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Technology development for preparation of frozen dessert (Kulfi) with incorporation of partially hydrolyzed guar gum (PHGG)

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Abstract
In the present investigation, the technology was developed to standardize the process for preparation of frozen dessert (kulfi) incorporated with partially hydrolyzed guar gum (PHGG). Frozen dessert (kulfi) was prepared from milk, sugar, cream and partially hydrolyzed guar gum at the levels of (3 per cent, 5 per cent and 7 per cent). Prepared frozen dessert product was analyzed for chemical and sensory properties. The prepared kulfi was analyzed for chemical composition like moisture, fat, carbohydrates, protein, fiber and ash. Sensory evaluation revealed that sample S_2 contain 5 per cent partially hydrolyzed guar gum sample was superior among all the samples. From the present investigation it was concluded that frozen dessert (kulfi) prepared with incorporation of partially hydrolyzed guar gum having good nutritional and sensory quality attributes.

Keywords: Partially hydrolyzed guar gum (PHGG), frozen dessert (kulfi), chemical properties, sensory properties

Introduction

Partially hydrolyzed guar gum attracted interest of many food scientists and nutritionist because of its health benefits. Moreover, it has very low viscosity, no color, no taste at physiologically beneficial concentration which makes it acceptable from consumer point of view. Partially hydrolyzed guar gum can be utilized as dietary fiber source in various food products without interfering with their textural and sensory properties (Greenberg and Sellman, 1998) [5]. Partially hydrolyzed guar gum can be produced by enzymatic hydrolysis, acid hydrolysis, irradiation, microwave and ultrasonication techniques (Tayal and Khan, 2000; Cheng *et al.*, 2002; Gupta *et al.*, 2009; Singh and Tiwari, 2009) [25, 4, 6, 23]. Enzymatic hydrolysis of guar gum is preferred for food processing applications. In enzymatic hydrolysis, enzymes such as mannanse, pectinase, cellulase etc. are used for processing (Yoon *et al*., 2008; Shobha *et al*., 2005; Mudgil *et al.*, 2014b) [28, 22, 11, 18]. These enzymes or hydrolyzing agents used in hydrolysis process, act on the linkage between the mannose backbone and breaks these linkages.

Partially hydrolyzed guar gum (PHGG) has attracted attention as a water-soluble dietary fiber as it shows physiological effects such as increasing defecating frequency and lowering the pH of feces of both healthy men and constipated women and reducing serum cholesterol, free fatty acid, and glucose concentrations in humans (Greenberg and Sellman, 1998; Heini *et al.*, 1998; Trinidad *et al.*, 2004; Minekus *et al.*, 2005; Stewart and Slavin, 2006; Yoon *et al.*, 2006) [5, 7, 26, 9, 24, 27].

When dissolved in hot or cold water, guar gum gives highly viscous solution even at low concentration. Due to this unique property, it is used as an additive in variety of processed food products such as tomato ketchup, ice cream, beverages, bakery and confectionery products (Mudgil, Barak and Khatkar, 2011, 2012a, 2014a) [13, 14, 17]. Due to its high viscosity, guar gum cannot be used as dietary fiber source, as it deteriorates the product sensory as well as processing properties when incorporated at higher concentration. Hence enzymatic hydrolysis of guar gum is carried out for the production of partially hydrolyzed guar gum (PHGG). Studies proved that PHGG show resemblance in basic molecular structure with native guar gum (Yoon, Chu and Juneja, 2008) [28]. PHGG obtained after enzymatic hydrolysis is a very low viscosity water soluble gum. During enzymatic hydrolysis of guar gum viscosity reduction is achieved via reduction in chain length and molecular weight of guar gum (Mudgil *et al*., 2012b, 2012c, 2014b) [15, 16, 11, 18]. In past few decades, there is growing interest in

fortification of food products with soluble dietary fiber to meet the daily requirements of fiber intake (Mudgil and Barak, 2013) [12]. PHGG is reported as tasteless, odorless and low viscosity water soluble dietary fiber (Yoon *et al*. 2008) [28].

Frozen desserts developed over history in much the same way as most foods: our ancestors kept trying different things until they found something that worked. Although numerous origin stories exist, the first frozen desserts likely were made by flavoring snow or ice. This may have been intentional but may also have simply occurred by chance. It is not our intention to delve into truth or myth because the history of frozen desserts has been documented in numerous publications.

