CONTEMPORARY RESEARCH IN INDIA
ISSN 2231 - 2137

DEVELOPMENT OF NUTRITIONAL RICH ICE CREAM BY FORTIFICATION WITH BOTTLE GOURD (*Lagenaria siceraria*)

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Received: 12/08/2017	Edited: 18/08/2017	Accepted: 24/08/2017

Abstract: *In present investigation the efforts have been made to prepare Ice cream fortified with bottle gourd different form. Ice cream was prepared using the various prepared forms of bottle gourd viz. puree (20, 25, 30%), shreds (20, 25, 30%), cubes (20, 25, 30%).The various forms of bottle gourd at selected levels were added after aging. It was found that addition of cube as well as shreds alone resulted in product with crunchy texture, lacking in flavor and lacking in desired caramelized, pleasant flavor. It was found that puree contributed to viscosity, richness, good flavor, appearance, texture and increase in palatability of ice cream. It reveals that the incorporation of 25% bottle gourd puree was found to be superior to that of other in-corporations.*

Key words*: Bottle gourd, Lagenaria siceraria, Ice cream, Fortification, Nutrition Rich.*

(Abbreviations: GMS - Glycerol Monostearate, CMC - Carboxy Methyl Cellulose, BGP - Bottle Gourd Puree, MSNF - Milk Solid Not Fat, TSS - Total Soluble Solid.)

Introduction

In India more then 20-25% of fruits and vegetables are spoiled before utilization. Despite being the world's second largest producer of fruits and vegetables, only 1.5% of the total fruits and vegetables produced are processed. Incorporation of vegetable for the preparation of dairy products is thought to be a convenient and economical alternative for utilization of these vegetables (*Hanif R., et al 2006).* Hence, there is a need to develop new functional dairy products to reflect consumer interest in health and naturalness. *Ranganna* (2002) observed that sensory quality is a combination of different senses of perception which come into play in choosing and eating a food. Appearance, which can be judged by the eye, eg:- color, size shape uniformity.

Currently health is a major concern of customers. Therefore, manufacturers are finding new ways to incorporate natural and innovative ingredients into ice cream for health benefits. Vegetable plays an important role in daily human diet. Consumption of vegetables has been associated with protection against certain types of cancer, cardiovascular disease and various age related diseases.

Among various vegetables grown in India, bottle gourd (Langenaria siceraria) has a high place in diet as it is rich and the cheaper source of nutrients. Bottle gourd has long been an important component of indigenous herbal medicine, particularly in Asia. Bottle gourd was used as an ingredient in ice-cream in this study since it is a highly valued vegetable containing good amounts of nutrients like carbohydrates, Vitamin A, Vitamin C and minerals.

Bottle gourd is a first domesticated vegetable species, providing food, medicine and lot more. The juice of bottle gourd is a valuable medicine for

exercise thirst due to severe diarrhea, diabetics and excessive use of fatty or fried foods. Bottle gourd (Langenaria Siceraria Mol. Standley) is an edible, medicinal and otherwise utilitarian domesticated cucurbit with an ancient pan tropical distribution.

Bottle gourd is light coloured bottle shaped gourd. It has white spongy pulp with seeds in it. It is rich in vitamin B1, B6, B9, B12, C, k, calcium, phosphorus, potassium, zinc, copper, sodium, dietary fibers and many more. The benefits of bottle gourd are, It is made of 96% water and best for weight loss. It is very low in calories. Bottle gourd is diuretic in nature that aids in urinary disorders. It flushes the toxins deposits hence aiding to cure disorder. It keeps the stomach cool and ultimately keeps the hairs healthy and black. There are varieties of bottle gourd like Pusa Summer, Pusa Nuveen, Ark Bihar, PB Comal etc.

Materials and Methods

Present work was carried out at Food Technology Laboratory, University Department of Chemical Technology, Dr. Babasaheb Ambedkar Marathwada University, and Aurangabad, India.

