TECHNOLOGY AND QUALITY ATTRIBUTES OF PROBIOTIC ICE CREAM*

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ABSTRACT

The feasibility of dispensing live probiotic organisms through ice-cream has being explored in the present investigation. The freeze dried cultures of Lactobacillus acidophilus; Lactobacillus delbrueckii ssp bulgaricus and Bifidobacterium bifidum were incorporated in the mix at 1% and 2% level before freezing with different combinations of cultures (8 treatments) and were frozen in a batch freezer. The treatments were subjected for physico chemical and sensory evaluation. Among them the ice cream containing Lactobacillus acidophilus + Bifidobacterium bifidum at 1% level was found to be acceptable and superior in all the above attributes. Further the viability of above treatment culture could be substantially retained in ice cream even after freezing which could be beneficial to consumers.

Key words: Probiotic ice cream, Yoghurt culture, pH, meltdown character, over run, acidity, sensory scores.

INTRODUCTION

Man's inquisitive desire to relish tasty food has now changed to food that has therapeutic and curative properties. Some of the reported nutritional and physiological benefits of probiotic foods are promotion of growth and digestion, setting effect on the gastro intestinal tract, improving bowel movement, suppression of cancer, catering to lactose intolerances and lowering of blood cholesterol level etc. Keeping the socio economic attributes and consumer preferences in view, development of a suitable food or dairy product for incorporation of these health promoting probiotic cultures is the need of the hour. Incorporation of beneficial bacteria into foods to counteract harmful organisms in the intestinal tract has been the most visible component of this new area. Ice cream being the most preference of consumer, probiotic ice-cream is a suitable vehicle for delivering beneficial micro organisms such as Lactobacillus and B.bifidum to consumers (Hekmat and Macmohan, 1991). Hence, an attempt has been made in the present study to standardize the preparation of an acceptable quality of ice cream using different cultures possessing probiotic activity by studying the physico chemical and sensory properties

MATERIALS AND METHODS

Fresh cow milk was standardized to 10% fat, milk solids not fat 11%, sugar 15% and stabilizer 0.3%. The liquid ingredients were mixed in aluminum container and warmed to 50°C in a water filled double jacketed steam vat. Calculated quantities of sugar and skim milk powder were added to the container with constant stirring after the temperature of the content was raised to 60ºC. Later the calculated quantity of stabilizer was added to the container at 65ºC. The ingredients were all well

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dispersed and the mix was filtered through a muslin cloth to remove the undissolved material in the mix.

The mix was homogenized at 60ºC by using a two stage homogenizer maintaining 2500 psi during first stage and 500psi during second stage of homogenization. The mix was pasteurized at 68ºC for 30 min in a double jacketed vat in order to safe guard the health of consumer. Then probiotic culture was inoculated when the temperature of the pasteurized mix reached to the desired temperature of inoculation i.e., 42 or 37ºC depending on the type of culture for 6 hrs.

The probiotic ice cream was prepared using the different cultures as shown below:

Control : Ice cream prepared without using cultures.

Treatment I: 1 percent of Lactobacillus acidophilus was inoculated at a temperature of 37ºC and incubated for 6 hrs.

Treatment II: 2 percent of Lactobacillus acidophilus was inoculated at a temperature of 37ºC and incubated for 6 hrs.

Treatment III: 1 percent of Yoghurt culture comprising 0.5 % Lactobacillus delbrueckii ssp bulgaricus and 0.5 percent Streptococcus salivarius ssp thermophilus was inoculated at a temperature of 37ºC and incubated for 6 hrs.

Treatment IV: 2 percent of Yoghurt culture comprising 0.5 percent Lactobacillus delbrueckii ssp bulgaricus and 0.5 percent Streptococcus salivarius ssp thermophilus was inoculated at a temperature of 37ºC and incubated for 6 hrs.

Treatment V: 1 percent of Lactobacillus acidophilus and yoghurt culture were inoculated at a temperature of 37ºC and incubated for 6 hrs.