The body or consistency of kulfi is related to the mechanical strength of the mix and its resistance to melting. Heat shock resistance is dependent on the nature and concentration of the stabilizer/emulsifier system used found that under different stabilizers, as the concentration of milk was increased the mean values of melt-down property was found to decrease indicating increased melting resistance. The addition of sodium alginate showed greater melt-down resistance than the addition of starch. This resistance to melting may be due to the stabilizing action of sodium alginate.

In view of the nutritional and health benefits of frozen dessert (kulfi) incorporated with partially hydrolyzed guar gum. To explore health and nutritional benefits of kulfi.

Materials and Methods

The present investigation was carried out in Department of Food engineering with collaboration of Department of Food Chemistry and Nutrition in College of Food Technology, VNMKV, Parbhani during year 2020-21.

Materials

The raw material such as milk, cream, sugar etc. were purchased from local market of Parbhani. Guar gum required for research work was available in the department of Food Engineering and the department of Food Chemistry and Nutrition.

Chemicals and glassware

The chemicals of analytical grade and glass wares required during investigation were used in the department of Food Engineering.

Methods

Proximate analysis

All samples were analyzed for moisture, crude protein, crude fat, total ash, mineral and total carbohydrate contents according to their respective standard methods as described in (A.O.A.C., 2000) [2].

Sensory evaluation of frozen dessert (Kulfi)

The sensory evaluation was carried out to assess the overall acceptability of the frozen dessert (kulfi) incorporated with partially hydrolyzed guar gum (PHGG). The quality attributes (colour, flavour, taste and texture) of prepared frozen dessert (kulfi) were evaluated against the control samples by 10 members using a Nine-point Hedonic Scale.

1. Formulation of kulfi with addition of PHGG

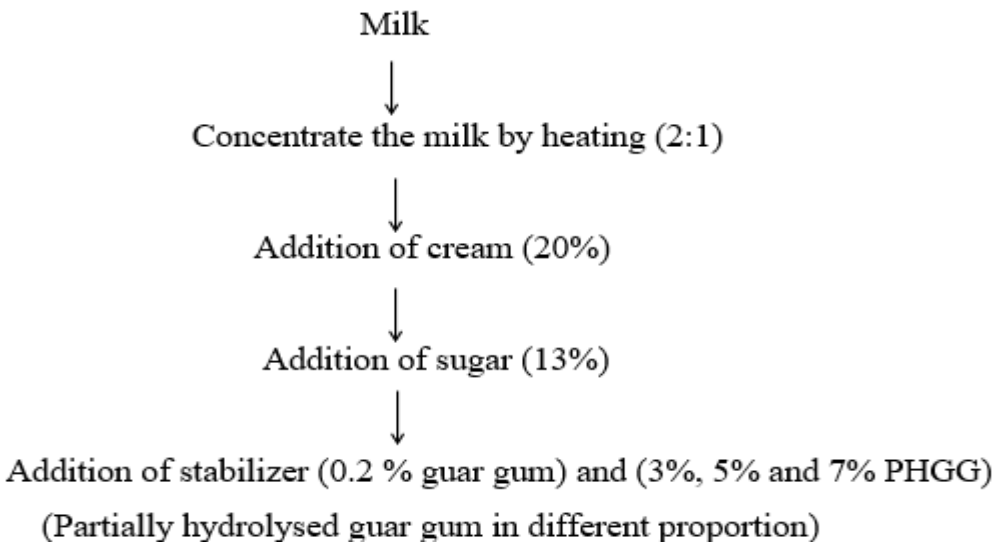
The kulfi was prepared with varying the proportion of PHGG. The formulation was presented in table 1. The proportion of milk, cream and sugar in each sample was kept constant.

Table 1: Formulation of kulfi with addition of PHGG

Sample	GG (%)	PHGG(%)	Milk (ml)	Cream (gm)	Sugar (gm)
S_0	0.2	0	670	200	130
S_1	0	3	670	200	130
S_2	0	5	670	200	130
S_3	0	7	670	200	130

S_0 = 0.2 gm guar gum added in kulfi
S_1 = 3 gm PHGG added in kulfi
S_2 = 5 gm PHGG added in kulfi
S_3 = 7 gm PHGG added in kulfi

Preparation of frozen dessert (kulfi) incorporated with partially hydrolyzed guar gum (Nalkar, 2012).



