RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume 43 Issue 2: 204-209 (June 2024)

Development of *Gulabjamun* with Incorporation of Foxtail Millet

H.S. Sahana[1], K.G. Vijayalaxmi[1]

10.18805/ajdfr.DR-1882

ABSTRACT

Background: *Gulabjamun* is a sweet indigenous commodity, commonly prepared from *khoa* in the country's northern, western, and central regions. The present study was undertaken to develop value added *gulabjamun* with *khoa* and foxtail millet for better nutritional profile.

Methods: Value added *gulabjamun* was prepared by incorporating foxtail millet flour at 20% (GJF1), 30% (GJF2) and 40% (GJF3) based on the weight of *khoa*.

Result: Sensory evaluation study revealed that GJF1 was best accepted among the variations and obtained an overall acceptability score of 8.55. The value added *gulabjamun* GJF1 had a moisture content of 33.51%, 12.28 g fat, 8.93 g protein, 1.28 g ash, 1.12 g crude fibre, 30.3 µg vitamin A, 144.25 mg calcium and 0.702 mg iron per 100 g. Though the rheological attributes showed a decreasing trend with incorporation of foxtail millet, the native texture of *gulabjamun* was retained. Millet incorporated gulabjamun (GJF1) had a shelf life of 5 days at room temperature and 15 days at refrigeration temperature. Therefore, foxtail millet could be successfully incorporated to *gulabjamun* with highly acceptable sensory attributes.

Key words: Foxtail millet, *Gulabjamun*, Nutritional analysis, Shelf life study, Texture analysis.

INTRODUCTION

In the current millennium, the dairy market is experiencing a transition from bulk commodities to delightfully tasty and novel value-added goods, with a distinctive niche segment in taste, colour and appearance. Value added food items have taken on significant importance nowadays.

Gulabjamun is a sweet indigenous commodity, commonly prepared from *khoa* in the country's northern, western, and central regions. It is usually prepared by kneading wheat flour (*maida*) and baking powder with cow or buffalo milk *khoa* to form smooth dough, portioning the dough, rolling it into balls of spherical shape, deep frying the balls in oil until they turn golden brown in color and soaking them in the sugar syrup overnight (Nalavade *et al*., 2015). The texture of *gulabjamun* is largely assessed by its textural attributes such as sponginess and juiciness, with crumbliness and gumminess being the main undesirable attributes (Ghosh *et al.,* 1986 and Patel *et al*., 1992).

Millets are known as food security crops owing to their sustainability under adverse agro-climatic conditions (Ushakumari *et al*., 2004). The richness in calcium, dietary fiber, polyphenol and protein contents in millets make them unique among the cereals (Bhat *et al.,* 2018). Smaller millets like finger millet have been used in value-addition of products like cookies (Sinha and Sharma, 2017).

Foxtail millet (*Setaria italica* L.) is a significant minor millet that is also known as Italian millet, German millet, Siberian millet and Bristle grass foxtail. The seeds are convex in shape, oval or elliptical, light yellow to brown, rusty or black. It continues to occupy a significant role in world agriculture, providing around six million tons of food to millions of people, primarily on poor or marginal soils in Southern Europe and in temperate, subtropical and tropical Asia (FAOSTAT, 2005). It is nutritionally superior to rice and wheat, and thus provides the population dependent on these grains with proteins, minerals and vitamins (Tylor and Emmanbux, 2008).

A combination of milk product (*gulabjamun*) and millet (foxtail) in the present scenario has synergistic effect, where, deficiency of lysine in foxtail millet and deficiency of dietary fibre and iron in milk product are being complemented by each other. Thus, the present study was undertaken to develop value added *gulabjamun* with foxtail millet for better nutritional profile.

MATERIALS AND METHODS

The study was carried out in the Department of Food Science and Nutrition, University of Agricultural Sciences, Bangalore, during the year 2019-2020.

Procurement of raw ingredients

Ingredients like full cream milk, millets, sugar, oil, *maida*, baking powder and ghee were procured from local markets of Bengaluru.

[1]Department of Food Science and Nutrition, Gandhi Krishi Vigyan Kendra, University of Agricultural Sciences, Bangalore-560 065, Karnataka, India.