Materials

Whole milk, sugar, commercial grade Glycerol Monostearate (GMS), corn flour, Carboxy Methyl Cellulose (CMC), Vanilla essence, was procured from Aurangabad city. Bottle gourd (Pusa Nuveen and Pusa Summer variety) were procured from local vegetable market of Aurangabad city. The instruments used while performing the project were Analytical Balance, Muffle Furnace, Rapid Moisture Analyzer MCC-120H.

Preparation of bottle gourd shreds

Bottle gourds were peeled, washed and halved into two parts using clean, dry knife, de-cored and shredded. From 1 kg bottle gourd ~ 15 to 20% of its weight was peel and 20 to 25% was core portion. Therefore, quantity of edible portion bottle gourd obtained after peeling and decoring was 40 to 45% of weight of initial weight of bottle gourd. The shreds were blanched (90^0C for 30 Second) to prevent enzymatic browning and transferred in pre-washed, sanitized clean pre-weighed stainless steel vessel.

Preparation of gourd cubes

Bottle gourds were peeled, washed, halved into two parts, decored and cut in pieces (average length 5.0 ± 1.0 cm slices, breath 2.0 ± 0.5 cm and thickness 2.0 ± 0.5 cm). These raw pieces were blanched (90^0C for 2 min) and drained. The pieces were then cut into 0.8 ± 0.2 cm3 cubes and taken in pre-washed, sanitized, clean, pre-weighed stainless steel vessel.

Preparation of bottle gourd puree

Bottle gourds were peeled, washed and cut into pieces of average length 5.0 ± 1.0 cm slices, breath 2.0 ± 0.5 cm and thickness 2.0 ± 0.5 cm using a clean sharp, dry stainless steel knife. These pieces were immediately blanched (90^0C for 2 min) to prevent enzymatic browning which affects the final quality of puree in terms of color and other sensory aspects. Puree was made from the blanched and drained bottle gourd slices by grinding for 2 to 3 min food processor. The puree was then transferred in a clean, sanitized pre-weighed stainless steel vessel. To prepare 1 kg processed bottle gourd puree 1.1 kg peeled bottle gourd was required. The prepared bottle gourd puree was bland in taste. Hence, sodium chloride was added at the rate of 0.1% by weight of raw puree to enhance its flavor.

Preparation of ice cream mix

Selection of ingredients
↓
Figuring the mix
↓
Making the mix
↓
Pasteurizing the mix (68^0C for 30 min)

↓
Homogenizing the mix (I-2500psi &II-500psi)
↓
Cooling and aging the mix (0-4^{0}C)
↓
Freezing the mix (-4 to -5^{0}C)
↓
Packaging of ice cream mix
↓
Hardening and Storage (-23 to -29^{0}C)

Figure 1: Preparation of ice cream mix

The tentative levels of milk fat as well as MSNF were based on FSSA requirements for different types of ice creams viz. low-fat, medium fat and ice cream. In preliminary trials, ice cream mixes were prepared with 2.0, 6.0 and 12% milk fat, which corresponded to requirements for low-fat, medium-fat and regular ice cream respectively. The MSNF content of ice cream varies inversely with the fat content. Therefore, the levels of MSNF selected were 12.0, 11.5 and 11.0% respectively. These levels were based on the minimum requirements for milk protein in ice cream mix according to FSSA requirements. Sugar, sodium alginate and GMS were added at the rate of 25, 4 and 2.4% respectively in all the mixes (*Bhandari V 2001*).

Preparation of ice cream

Boiling of milk → Addition of sugar

Corn flour+GMS+CMC → Mix with little portion of milk

↓
Mixing & stirring
↓
Addition of bottle gourd puree
↓
Sieving
↓
Addition of cream
↓
Cooling (room temperature)
↓
Addition of essence and colour
↓
Cooling and aging (0-4^0 C)
↓
Freezing (-4^{0}to -5^0 C)
↓
Hardening and storage (-23^0 to -29^0 C)

Figure 2: Preparation of ice cream

Preliminary investigations were carried out using different blend of stabilizers viz. corn flour, Carboxy methyl cellulose along with GMS as emulsifier resulted in a product having acceptable flavor, body and texture, good meltdown and total score. From the experimentation carried out, the formulation chosen was 12% milk fat, 11% MSNF,

24% sucrose, 0.3% CMC, 2.4% corn flour and 4% GMS, 37.37% total solids.