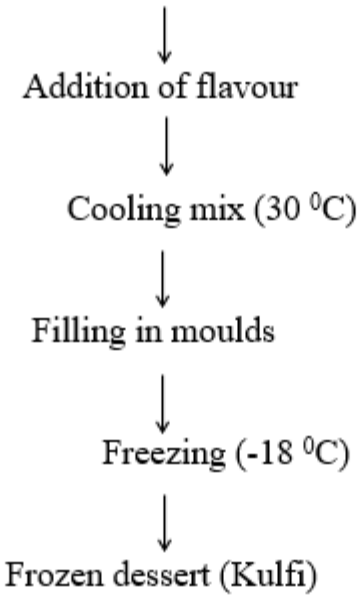


Fig 1: Preparation of frozen dessert (kulfi)

Results and Discussion

1. Chemical Properties of PHGG

The chemical properties of PHGG i.e. moisture, protein, fat, ash, total dietary fiber (TDF), insoluble dietary fiber (IDF) and soluble dietary fiber (SDF) etc. were carried out and result obtained are tabulated in table 2.

Table 2: Chemical properties of PHGG

Parameters (%)	PHGG
Moisture	7.54±0.03
Protein	2.07±0.04
Fat	1.2±0.1
Ash	2.10±0.03
TDF	81.30±1.30
IDF	2.30±0.07
SDF	79.00±1.05

*Each value is average of three determinations

The results pertaining to chemical analysis of PHGG are presented in table 2. It was revealed that, the moisture for PHGG (7.54±0.03 per cent), crude fat (1.2±0.1per cent), protein (2.07±0.04 per cent), ash (2.10±0.03 per cent), total dietary fiber i.e. TDF (81.30±1.30 per cent), insoluble dietary fiber IDF i.e. (2.30±0.07) and soluble dietary fiber i.e. SDF (79.00±1.05 per cent). These values of chemical properties recorded in the present study are similar to the values reported earlier by (Mudgil *et al.*, 2016; Seon-Joo *et al.*, 2008) [10, 21].

3. Chemical properties of milk

The chemical properties of milk was carried out and result obtained are tabulated in table 3.

Table 3: Chemical properties of milk

Parameters (%)	Content (%)
Water	82.91±0.09
Protein	3.55±0.21
Fat	7.02±0.17
Lactose	5.12±0.11
Ash	0.78±0.007
SNF	9.88±0.09
Total solid	16.975±1.30

*Each value is average of three determinations

The chemical composition of milk is summarized in above table 3, as milk contains water (82.91±0.09 per cent), protein (3.55±0.21 per cent), fat (7.02±0.17 per cent), lactose (5.12±0.11 per cent), ash (0.78±0.007 per cent), SNF (9.88±0.09 per cent) and total solids (16.975±1.30 per cent) respectively. All these values of chemical composition of buffalo milk were found to be in good agreement with those reported by Salman *et al.*, (2014) [20].

4. Sensory evaluation of frozen dessert kulfi incorporated with partially hydrolyzed guar gum

The sensory evaluation of kulfi with the addition of PHGG was carried out by trained and semi trained panel members using 9 point hedonic scale. The scores were given by evaluating color and appearance, flavour, taste and overall acceptability which was compared with control sample and presented in table 4.

Table 4: Sensory evaluation of frozen dessert kulfi incorporated with partially hydrolyzed guar gum

Sample	Color	Flavour	Taste	Texture	Overall acceptability
S_0	7.7	7.5	7.5	7.1	7.5
S_1	7.8	7.5	7.4	7.5	7.5
S_2	7.9	7.6	8.4	8.0	8.6
S_3	7.8	7.5	8.2	8.0	8.2
SE±	0.05004	0.0259	0.07229	0.05073	0.05004
CD@5%	0.14678	0.07597	0.21204	0.1488	0.14678

*Each value is average of three determinations

The maximum score for color attribute was received by sample S_2 (7.9). While the lowest score was noted in case of S_0 (7.7). All Samples S_0, S_1, S_2 and S_3, sample found good score for flavour and taste. An appraisal of table 4. Showed that, the sample S_2 got good score for Taste (8.4). The mean score for flavour was ranged from 7.5 to 7.6 It was found that sample S_2 had the highest score for texture (8.0) followed by S_3 (7.9) and S_1 (7.5).