Corresponding Author: H.S. Sahana, Department of Food Science and Nutrition, Gandhi Krishi Vigyan Kendra, University of Agricultural Sciences, Bangalore-560 065, Karnataka, India.
Email: sahanahs27@gmail.com

How to cite this article: Sahana, H.S. and Vijayalaxmi, K.G. (2024). Development of *Gulabjamun* with Incorporation of Foxtail Millet. Asian Journal of Dairy and Food Research. 43(2): 204-209. doi: 10.18805/ajdfr.DR-1882.

Submitted: 31-01-2022 **Accepted:** 25-04-2022 **Online:** 23-06-2022

Development of product

Fresh *khoa* was broken into bits and was kneaded well to a homogenous mass free of lumps. *Maida*, used as a binding agent was added at 14% and baking powder, used as a leavening agent was added at 1% rate. Foxtail millet flour was added at 20%, 30% and 40% rate based on the weight of *khoa*. Dry ingredients were first mixed thoroughly prior addition to *khoa*. Sufficient kneading was done till the dough could easily be rolled into smooth balls. Milk was used to soften the dough to desired consistency. The dough was uniformly rolled into 10 g balls each and were deep fried to golden brown colour and subsequently transferred to 60° Brix sugar syrup maintained at about 60°C. The fried balls were left undisturbed for about 2 hours to completely absorb the sugar syrup. Formulation of *gulabjamun* is given in Table 1.

Sensory evaluation

Sensory evaluation was carried out using nine-point hedonic scale. The score card was based mainly on appearance, colour, texture/consistency, taste and overall acceptability. Twenty-two semi trained judges having good health status and interested in sensory evaluation were selected from Department of Food Science and Nutrition, UAS, Bangalore.

Nutritional analysis

Moisture, protein, fat, ash and crude fibre content of sensorial best accepted *gulabjamun* along with control *gulabjamun* (GJN1) were analyzed using standard methods specified by AOAC. Carbohydrate content of the same was calculated using difference method. Titrimetric method for calcium (Heau *et al.,* 1965), atomic absorption spectrophotometry for iron and liquid chromatography for vitamin A (AOAC, 2001) estimation was employed.

Texture analysis

Texture profile analysis (TPA) was done using Stable Micro System TAXDi Texture Analyzer fitted with 100 kg load cell. A P36R cylindrical probe was used with 5 mm/s of pre-test, 0.5mm of test and post-test speeds. Representative graphs for the texture of products displayed in the computer attached to the instrument was studied to compute parameters such as hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness.

Shelf life study

The product best accepted by the sensory panel along with control *gulabjamun* was considered for shelf life studies and the changes in sensory characteristics, moisture and microbial load were studied for a period of 15 days. The products were stored in air tight polypropylene containers and studied at room and refrigerated temperature (7°C). The containers were dipped in 0.5 per cent H_2O_2 solution and dried in an oven maintained at 60-65°C for 30 min prior to the study.

Data analysis

The data was analyzed using one-way analysis of variance (ANOVA) (F-test) and in randomized complete block design to determine the level of significance. Two-way analysis of the variance was applied for microbial population.

RESULTS AND DISCUSSION

Sensory evaluation

Mean scores for sensory attributes of foxtail millet incorporated *gulabjamun* are presented in Table 2. The scores of *gulabjamun* incorporated with foxtail millet ranged from 8.59 to 8.81 for appearance, 8.58 to 8.59 for colour, 7.82 to 8.68 for texture/consistency, 7.79 to 8.86 for taste and 7.97 to 8.77 for overall acceptability. Control had highest score for all of the sensory characteristics. Sensory scores were observed to decrease with increasing incorporation levels. Among the variations, GJF1 with 20% incorporation levels was found to be best accepted and GJF3 with 40% incorporation levels had the least score. Statistical significance was observed in sensory characteristics like texture, taste and overall acceptability at 5% level. Whereas, appearance and colour showed non-significant difference owing to the reason that each of them were formed into uniform balls and were fried till golden brown colour. A decreasing score was observed in case of texture with increasing levels of millet incorporation. Replacing *khoa* with millet flour hardened the texture and reduced the sugar syrup absorption.

In line with the study, *Gulabjamun* developed by incorporating *Amaranthus hypochondriacus* L. (*Rajgara*) showed the overall acceptability scores ranging from 6.67 to 7.88 on a scale of 10 (Shendurse and Chaudhary, 2020).

Table 1: Formulation of *gulabjamun*.

