

UTILIZATION AND EVALUATION OF FENUGREEK (*TRIGONELLA FOENUM GRAECUM*) GUM AS A STABILIZER IN ICE CREAM

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Abstract

The investigation entitled “Utilization and evaluation of fenugreek (*Trigonella foenum graecum*) gum as a stabilizer in ice cream” was carried out to study the effect of different concentration of fenugreek gum as a stabilizer in ice cream. Fenugreek (HM-57) seed mucilage was extracted and the yield of fenugreek gum was found to be 20%. The gum was assessed for its acceptability in ice cream as a stabilizer. The gum was added in the ice cream at levels of 0.5%, 1.0%, 1.5% and 2.0% and assessed for sensory acceptability and physical properties. Among the four treatment, treatment T1 was found to be more acceptable with respect to mentioned quality parameters. During the study it was found that the ice cream incorporated with fenugreek gum at 0.5% (T1) has the best sensory quality as compare to other levels (T2, T3, T4) and even to control (C) ice cream. Moreover overrun and melting behavior of ice cream were found to improve with the increasing level of incorporated of fenugreek gum. Fenugreek gum has been proved as a good natural stabilizer in ice cream and may be used in diabetic products as a natural stabilizer.

Keywords: fenugreek gum, natural stabilizer, over run, ice cream, sensory acceptability

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1. INTRODUCTION

Fenugreek is the Fabaceae family's annual plant. Its seeds are small in size, golden-yellow in colour, hard and have four-faced stone like structure. Whole fenugreek seed or its ground powder is used in pickles, vegetable dishes, spice powder, condiments. Fenugreek seeds are sticky, fibrous, and gummy in nature (Murlidar, 2012). Fenugreek leaves are rich in protein, minerals and fiber. The protein content was found up to 43.8 g/100 g endosperm. Fenugreek is rich in dietary fiber and also rich in vitamins like niacin, pyridoxine and choline. Fenugreek includes flavonoid and phenolic compounds that improve capacity of antioxidant and have positive effects on pancreas and liver (Wani, 2016). The fenugreek gum comes from the seed endosperm involves mannose and galactose. The fenugreek gum is used as food agents like thicker, stabilizer and emulsifier. As compared to other gums such as guar gum and locust beans, fenugreek gum is used less in food industry (Bahadur, et. al., 2016). Due to more galactose content, fenugreek gum has greater water solubility compared to other kinds of

gum such as guar gum. This soluble dietary fiber can also be integrated into the production of bread (Roberts, K. T. et. al., 2012). Fenugreek gum is odourless, tasteless and is source of many dietary components, including proteins, vitamins, and a high fiber. Fenugreek gum is used in the food and beverage industry as a stabilizer and thickener. Fenugreek gum is an emulsifier capable of mixing oil and water. Fenugreek seed gum (FSG) can be used as antioxidant and anti-fungi agent in food systems. FSG has an excellent emulsification capacity which enables its application in the food, cosmetics and/or pharmaceutical industries (Salarbashi et al., 2019).

Thus, fenugreek gum operates as a gum and emulsifier that has made it possible to use it as a food stabilizer for industrial utilization (Farhat Rashid, S. H. (2017).

Compared to other gums such as guar gum and locust bean gum, fenugreek gum has superior features and is therefore used in many sectors. The distinct range of ice cream varies depending on the complete solids, fat content, desired overflow etc. Ice cream distribution is generally expressed as a proportion of its constituents, i.e. percent of milk fat, not fat

solids milk, sugar, stabilizer, and total solids. A stabilizer's primary function is to decrease the quantity of water free in ice cream mix by connecting it as "hydration water" or by immobilizing it in a gel framework. The small percentage of the stabilizer's ability to absorb and hold bound water in large amounts that produces good body, texture, slow melting and heat shock in the resulting product (Roberts and Kumar, 2012).