Treatment VI: 2 percent of Lactobacillus acidophilus and Yoghurt culture were inoculated at a temperature of 37ºC and incubated for 6 hrs.

Treatment VII: 1 percent of Lactobacillus acidophilus and Bifidobacterium bifidum were inoculated at a temperature of 42ºC and incubated for 6hrs.

Treatment VIII: 2 percent of Lactobacillus acidophilus and Bifidobacterium bifidum were inoculated at a temperature of 42ºC and incubated for 6 hrs.

After the incubation period the fermented ice cream mix was added flavor and frozen in a batch freezer then was packed in polystyrene cups and kept at -18ºC for analysis. The average over run of freezer is 60-70%.

The acceptability of ice cream prepared with different types of lactic acid bacteria was studied by conducting sensory evaluation by a panel of 6 trained judges, using 9 point hedonic scale. The ice cream was evaluated for physico-chemical parameters like pH, titratable acidity, meltdown rate, over run, and viability of micro organisms following the standard methods of BIS (1980) and protein content with Kjeldahl method described by Menifee and Over man (1940). The data obtained was statistically analyzed by using the standard methods prescribed by Snedecor and Cochran (1964).

RESULTS AND DISCUSSION

The physico chemical attributes of ice creams in- corporated with different probiotic cultures at different levels were presented in table 1 revealed that the probiotic culture of ice-cream prepared using Lactobacillus acidophilus at 2% level was recorded a statistically significantly higher acidity (0.43%LA) and Lactobacillus acidophilus + Bifidobacterium bifidum at 1% level culture had lower acidity (0.26%LA) compared among with other combinations while it was 0.23%LA only in case of control ice cream. The corresponding pH values also followed a similar trend. The protein percentage in the ice cream

ranged between 4.1 to 4.13% which statistically insignificant indicating that the bacterial multiplication has not influenced in increase of protein content. The melt down rate varies from 29.4 to 31.1 at 1% level and 29.3 to 30.6 ml/30 min at 2% level. Even though the mean melt down rate of control ice cream was 36.4ml/30 min statistically an insignificant difference in the mean values among the ice creams incorporated with different cultures was observed. Over run studies revealed that the mean overrun value of control ice cream was 60.40% whereas the overrun of probiotic ice cream made with 1% cultures varies from 53.20 to 53.90 and 53.00 to 53.10 at 2% level incorporation of probiotic cultures in ice creams and these values were significantly different compared with control ice cream. The difference in the overrun between the two levels of culture addition was found to be marginal which may be due to the increased acidity resulting in increased viscosity of the mix, which would inturn impediment to the incorporation of air during ice cream preparation. The observations in the present study are in conformity with the observations made by Christiansen et. al.(1996).

Table -1

Mean score of physico chemical attributes of ice cream prepared bys using different starter cultures.

Treatment/ parameter	pH	Acidity % LA	Protein %	Meltdown rate l/30min	Over run %
Control	6.60	0.23	4.10	36.4	60.40
L. acidophilus 1%	5.74	0.33	4.11	29.4	53.30
L. acidophilus 2%	5.56	0.43	4.13	29.3	53.00
Yoghurt culture1%	6.10	0.27	4.11	30.0	53.20
Yoghurt culture2%	5.90	0.28	4.12	29.4	53.10
L.acidophilus+Yoghurt culture 1%	5.98	0.32	4.12	29.6	53.90
L.acidophilus+Yoghurt culture 2%	5.83	0.34	4.13	29.4	53.10
L.acidophilus+B.bifidum 1%	6.20	0.26	4.11	31.1	53.60
L.acidophilus+B.bifidum 2%	6.00	0.27	4.12	30.6	53.10
F value	**	**	NS	NS	**

* : Significant at 5% level (P < 0.05) ** : Significant at 1% level (P < 0.01) NS: Not Significant

Sensory evaluation: All the ice cream samples were subjected to sensory evaluation to determine the acceptability of the product. The data depicted in table 2 pertaining to sensory scores of different ice cream samples revealed that there is no significant difference statistically between treatments in case of flavor and color scores. How ever higher flavor score was noted in case of probiotic ice cream made with Lactobacillus acidophilus + Bifidobacterium bifidum at 1% level seems to be produced least acidity than compared to the other samples. The body and textural scores pertaining to different treatments has found to be statistically different indicating that ice cream with L.acidophilus had least score for body and texture compared to other treatments which could be possible due to perceptible sogginess in the product.