Particulars	GJN1	GJF1	GJF2	GJF3
Khoa (g)	100	80	70	60
Foxtail millet (g)	0	20	30	40
Maida (g)	14	14	14	14
Baking powder (g)	1	1	1	1
Sugar syrup	60°Brix	60°Brix	60°Brix	60°Brix

Table 2: Mean scores for sensory attributes of foxtail millet incorporated *gulabjamun*.

Sample	Appearance	Colour	Texture Consistency	Taste	Overall acceptability
GJN1	8.82	8.59	8.68	8.68	8.77
GJF1	8.75	8.58	8.55	8.59	8.55
GJF2	8.68	8.58	8.05	8.19	8.11
GJF3	8.59	8.58	7.82	7.86	7.97
CD at 5%	-	-	0.268	0.267	0.224
SE.m ±	0.079	0.05	0.094	0.094	0.079
F value	NS	NS	*	*	*

*- Significant at 5% level, NS- Non significant.

Nutritional analysis

Table 3 presents the nutritional composition of best accepted *gulabjamun*. Owing to the addition of foxtail millet to *gulabjamun*, crude fibre and iron content significantly increased (at 5% level) from 0 to 1.12 and 0.58 to 0.702 respectively. Whereas, a significant decrease in fat, protein, calcium and vitamin A content was observed as, per gram availability of these nutrients are higher in *khoa* than in the millets.

The results obtained in the present study are in accordance with those reported by Prajapati *et al.* (1992), Adhikari *et al.* (1994), Nalawade *et al.* (2015) and Chaudhari (2016).

Texture analysis

Textural profile of best accepted *gulabjamun* variations is tabulated as in Table 4. It was observed from the results that hardness, cohesiveness and gumminess of *gulabjamun* increased with addition of foxtail millet; whereas, springiness, adhesiveness and chewiness showed a decreasing trend. However, significant difference among the variations in all of the rheological parameters was observed at 5% levels. It was evident that with addition of millets to *gulabjamun*, the hardness increased. This increase might be due to the decrease in fat content and reduction in moisture content (Gulhati *et al.*, 1992).

Table 3: Nutritional composition of best accepted *gulabjamun*.

Nutrients per 100 g	Control	KBF1	F value	SE m ±	CD at 5%
Moisture (%)	35.9	33.51	*	0.031	0.125
Fat (g)	14.08	12.28	*	0.021	0.084
Protein (g)	9.37	8.93	*	0.027	0.111
Total ash (g)	1.19	1.28	*	0.017	0.067
Crude fibre (g)	0	1.12	*	0.009	0.036
Carbohydrate (g)	39.46	42.88	*	0.040	0.162
Energy (Kcal)	322.04	317.76	*	0.266	1.072
Calcium (mg)	237.6	144.25	*	0.060	0.242
Iron (mg)	0.58	0.702	*	0.009	0.036
Vitamin A as Retinol acetate (µg)	41.2	30.3	*	0.035	0.143

*- Significant at 5% level.

Table 4: Textural profile of best accepted *gulabjamun* variations.

Sample	Hardness	Cohesiveness	Springiness	Adhesiveness	Gumminess	Chewiness
GJN1	9.3310	0.2871	5.5619	0.0886	2.6788	14.8961
GJK1	11.6158	0.3793	2.7694	0.0272	4.4062	12.2102
GJF1	11.5471	0.3552	3.4374	0.0366	4.1017	14.1009
F value	*	*	*	*	*	*
SE m ±	0.044	0.007	0.015	0.001	0.084	0.280
CD at 5%	0.145	0.025	0.050	0.005	0.278	0.927

*- Significant at 5% level, GJN1- Control *gulabjamun*, GJF1- Foxtail millet incorporated *gulabjamun* (20%).

Table 5: Effect of storage on sensory scores of *gulabjamun* at room temperature.

Sample	Duration	Appearance	Texture/Consistency	Colour	Taste	Overall acceptability
Control	0th day	8.81	8.68	8.59	8.68	8.77
	3rd day	8.68	8.45	8.36	8.32	8.63
	5th day	8.59	8.36	8.05	8.50	8.54
	F value	*	*	*	*	*
	SE.m ±	0.072	0.072	0.337	0.065	0.055
	CD at 5%	0.101	0.207	0.118	0.186	0.156
GJF1	0th day	8.75	8.54	8.58	8.59	8.54
	3rd day	8.61	8.31	8.49	8.45	8.36
	5th day	8.43	8.09	8.35	8.36	8.10
	F value	*	*	*	*	*
	SE.m ±	0.062	0.069	0.055	0.055	0.081
	CD at 5%	0.177	0.198	0.156	0.156	0.231

*- Significant at 5% level, GJN1- Control *gulabjamun*, GJF1- Foxtail millet incorporated *gulabjamun* (20%).