Stabilizers maintain homogeneity at the time of freezing or aeration process and control ice crystal growth. It play crucial role in resisting structural changes at the time of "heat shock" during storage. Stabilizer lead to uniform ice cream melting, mouth feeling and texture at the moment of serving and consuming. Stabilizers improve air cell distribution, air incorporation, body, texture, melting properties and storage stability.

Developing big ice crystals and eventually helping to achieve desirable completed ice cream composition also minimizes stabilizers. Fenugreek gum has good scope as an alternative to regular gums used in food industry (Poonam and Sonika, 2021). This part of the study had been planned with the objective to prepare ice cream with fenugreek gum and assess its qualitative parameters.

2. MATERIALS AND METHODS

Domain of the study

The present study was carried out in the Department of Food Technology, Guru Jambheshwar University, Hisar, Haryana, India. This part includes the information regarding the research design and methodological steps followed to achieve the objectives.

Procurement of raw materials

Fenugreek seeds of (HM-57) variety were procured from HAU, Hisar, Haryana and the other ingredients used for the preparation of ice cream were procured from local market.

Fenugreek gum Extraction

The coarsely ground fenugreek seeds of variety HM -57 was boiled for 30 minutes with water, filtered using muslin cloth after releasing mucilage in water and the filtrate was permitted to cool down and then precipitated the gum by adding ethyl alcohol in the filtrate 1:1 ratio. Then using muslin cloth fenugreek gum was separated and dried in oven at 90°C and powdered (Figure 1).



Figure 1. Fenugreek seeds (HM-57) and fenugreek gum

Optimization of fenugreek gum in ice cream

The ice cream was prepared using different proportions of fenugreek gum as stabilizer as shown in figure 2.

Quality evaluation of fenugreek gum incorporated ice cream

Over run property of ice cream: The overrun of ice cream relies on how much air is whipped during the freezing phase in the blend. It was described as the quantity of ice cream that exceeds the mixing quantity following standard method (SuKumar De, 2008).

Meltdown behavior: Sample of ice cream (100gm) stored at -17°C from the containers were removed, weighed and placed on mesh wire screens at room temperature ($35 \pm 1^{\circ}\text{C}$) and melt weight was recorded at 2 minute intervals for 10 minutes for meltdown behavior.