Table 2

Mean sensory scores of ice cream prepared by using different starter cultures.

Treatments	Flavor (40)	Body& Texture(30)	Color(5)
Control	36.5	28.0	4.38
L. acidophilus 1%	36.2	25.8	4.38
L. acidophilus 2%	36.0	25.0	4.37
Yoghurt culture1%	36.4	26.5	4.38
Yoghurt culture2%	36.3	26.3	4.38
L.acidophilus+Yoghurt culture 1%	36.2	26.2	4.37
L.acidophilus+Yoghurt culture 2%	36.1	25.8	4.37
L.acidophilus+B.bifidum 1%	36.6	28.1	4.38
L.acidophilus+B.bifidum 2%	36.5	28.0	4.38
F value	NS	**	NS

* : Significant at 5% level (P < 0.05) ** : Significant at 1% level (P < 0.01) NS: Not Significant

CONCLUSION

Based on the study of above attributes it could be possible to prepared probiotic ice cream successfully using the various starter cultures with combinations mentioned above. All the samples found to be acceptable however the ice cream with Lactobacillus acidophilus + Bifidobacterium bifidum at 1% level culture showed a better acceptability by the Judges which had low acidity as well as higher scores for all the sensory attributes are same to as control ice cream.

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Probiotic foods are a group of functional foods with growing market shares and large commercial interest [1]. Probiotics are live microorganisms which when administered in adequate amounts confer a beneficial health benefit on the host [2]. Probiotics have been used for centuries in fermented dairy products. However, the potential applications of probiotics in nondairy food products and agriculture have not received formal recognition. In recent times, there has been an increased interest to food and agricultural applications of probiotics, the selection of new probiotic strains and the develo Ice Creams made from cream or butter (dairy ice creams) and from vegetable fat (nondairy ice creams) are essentially comparable in nutritional value. There are differences, however, in the vitamin A content, which is higher in dairy ice cream, and the vitamin E content, which is higher in nondairy ice cream.Â Ice cream is recommended as an effective delivery medium for probiotic organisms. It is valuable for its high-quality protein and easily assimilated calcium. Ice creams of a wide range of flavors are now available.Â Ice cream technology: Information on the general principles of ice cream technology and manufacture can be found in the classic reference by Marshall et al. (2003) which also discusses aspects of the global ice cream market. Cocoa flavoured soymilk ice cream. Phytochemical rich ice cream incorporating kinnow peel.Â Frozen yoghurt technology is widely adopted for the inclusion of probiotic cultures into ice creams and desserts. Several combinations of Bifidobacterium and Lactobacilli have been used.5 It can be directly (blending of probiotic cultures and ice cream mix prior freezing process) added or milk is involved in fermentation for probiotic cell proliferation into the ice cream mix. The protection of cells from cryogenic damage or shock is important in both cases.Â Fat content is a vital parameter for texture and quality of ice cream and reduced fat ice cream has a body and texture associated with customer dissatisfaction. the sensory attributes of probiotic ice cream. Viability of probiotic bacteria in ice cream. from formulation to time of consumption. Maintaining the viability of probiotic cultures in food until. the end of shelf life is an important criterion for providing. effective probiotic food products. The majority of studies. regarding viability of probiotic bacteria in ice cream have.Â as freezing technology and storage time. It has been. proven that short-chain polysaccharides are more cryo-. protective than long-chain polysaccharides (Champagne. and Rastall 2009). Short-chain polysaccharides deemed. â€˜prebiotic compoundsâ€™(e.g., fructo-oligosaccharides, see.