Table 6: Effect of storage on sensory scores of *gulabjamun* at refrigeration temperature.

Sample	Duration	Appearance	Texture/Consistency	Colour	Taste	Overall acceptability
Control	0th day	8.81	8.68	8.59	8.68	8.77
	5th day	8.59	8.31	8.40	8.50	8.54
	10th day	8.45	8.29	8.27	8.47	8.31
	15th day	8.35	8.22	8.13	8.40	8.11
	F value	*	*	*	*	
	SE.m ±	0.084	0.079	0.067	0.067	0.066
	CD at 5%	0.240	0.224	0.190	0.191	0.188
GJF1	0th day	8.75	8.54	8.58	8.59	8.54
	5th day	8.25	8.14	8.31	8.27	8.14
	10th day	8.16	8.09	8.28	8.23	7.98
	15th day	7.95	7.98	8.18	8.14	7.86
	F value	*	*	*	*	*
	SE.m ±	0.090	0.084	0.082	0.091	0.096
	CD at 5%	0.254	0.239	0.232	0.257	0.272

*- Significant at 5% level, GJN1- Control *gulabjamun*, (20%), GJF1- Foxtail millet incorporated *gulabjamun* (20%).

Table 7: Effect of storage on moisture content of *gulabjamun* at room temperature.

Duration	Moisture content (%)	
	GJN1 (Control)	GJF1
0th day	35.90	33.51
3rd day	35.73	33.39
5th day	35.60	33.31
F value	*	*
SE ±	0.012	0.019
CD Value	0.05	0.077

*- Significant at 5% level, GJN1- Control *gulabjamun*, GJF1- Foxtail millet incorporated *gulabjamun* (20%).

Table 8: Effect of storage on moisture content of *gulabjamun* at refrigeration temperature.

Duration	Moisture content (%)	
	GJN1 (Control)	GJF1
0th day	35.90	33.51
5th day	35.55	33.24
10th day	35.42	33.19
15th day	35.32	33.03
F value	*	*
SE ±	0.016	0.015
CD Value	0.056	0.053

*- Significant at 5% level, GJN1- Control *gulabjamun*, GJF1- Foxtail millet incorporated *gulabjamun* (20%).

Studies conducted by Singh *et al*. (2009), Ghube *et al*. (2015) and Yawale and Rao (2012) were in line with the above results.

Shelf life study

Shelf life study by sensory evaluation

Table 5 and 6 represent the effect of storage on sensory scores of *gulabjamun* at room and refrigeration temperature respectively. The sensory scores of *gulabjamun* during storage, regardless of storage at room temperature or refrigeration temperature, tend to decrease with the increase in storage period. Samples had acceptable sensory scores between 'like very much' to 'like extremely' till 5th day when stored at room temperature and till 15th day at refrigeration temperature.

During storage, experimental sample of *gulabjamun* may have undergone various physicochemical and microbial changes, which tends to affect the sensory attributes of the product. The observed decline in overall acceptability of *gulabjamun* could partly be attributed to development of change in flavour owing to development of flat, insipid taste with slight souring tinge.

A similar finding from a study conducted by Chaudhary (2016) showed that at the room temperature (30±2°C) flavour, body and texture, colour and appearance and overall acceptability score of gulabjamun decreased significantly (P<0.05) from 8.83 to 6.4, 8.5 to 6.30, 8.67 to 7.85 and 8.67 to 6.3 respectively while at refrigeration temperature (7±2°C) from 8.83 to 6.43, 8.5 to 6.1, 8.67 to 7.27 and 8.67 to 6.13 respectively.

Shelf life study by moisture content

Effect of storage on moisture content of *gulabjamun* at room and refrigeration temperature given in the Table 7 and 8 respectively. Moisture content of *gulabjamun* samples decreased with increasing storage period. Control *gulabjamun* had a decrease in moisture from 35.90 to 35.60 by 5th day when stored at room temperature and to 35.32 by 15th day when stored at refrigeration temperature. Foxtail millet incorporated *gulabjamun* (20%) showed a decrease in moisture content from 33.51 to 33.31 by 5th day at room temperature and to 33.03 by 15th day at refrigeration temperature. All of the samples at both room and refrigeration temperature showed a significant difference at 5% levels.