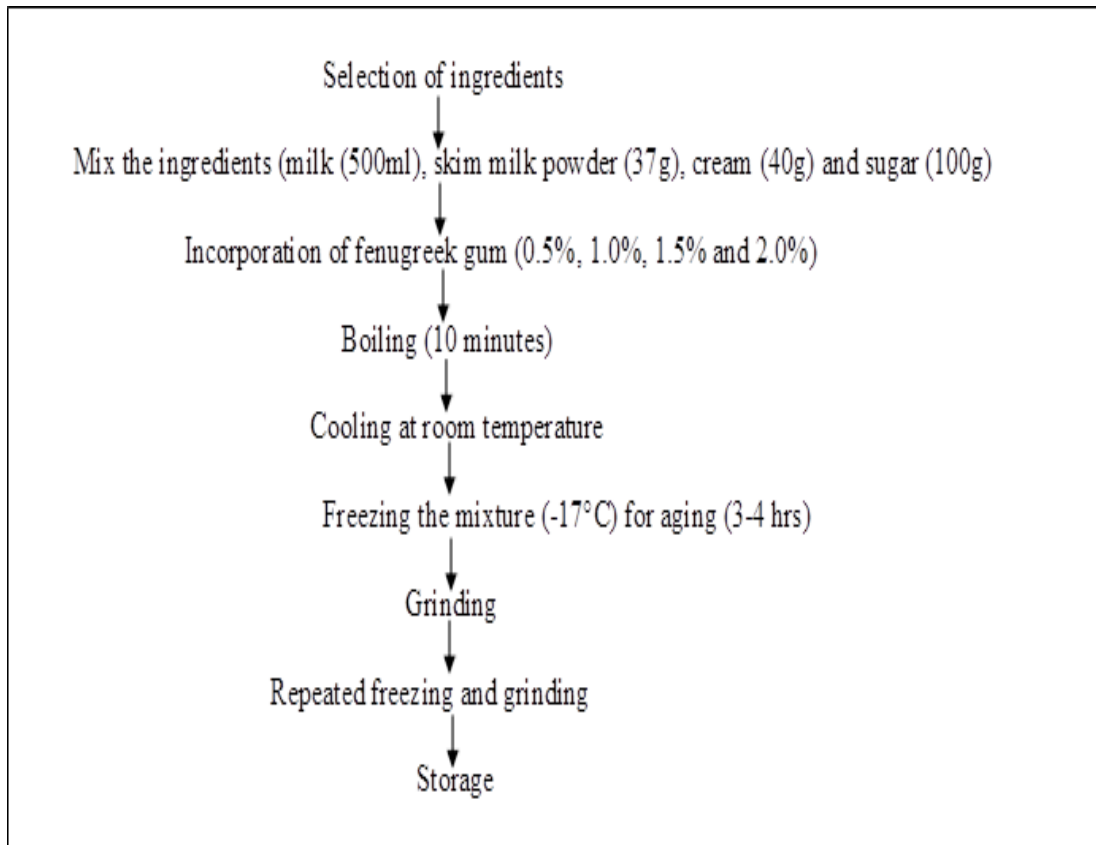


Figure 2. Preparation and optimization of ice cream incorporated with fenugreek gum

Sensory evaluation of fenugreek gum incorporated ice cream as stabilizer

The fenugreek gum incorporated ice cream was evaluated for acceptability on a 9- Point Hedonic scale by semi-trained panelists on scale representing score 9 for samples “like extremely” to 1 “dislike extremely”.

Statistical analysis

The data reported are the average of triplicate observations and the results were represented as mean \pm SD (Standard Deviation) using one way ANNOVA.

3. RESULTS AND DISCUSSION

The various findings and observations recorded during the present study entitled “Utilization and evaluation of fenugreek gum as a stabilizer in ice cream” has been compiled and discussed under different head. Fenugreek gum yield was found to be 20% in HM-57 variety. Bahadur, et. al. (2016) reported the fenugreek gum yield

to be 24.8% using cold water extraction method.

Optimization of fenugreek gum in ice cream

The standard recipe for the preparation of ice cream included milk (500ml), sugar (100gm) cream (40gm) and skim milk powder (37gm). The fenugreek gum was incorporated in ice cream at the concentration of 0.5%, 1.0%, 1.5% and 2.0 (Table 1 and Figure 2).

Fenugreek gum incorporated ice cream formulations were represented as C (Control Sample ; 0% fenugreek gum), T1 (0.5 % fenugreek gum), T2 (1.0 % fenugreek gum) and T3 (1.5 % fenugreek gum) and T4 (2.0 % fenugreek gum).

Jain (1962) suggested mixing of 38 percent complete solids, 14.5 percent sugar, 12 percent fat, 11 percent serum solids and 0.4-0.5 percent stabilizer for the production of ice cream. Either 10% of mango pulp and banana pulp was proposed.

Table 1. Recipe for preparation of ice cream incorporated with fenugreek gum

S.No.	Ingredients	Quantity
1.	Milk	500ml
2.	Sugar	100gm
3.	Cream	40gm
4.	Skim milk powder	37gm
5.	Fenugreek gum	0.5, 1.0, 1.5, 2.0%

Table 2. Overrun and melting behaviour of fenugreek gum incorporated ice cream

S.No.	Sample	Over-run%	Meltdown (ml/minutes)
1	C	26.95	1.37
2	T1	27.60	1.45
3	T2	28.20	1.42
4	T3	29.23	2.07
5	T4	32.66	2.13

Sangle et. al (2015) studied guar gum as a cold cream stabilizer with at levels of 0.2, 0.4 and 0.6%. The guar gum added in comparison to control samples at a rate of 0.4% was discovered with outstanding sensory characteristics. The influence of concentration (0-0.5% w/w) of gum tragacanth (GT) on rheological properties of ice cream mixes prepared with milk or water based were investigated and results highlighted the possible application of GT as a valuable member to promote structural properties of ice cream (Kurt, A., et al, 2016).

