 30-35 min until it gets thick. The Sugar and Butter are added to the milk and the spinach powder, chickpea powder and pistachio powder are added. The mix is blended for 90 sec. Then, the prepared Ice cream is packed in an airtight container and kept in a freezer at a temperature of -4 to -5℃.

Physicochemical analysis:

Titratable acidity and ash were determined according to ISI (1984) method. Total solid content was determined according to FSSAI (2015) method. pH was determined according to AOAC (2005) method. Protein content was estimated using Lowry's method. Fat was determined using AOAC (2019) method. Minerals like sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Phosphorous (P), Iron (Fe) and Zinc (Zn) was determined using AOAC (2019) method. Overrun of Ice cream is calculated based on weight basis using the formula (Arashdeep singh et al., 2014):

$$\text{Overrun \%} = \frac{\text{Weight of ice cream mix} - \text{Weight of ice cream}}{\text{Weight of ice cream mix}}$$

Result and Discussion

The physico-chemical properties of Fortified Ice cream like Overrun, Total solid content, Protein, Fat, Fibre, Ash, pH and titratable acidity are analysed at regular intervals of time till the growth of microorganisms are observed. The results obtained are given in Table.

The total solid content of Ice cream is increased significantly, the elevation in total solid contet of ice cream is increased due to the loss of moisture from the samples during Storage. The increase in

total solid content of ice cream produced with soymilk and skim milk during the storage of 30 days (Abdullah et al., 2003).

Table 1. Effect of storage on total solid content, overrun, ash of fortified ice cream

Ice cream type	Storage period (days)				
	0	15	30	45	60
Overrun					
Control	49.34	49.18	48.96	48.75	48.69
Fortified ice cream	55.45	55.23	55.09	54.87	54.18
Total solid content					
Control	35.23	35.29	35.41	35.74	35.92
Fortified ice cream	44.62	44.69	44.78	44.91	45.36
Ash					
Control	0.59	0.59	0.60	0.61	0.61
Fortified ice cream	0.82	0.82	0.825	0.83	0.83

The titratable acidity of sample was increased significantly while there was a decrease in pH. The increase in acidity was due to the formation of lactic acid by lactic acid bacteria and psychrophilic bacteria during storage (Murtaza et al., 2004).

Table 2. Effect of storage on ph, titratable acidity of fortified ice cream

Ice cream type	Storage period (days)				
	0	15	30	45	60
pH					
Control	6.44	6.43	6.43	6.42	6.41
Fortified ice cream	6.62	6.61	6.60	6.60	6.59
Titratable acidity					
Control	0.196	0.197	0.198	0.199	0.199
Fortified ice cream	0.185	0.188	0.191	0.193	0.194

Table 3. Effect of storage on protein of fortified ice cream

Ice cream type	Storage period				
	0	15	30	45	60
Protein (g)					
Control	4.5	4.51	4.51	4.51	4.50
Fortified ice cream	5.95	5.95	5.96	5.96	5.96

Fat (g)					
Control	4.61	4.60	4.60	4.61	4.61
Fortified ice cream	5.42	5.41	5.40	5.41	5.41

The effect of fortification of Iron in ice cream was found to be significant. Storage period was non-significant on protein, fat and ash content of ice cream. There was a significant change occurs in the Ice cream during cold storage.

Table 4. Effect of storage on Na, K and Ca of fortified ice cream

Ice cream type	Storage period (days)														
	0			15			30			45			60		
Minerals	Na (mg)	K (mg)	Ca (mg)	Na (mg)	K (mg)	Ca (mg)	Na (mg)	K (mg)	Ca (mg)	Na (mg)	K (mg)	Ca (mg)	Na (mg)	K (mg)	Ca (mg)
Control	65	199	132	65	199	132	64.8	198.2	131.5	64.4	198.2	131.3	64.3	198	131.1
Fortified ice cream	95	208	148	95	207.6	148	94.2	207.1	147.6	94.2	207.1	147.3	94.2	207	147.2

The substantial decrease of overrun of ice cream. The decrease in overrun is due to loss of air and moisture from ice cream. The shrinkage in the ice cream during storage was caused by the loss of air due to collapse of weakened films of mix from ice cream leading to a loss in volume (Potter and Hotchkiss, 1995).

Table 5. Effect of storage on Fe and Zn of fortified ice cream

Ice cream type	Storage Period (days)									
	0		15		30		45		60	
Minerals	Fe (mg)	Zn (mg)	Fe (mg)	Zn (mg)	Fe (mg)	Zn (mg)	Fe (mg)	Zn (mg)	Fe (mg)	Zn (mg)
Control	0	0	0	0	0	0	0	0	0	0
Fortified ice cream	22.27	25.76	22.26	25.73	22.20	25.70	22.18	25.68	22.15	25.65

Table 4. Effect of storage on P and Mg of fortified ice cream

Ice cream type	Storage Period (days)									
	0		15		30		45		60	
Mineral	P (mg)	Mg (mg)	P (mg)	Mg (mg)	P (mg)	Mg (mg)	P (mg)	Mg (mg)	P (mg)	Mg (mg)
Control	97.2	60.1	97.0	59.98	96.95	59.95	96.86	59.93	96.68	59.90

Fortified ice cream	510.7	173.1	509.99	148	509.84	147.6	509.18	147.3	508.92	147.1

Conclusion

From the study it was concluded that there was no changes in Protein and Fat, slight difference occurs in the minerals like (Na, K, Ca, P, Mg, Fe, Zn). The increase in Total solid was due to the loss of moisture. The titratable acidity of sample was increased significantly while there was a decrease in pH during storage. The decrease in overrun occurs during cold storage.

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