Table 9: Microbial population of *gulabjamun* in room temperature at different intervals of storage.

Organisms		Duration			
		0th day	3rd day	5th day	Mean
TBC (CFU/g)	GJN1	53.3 (2.415)	273.3 (2.273)	716.7 (2.198)	2.296
	GJF1	43.3 (8.495)	393.3 (8.935)	836.7 (9.174)	8.868
	Mean	5.455	5.604	5.686	
		F-value	**SEm ±**	**CD at 5%**	
	Treatment	*	0.127	0.270	
	Duration	*	0.127	0.270	
	T × D	*	0.221	0.467	
Fungi (CFU/g)	GJN1	0 (0.707)	3.3 (1.949)	6.6 (2.665)	1.774
	GJF1	0 (0.707)	6.6 (2.665)	13.3 (3.715)	2.362
	Mean	0.707	2.307	3.19	
		F-value	**SEm ±**	**CD at 5%**	
	Treatment	NS	0.074	-	
	Duration	*	0.074	0.221	
	T × D	NS	0.128	-	
Coliforms (CFU/g)	GJN1	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	GJF1	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	Mean	0.707	0.707	0.707	
		F-value	**SEm ±**	**CD at 5%**	
	Treatment	NS	0.00	-	
	Duration	NS	0.00	-	
	T × D	NS	0.00	-	

NS- Non significant, *- Significant at 5% level, GJN1- Control *gulabjamun*, GJF1- Foxtail millet incorporated *gulabjamun* (20%). Values in parenthesis indicate $\sqrt{(x + 0.5)}$.

Table 10: Microbial population of *gulabjamun* in refrigeration temperature at different intervals of storage.

Organisms		Duration				
		0th day	5th day	10th day	15th day	Mean
TBC (CFU/g)	GJN1	53.3 (2.415)	323.3 (5.730)	393.3 (6.311)	796.7 (8.954)	5.853
	GJF1	43.3 (2.198)	296.7 (5.492)	473.3 (6.916)	906.7 (9.548)	6.039
	Mean	2.296	5.391	6.649	9.255	
		F-value		**SEm ±**	**CD at 5%**	
	Treatment	NS		0.083	-	
	Duration	*		0.096	0.283	
	T × D	*		0.167	0.490	
Fungi (CFU/g)	GJN1	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	3.3 (1.949)	1.018
	GJF1	0.00 (0.707)	0.00 (0.707)	3.3 (1.949)	6.6 (2.665)	1.507
	Mean	0.707	0.707	1.535	2.426	
		F-value		**SEm ±**	**CD at 5%**	
	Treatment	NS		0.056	-	
	Duration	*		0.064	0.189	
	T × D	NS		0.111	-	
Coliforms (CFU/g)	GJN1	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	GJF1	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.707
	Mean	0.707	0.707	0.707	0.707	
		F-value		**SEm ±**	**CD at 5%**	
	Treatment	NS		0.00	-	
	Duration	NS		0.00	-	
	T × D	NS		0.00	-	

NS- Non significant, *- Significant at 5% level, GJN1-Control *gulabjamun*, GJK1-Kodo millet incorporated *gulabjamun* (20%), GJF1-Foxtail millet incorporated *gulabjamun* (20%).
Values in parenthesis indicate $(\sqrt{x} + 0.5)$.

Similar findings were also observed in a study conducted by Vasava *et al*. (2018), gluten-free *gulabjamun* packed in composite polyethylene terephthalate (PET) bottles and stored at refrigeration temperature showed a decrease in moisture from 32.9 to 31.57 by 35th day of shelf life study.

Shelf life study by microbial population

Table 9 and 10 show the microbial population of *gulabjamun* in room temperature at different intervals of storage. BIS specifications for *gulabjamun* allow a maximum of 2000 cfu/g total bacterial count and 50 cfu/g fungi. The results reported during the study were well within the limits. However, foxtail millet incorporated *gulabjamun* samples, on storage at room temperature, developed visible mold growth on 6th day and was observed in control product on 7th day. Chaudhary (2016) also studied the effect of room and refrigerated storage on microbial population in *gulabjamun* and results were in accordance with the present study.

Therefore, foxtail millet incorporated *gulabjamun* (GJF1) was acceptable up to 5 days at room temperature and up to 15 days at refrigerated storage.