Over run and melting of fenugreek gum incorporated ice cream

The overrun of ice cream relies on how much air is whipped during the freezing phase in the blend. It is described as the quantity of ice cream that exceeds the mixing quantity. The results (Table 2) revealed that the control (C) sample showed over run 26.95% and that for T1, T2, T3, T4 overrun was found to be 27.60%, 28.20%, 29.23% and 32.66%, respectively. The highest over run was obtained for sample T4 (38.66%) as compare to control sample (26.95%). The T4 sample 2.0% has highest overrun because concentration of fenugreek gum was more as a stabilizer. The fenugreek gum worked as a good stabilizer in

the ice cream and higher concentration, higher over run% was recorded.

The ice creams containing fenugreek gum melted slowly than the control ice creams because the fenugreek gum slowed the rate of heat transfer. However, the melting properties of the ice cream samples indicated that the ice creams supplemented with low concentrations of fenugreek gum had lower resistance values than more concentrations of fenugreek gum. The melting properties of control sample (C) were found to be 1.37 ml/min, however, the meltdown behaviour of T1, T2, T3 and T4 samples were found to be 1.45ml/min, 1.42ml/min, 2.07ml/min, and 2.13ml/min, respectively. The melting behaviour of fenugreek gum incorporated ice cream was found to be high as compared to control sample. Higher the level of incorporation, higher the melting time was recorded for ice cream.

Sensory evaluation of fenugreek gum incorporated ice cream

The fenugreek gum incorporated ice cream samples were evaluated for sensory parameters like colour, taste, mouthfeel, aroma and overall acceptability.

Table 3: Sensory evaluation of fenugreek gum incorporated ice cream

Sensory attributes	Sample codes				
	C (control)	T1 (0.5%)	T2 (1.0%)	T3 (1.5%)	T4 (2%)
Colour & Appearance	7.90±0.94	7.90±0.94	7.63±0.50	7.72±0.78	7.36±0.67
Taste	7.54±1.21	7.81±0.60	7.63±0.50	7.0±0.44	6.36±0.92
Mouth feel and texture	7.18±0.16	7.72±0.90	7.36±0.92	7.27±1.00	6.45±0.93
Flavour	7.72±1.34	7.63±0.67	7.27±0.64	7.0±0.63	6.72±0.90
Overall acceptability	7.59±1.06	7.77±0.59	7.47±0.50	7.25±0.51	6.72±0.69

The values are triplicate means ± SD.