Table1: Composition of Ingredients and Levels of addition of bottle gourd puree (BGP) (%) for Formulation of Ice cream

Ingredients	Levels of addition of bottle gourd puree (BGP) (%)			
	Blank	20%	25%	30%
Milk (ml)	500	500	500	500
Sugar(g)	150	150	150	150
Corn flour(g)	12	12	12	12
GMS(g)	20	20	20	20
CMC(g)	1.5	1.5	1.5	1.5
Bottle gourd (g)	__	54	57.5	81

Physicochemical analysis

Moisture content: The moisture content was determined with the help of rapid moisture analyzer as per standard methods (*AOAC, 2000)* and results were expressed in terms of percentage.

Ash content: The ash content was determined with the help of muffle furnace as per standard methods (*AOAC, 2000*) and results were expressed in terms of percentage.

Protein content: The protein content was determined with the help of Kjeldahl apparatus method as per the standard method (*AOAC, 2000*) and results were expressed in terms of percentage.

Fat content: The fat content was determined with the help of Gerber's centrifuge apparatus as per the standard method (*AOAC, 2000*) and results were expressed in terms of percentage.

Organoleptic evaluation:

The ice cream prepared by optimizing the levels of addition of BGP (Bottle Gourd Puree) along with control ice cream were subjected to sensory laboratory under white light for attributes of Appearance, color, taste, mouth feel, flavor and overall acceptability by a preference method, semi trained panel of judges with the help of nine point hedonic scale (1for dislike extremely and 9 for like extremely) (*Amerine et al. 1965).*

Results and Discussion

The results obtained in the present investigation entitled "Devlopment Of Nutritional Rich Ice Cream By Fortification With Bottle Gourd (*Lagenaria siceraria*)" are summarized here with and discussed for their significance. The whole data obtained on various aspects of study is categorized under the following headings and subheadings.

Effect of different levels of bottle gourd cube and puree addition on physicochemical properties of bottle gourd ice-cream

Fat content of ice-cream greatly influences the physico-chemical and sensory properties of ice-cream. Fat imparts rich flavor, soft body and smooth texture and also important in acceptance of ice-cream in terms of consumer's sensory perception. The values of fat in bottle gourd ice-cream ranged from 10.536 to 11.117% of bottle gourd ice cream. Bottle gourd ice-cream prepared by using 20% puree addition was having highest% fat (11.12%) content. There was a progressive decrease in fat content of experimental samples with increase in level of addition of bottle gourd puree and cubes.

Bottle gourd ice-cream prepared by using 20% puree addition was having lowest % of total solid content, where as Bottle gourd ice cream prepared by using 25% and 30% puree addition was having optimum total and highest solid content. There was a progressive increase in total solids content of experimental ice-cream with increase in level of addition of bottle gourd puree. This effect could be attributed to the higher total solid content of bottle gourd puree (57.32%) compared to total solids content of basic ice-cream mix i.e. 37.37%.

The values of ash content ranged from 0.857 to 0.897% of bottle gourd ice-cream. Bottle gourd ice-cream prepared by using 30% puree addition was

having highest% ash content. Bottle gourd ice-cream prepared by using 25% puree addition was having medium% ash content Bottle gourd ice-cream prepared by using 20% puree addition was having lowest% ash content. The values of acidity ranged from 0.1902 to 0.1933% lactic acid of bottle gourd ice-cream.