There was notable difference among the samples in context to all the sensory parameters. Overall, by considering the different sensory attributes, the kulfi formulation S_2 containing 5% PHGG was found to be superior than the other samples.

5. Chemical composition of Sensory selected frozen dessert (kulfi) sample incorporated with partially hydrolyzed guar gum.

Proximate composition like moisture, protein, fat, ash, carbohydrate etc. described in following table 5

Table 5: Chemical composition of sensory selected frozen dessert (kulfi) sample incorporated with partially hydrolyzed guar gum

Parameters (%)	S_0	S_2
Moisture	61.91±0.95	60.34±0.27
Protein	8.19±0.02	7.55±0.28
Fat	12.7±0.14	10.91±0.57
Ash	2.8±0.14	3.13±0.33
Carbohydrate	16.05±1.2	14.44±1.5
SDF	-	3.95

*Each value is average of three determinations

S_0 = 0.2 gm guar gum added in kulfi

S_2 = 5 gm PHGG added in kulfi

Proximate composition of kulfi summarized in table 5, the control sample (S_0) was higher fat content (12.7±0.14 per cent) than selected sample. The moisture (61.91±0.95 per cent), protein (8.19 ± 0.02 per cent), ash (2.8±0.14 per cent), carbohydrate (16.05±1.2 per cent).While selected sample (S_2) contained fat (10.91±0.57 per cent), moisture (60.34±0.27 per cent), protein (7.55±0.28 per cent), ash (3.13±0.33 per cent), carbohydrate (14.44±1.5 per cent) and soluble dietary fiber SDF (3.95 per cent). These findings were supported by Bhadakwad *et al.*, (2009) [3]; Kumar *et al.*, (2012) [8] and Ahsan *et al.*, (2015) [1].

Conclusion

Hence it can be finally concluded that frozen dessert (kulfi) incorporated with partially hydrolyzed guar gum not only increase soluble dietary fiber but also retained its nutritional and sensory quality attributes. Frozen dessert (kulfi) with 5% partially hydrolyzed guar gum achieved highest score for overall acceptability and good textural property with compare to control sample. Finally It was concluded that utilization of partially hydrolyzed guar gum will helps to achieve desire consistency, texture with soluble dietary fiber with respect to quality of food products along with health benefits in dairy desserts.