CONCLUSION

Milk and dairy products are considered as 'nearly complete' foods as they contain a wide array of nutrients. However, it is well known that milk is not a good source of iron and fibre. Millets, in contrast, are deficient in essential amino acids like lysine, compromising the protein quality. An effort was therefore made in the present study to formulate food products from milk-millet combination. Results revealed that foxtail millet could successfully be incorporated to a traditional dairy product like *gulabjamun*, with highly acceptable sensory attributes. Thus, development and consumption of such products from milk-millet combination can be encouraged among all healthy sectors of population and the enhanced nutritional profile can be exploited.

Conflict of interest

All authors declare that they have no conflict of interest.

REFERENCES

Adhikari, A.K., Mathur, O.N. and Patil, G.R. (1994). Interrelationship among Instron textural parameters, composition and microstructure of *khoa* and *gulabjamun* made from buffalo milk. Journal of Food Science and Technology. 31: 279-284.

Association of Official Analytical. (2001). Official Methods of Analysis, Chemists, 18th ed. Washington, D.C., USA.

Bhat, S., Nandini, C. and Tippeswamy, V. (2018). Significance of small millets in nutrition and health-A review. Asian Journal of Dairy and Food Research. 37: 35-40.

Chaudhary, C.B. (2016). Development of technology for manufacture of *gulabjamun* utilizing *moraiyo* (*Panicum miliare*), M.tech thesis, Anand Agricultural University, Anand.

FAOSTAT (2005). Statistical database of the Food and Agricultural Organization of the United Nations.

Ghosh, B.C., Rajorhia, G.S. and Pal, D. (1986). Complete *gulabjamun* mix. Indian Dairyman. 38: 279-282.

Ghube, S.D., Bidwe, K.U., Shelke, R.R. and Shegokar, S.R. (2015). Studies on physico-chemical properties of *gulabjamun* prepared from cow milk *khoa* blended with wheat bran. Research Journal of Animal Husbandry and Dairy Science. 6: 99-104.

Heau, W.R., Menzel, R.G., Roberts, H. and Freee, M.H. (1965). Methods of Soil and Plant Analysis. Agriculture Research Service, Department of Agriculture. USA.

Nalawade, M.R., Shinde, A.T., Kokare, R.L. and Lingayat, N.T. (2015). Studies on preparation of *gulabjamun* blended with wheat bran. Research Journal of Animal Husbandry and Dairy Science. 6: 139-144.

Patel, A.A., Patil, G.R., Garg, F.C. and Rajorhia, G.S. (1992). Textural characteristics of market samples of *gulabjamun*. Indian Journal of Dairy Science. 45: 356-359.

Prajapati, P.S., Thakar, P.N. and Upadhyay, K.G. (1992). Influence of use of pre-soaked suji (semolina) on the quality of *gulabjamun*. Indian Journal of Dairy Science. 45: 630-632.

Shendurse, A.M., and Chaudhary, M.K. (2020). Development of *Gulabjamun* by incorporating the *Amaranthus hypochon driacus* L. (Rajgara). Journal of Pharmacognosy and Phytochemistry. 9: 1913-1918.

Singh, A.K., Kadam, D.M., Sexena, M. and Singh, R.P. (2009). Efficacy of defatted soy flour supplement in *gulabjamun*. African Journal of Biochemistry Research. 3: 130-135.

Sinha, R. and Sharma, B. (2017). Use of finger millet in cookies and their sensory and nutritional evaluation. Asian Journal of Dairy and Food Research. 36: 264-266.

Tylor, J.R.N. and Emmanbux, M.N. (2008) Millets: Handbook of Gluten-free Cereal Products and Beverage, Academic Press, Amsterdam and London.

Ushakumari, S.R., Shrikantan, L. and Malleshi, N.G. (2004). The functional properties of popped, flaked, extruded and roller dried foxtail millet (*Setaria italica*). International Journal of Food Science and Technology. 39: 907-915.

Vasava, N.M., Pinto, S. and Paul, P. (2018). Effect of storage on Physico-Chemical, sensory and microbiological quality of gluten-free *gulabjamun.* The Pharma Innovation Journal. 7: 612-619.

Yawale, P.A. and Rao, J.K. (2012). Development of *khoa* powder based *Gulabjamun* mix. Indian Journal of Dairy Science. 65: 361-367.