Table 2: shows results regarding Physicochemical analysis, total solid and acidity of Ice cream with different % BGP

Sample with level of addition of BGP(%)	Fat (%)	Ash (%)	Moisture content (%)	Protein (%)	Carbohydrate (%)	Acidity (%)	TSS (%)
Control	12.00 ± 0.25	0.82± 0.12	29.27± 0.35	4.31± 0.18	53.62 ± 0.41	0.2300 ± 0.24	32.20± 0.78
20%	10.52± 0.43	0.857± 0.16	26.56± 0.46	5.82± 0.24	56.75 ± 0.58	0.1902 ± 0.41	36.61± 0.27
25%	11.05± 0.23	0.863± 0.19	27.40± 0.43	6.46± 0.27	54.22 ± 0.64	0.192± 0.34	37.82± 0.64
30%	11.12± 0.34	0.887± 0.13	28.88± 0.34	7.25± 0.31	51.86 ± 0.74	0.1933 ± 0.17	38.20± 0.82

**All the parameters indicated in % and each value is mean of three determinations with standard deviation.*

Effect of addition of bottle gourd puree on sensory properties of ice cream

The ice cream prepared from the addition of bottle gourd puree were analyzed for sensory quality parameters like color, taste, flavor, appearance, mouth feel and overall acceptance on nine point hedonic scales. The sensory scores presented in the table 3 indicate that color of control sample and ice cream with 25% addition were good compared to other samples.

Table 3: shows Effect of addition of bottle gourd puree on sensory properties of ice cream

Sensory Parameter	Control Sample	Level of addition of Bottle Gourd Puree (BGP) (%)		
		20%	25%	30%
Appearance	7.4 ±0.5164	7.2 ± 0.3428	8.5 ± 0.4127	6.7 ± 0.6532
Color	7.3 ± 0.2645	7.4 ± 0.7462	8.3 ± 0.7315	6.5± 0.7381
Taste	7.7 ± 0.3753	6.6 ± 0.4125	8.2 ± 0.2435	6.7 ± 0.2419
Texture	7.9 ± 0.6124	7.1 ± 0.6421	8.2 ± 0.8124	7.0 ± 0.4938
Flavor	7.8 ± 0.3421	6.8 ± 0.2376	8.5 ± 0.4137	6.9 ± 0.4371
Overall acceptability	7.7 ± 0.3427	7.0 ± 0.4127	8.4 ± 0.4132	6.8 ± 0.3147

**All the parameters indicated in % and each value is mean of ten determinations with standard deviation.*

As the addition of puree per cent increases color of ice cream darken. The taste of control sample and 25% added bottle gourd puree had good acceptability than other samples while samples with 20% level of addition of bottle gourd puree were less acceptable than 25% addition whereas 30% level of addition of bottle gourd puree was low in sensory taste as they taste bitter.

Color parameters determines up to which extent the green color darkens. As the level of addition increases the green color darkens giving unacceptable color at 30% addition. The 30%

addition makes texture unacceptable (*Soukoulis C., et al 2009*). Flavor parameters tells about the presence of bottle gourd flavor, on addition of bottle gourd puree bitterness increases causing ice cream unacceptable at 30% addition.

Appearance parameter tells about the looks of the ice cream physically, it becomes light green on addition of bottle gourd puree. Mouth feel parameters tell about the feeling of ice cream when they are ingested and 30% addition makes this unacceptable.

Conclusion and Discussion

Discussion

The experiment was carried out to prepare vegetable ice cream with the addition of bottle gourd puree and to check the increase in nutritional level of ice cream. The ice creams were prepared by adding bottle gourd puree at the levels of 20%, 25% and 30% respectively. Bottle gourd ice cream were evaluated for its various physicochemical, nutritional and organoleptic quality parameters, and then study revealed that ice cream prepared by adding bottle gourd puree at level 25% gave a better acceptable taste, texture and flavor. There was gradual increase in medicinal properties and organoleptic tests gave best results for level of 25% addition of bottle gourd puree.

Conclusion

From the present study it can be concluded that ice cream prepared by adding bottle gourd puree at level of 25% was found to be superior with respect to organoleptic qualities and also increase in medicinal properties compared to control sample. The investigation on addition of bottle gourd puree in different levels in various types of ice cream and other food products to be undertaken in order to satisfy the consumer demand of nutraceutical and healthy food in near future.

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