References

1. Ahsan S, Zahoor T, Hussain M, Khalid N, Khaliq A, Umar M. Preparation and quality characterization of soy milk based non-dairy ice cream. International Journal of Food and Allied Sciences 2015;1(1):25-31.
2. AOAC. Methods of analysis, 17th Association of official Analytical Chemists, Washington, DC 2000.
3. Bhadakawad AD, Adangale SB, Shinde DB, Mitkari KR, Khating LE. Preparation of golden kulfi from buffalo milk blended with safflower milk. Journals of Dairying, Foods and Home Science 2009;28(1):35-38.
4. Cheng Y, Brown KM, Prudhomme RK. Preparation and characterization of molecular weight fractions of guar galactomannans using acid and enzymatic hydrolysis. International Journal of Biological Macromolecules 2002;31(3):29-35.
5. Greenberg NA, Sellman D. Partially hydrolyzed guar gum as a source of fiber. Cereal Food World. American Association of Cereal Chemists 1998;43(9):703-707.
6. Gupta S, Shah B, Sanyal B, Variyar PS, Sharma A. Role of initial apparent viscosity and moisture content on post irradiation rheological properties of guar gum. Food Hydrocolloids 2009;23(7):1785-1791.
7. Heini AF, Castro CL, Schneider H, Kirk KA, Considine RV, Weinsier RL. Effect of hydrolyzed guar fiber on fasting and postprandial satiety and satiety hormones: A double-blind, placebocontrolled trial during controlled weight loss. International Journal of Obesity. 1998;22(1):906-909.
8. Kumar A, Singh KP, Gupta MP, Singh B. Physico-chemical quality of Kulfi. Indian Research Journal of Extension Education 2012;2:242-243.
9. Minekus M, Jelier M, Xiao JZ, Kondo S, Iwatsuki K, Kokubo S *et al*. Effect of partially hydrolyzed guar gum (PHGG) on the bioaccessibility of fat and cholesterol. Bioscience, Biotechnology and Biochemistry. 2005;69(5):932-938.
10. Mudgil D, Barak S, Khatkar BS. Optimization of textural properties of noodles with soluble fiber, dough mixing time and different water levels. Journal of Cereal Science 2016;69(1):104-110.
11. Mudgil D, Barak S, Khatkar BS. Optimization of enzymatic hydrolysis of guar gum using response surface methodology. Journal of Food Science Technology. 2014b;51(8):1600-1606.
12. Mudgil D, Barak S. Composition, properties and health benefits of indigestible carbohydrate polymers as dietary fiber: a review. International Journal of Biological Macromolecules 2013;61:1-6.
13. Mudgil D, Barak S, Khatkar BS. Effect of hydrocolloids on the quality characteristics of tomato ketchup. Carpathian Journal of Food Science and Technology 2011;3(1):39-43.
14. Mudgil D, Barak S, Khatkar BS. Soluble fibre and cookie quality. Agro Food Industry Hi Tech 2012a;23(3):15-17.
15. Mudgil D, Barak S, Khatkar BS. Process optimization of partially hydrolyzed guar gum using response surface methodology. Agro Food Industry Hi Tech, 2012b;23(1):13-15.
16. Mudgil D, Barak S, Khatkar BS. X-ray diffraction, IR spectroscopy and thermal characterization of partially hydrolyzed guar gum. International Journal of Biological Macromolecules 2012c;50(4):1035-1039.
17. Mudgil D, Barak S, Khatkar BS. Guar gum: processing, properties and food applications- a review. Journal of Food Science and Technology 2014a;51(3):409-418.
18. Mudgil D, Barak S, Khatkar BS. Optimization of enzymatic Hydrolysis of guar gum using response surface methodology. Journal of Food Science and Technology, 2014b;51(8):1600-1605.
19. Nalkar SD. Preparation of probiotic kulfi with incorporation of mango (mangifera indica) pulp. ph.d thesis, Department of Animal Husbandry and Dairy Science, Dapoli 2012, 75-76.
20. Salman M, Khaskheli M, Israr-ul-haq, Rahman A, Khuhro A, Rauf M, Hamid H *et al*. Comparative studies on nutritive quality of buffalo and cow milk. International Journal of Research in Applied, Natural and Social Sciences 2014;2(12):69-78.
21. Seon-Joo Yoon, Djong-Chi Chu, Lekh Raj Juneja. Chemical and Physical Properties, Safety and Application of Partially Hydrollzed Guar Gum as Dietary Fiber. Clinical Biochemestry Nutrition 2008;42(1):1-7.
22. Shobha MS, Kumar AV, Tharanathan RN, Koka R,

Gaonkar AK. Modification of guar galactomannan with the aid of Aspergillus niger pectinase. Carbohydrate Polymer. 2005;62(3):267-273.
23. Singh V, Tiwari A. Hydrolytic fragmentation of seed gums under microwave irradiation. International Journal Biological Macromolecules 2009;44(2):186-189.
24. Stewart ML, Slavin JL. Molecular weight of guar gum affects short-chain fatty acid profile in model intestinal fermentation. Molecular Nutrition Food Research 2006;50(10):971-976.
25. Tayal A, Khan SA. Degradation of a water-soluble polymer: molecular weight changes and chain scission characteristics. Macromolecules 2000;33(26):9488-9493.
26. Trinidad T, Perez E, Loyola A, Mallillin A, Encabo R, Yokawan T *et al*. Glycemic index of sunfibre (*Cyamopsis tetragonolobus*) products in normal and diabetic subjects. International Journal of Food Science and Technology. 2004;39(1):1093-1098.
27. Yoon SJ, Chu DC, Juneja LR. Physiological functions of partially hydrolyzed guar gum. Journal of Clinical Biochemistry Nutrition 2006;39(1):134-144.
28. Yoon SJ, Chu DC, Juneja LR. Chemical and physical properties, safety and application of partially hydrolyzed guar gum as dietary fiber. Journal of Clinical Biochemistry and Nutrition 2008;42(1):1-7.