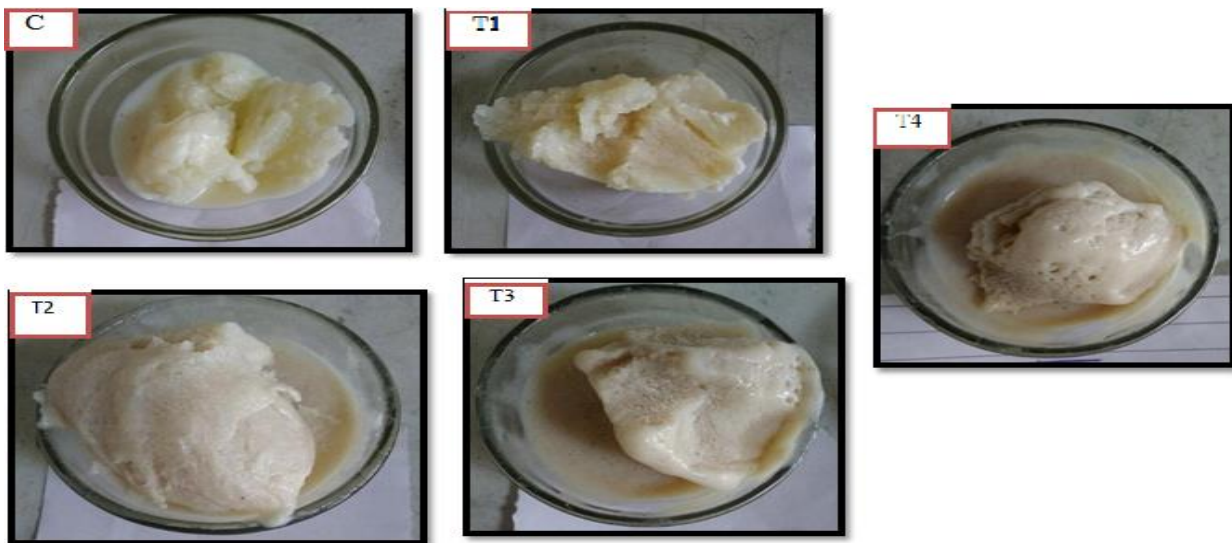


Figure 3. Fenugreek gum incorporated ice cream

C = Control sample (0% fenugreek gum)
 T1 = 0.5 % fenugreek gum
 T2 = 1.0 % fenugreek gum
 T3 = 1.5 % fenugreek gum
 T4 = 2.0 % fenugreek gum

The result of sensory evaluation in Table 3 revealed that the concentration of fenugreek gum at (T1) 0.5% scored highest among all treatments for all the organoleptic parameters. The fenugreek gum at (T2) 2% scored least of all treatments for the organoleptic parameters. This can be inferred due to the gummy taste of the fenugreek gum imparting after effect to the product. Control (C) and T1 treatment received top score of 7.90 for colour followed by treatment T3, T2, T4 with the scores 7.72, 7.63 and 7.36, respectively. The fenugreek gum concentration affected the colour of ice cream. The result of taste score represented variation in the scores given by the judges for taste. The ice cream incorporated at 05% level (T1) was

found to be highly acceptable with the highest score of 7.81 followed by treatment C, T2, T3, T4 with the score values of 7.54, 7.63, 7 and 6.36, respectively. Ice cream with highest level of fenugreek gum (T4) scored lowest (6.36). High levels of fenugreek gum (2.0%) imparted gummy taste and reduced acceptability in terms of taste. However, taste of fortified ice cream (T1) was even more acceptable than control (C) ice cream.

It may be visualized from Table 3 that the ice cream in term of texture scores of final product ranging from 6.45 to 7.72. Texture of treatment T1 scored highest (7.72) followed by T2, T3, T4 and (C) with the score value of 7.36, 7.27, 6.45 and 7.18, respectively. Texture of

fenugreek gum incorporated ice cream at 2.0% levels T4 was found to be less acceptable however T1 was found to be more acceptable than control sample. Control treatment (C) received high score of 7.72 for flavor. It was followed by treatments T1, T2, T3 and T4 at 7.63, 7.27, 7 and 6.72 score, respectively. variation were observed for overall acceptability score of the final products. The treatment C, and T1 valued in between like moderately to like very much. Lowest score were observed in treatment (2.0%) due to gummy taste. The results of overall acceptability scores (Table 3) revealed that fenugreek gum incorporated ice cream at level of 0.5% (T1) was more acceptable when compared with other levels (T2, T3,T4) and even to control ice cream. It is revealed from the scores of the overall acceptability that the fenugreek gum may be successfully incorporated up to 0.5% level.

4. CONCLUSIONS

It is concluded from the study that all the levels of incorporation of fenugreek gum to ice cream were moderately acceptable, however lowest levels (T1) of incorporation at 0.5% was most acceptable in terms of all sensory characteristics. Moreover, the fenugreek gum as a as a stabilizer improved the ice cream quality. Hence fenugreek gum has a great potential for use in diabetic products as a natural stabilizer.

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