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Replacement of Maida by Soybean Flour (*Glycine max*) for Preparation of *Gulabjamun*

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Abstract

The present investigation entitled "Replacement of maida by soybean flour (*Glycine max*) for preparation of *gulabjamun*" was undertaken during 2023-24 with a view to standardize the process for preparation of with *gulabjamun* improved nutritional value using soybean flour. The product obtained was subjected for sensory evaluation and chemical analysis. It was observed that, all the sensory attributes *viz*., colour and appearance, flavour, body and texture and overall acceptability of *gulabjamun* samples under different treatment combinations were significant. The colour and appearance, flavour, body and texture and overall acceptability score ranged from colour and appearances for the treatments T_0, T_1, T_2, T_3 and T_4 were 7.65, 7.50, 8.21, 8.05 and 7.91, respectively. The mean flavour score of soybean *gulabjamun* for treatments T_0, T_1, T_2, T_3 and T_4, were7.66, 7.52, 8.25, 8.08 and 7.85, respectively. The average scores for body and texture attribute of *gulabjamun* prepared under each treatment ranged between 7.59 to 8.44. The mean flavour score of soybean *gulabjamun* for treatments T_0, T_1, T_2, T_3 and T_4, were7.66, 7.52, 8.25, 8.08 and 7.85, respectively. The mean scores for overall acceptability of fresh *gulabjamun* varied from 7.59 to 8.30 for different treatment combinations Treatment T_2 (50% maida and 50% soybean flour) found to be significantly ($P<0.05$) superior over all other treatments in terms of better colour, flavour, uniform granular texture, with cooked flavour and free from doughy feel. The optimized soybean *gulabjamun* had physico-chemical composition as 30.55, 12.04, 7.66, 1.53, 22.42, 25.79, 48.21, 69.44 per cent, moisture, fat, protein, ash, reducing sugar, non-reducing sugar, total sugar,and total solid ,respectively.

Key words : *Gulabjamun* , Sensory evaluation *gulabjamun*, fat, protein, ash, reducing sugar, non-reducing sugar, total sugar,and total solid.

Gulabjamun is a popular indigenous sweet commodity, commonly prepared from *khoa* in the northern, western and central parts of the country. It is generally prepared from cow or buffalo milk *khoa* by kneading it with wheat flour (*maida*) and baking powder to form a smooth dough, portioning the dough, rolling them into balls of spherical shape, deep- frying the balls in oil till they turn golden brown in colour and soaking them in sugar syrup overnight (Nalawade *et* al., 2015).

Soybean is one of the nature's wonderful nutritional gifts. It is one of the very few plants that provide a complete protein with minimum saturated fat. Regular consumption of soybean helps to prevent cancer, reduce cholesterol level, combating osteoporosis and menopause regulation. Soybeans contain all the three essential macro nutrients required for good nutrition, complete protein (40%), carbohydrate (18%), fat (18%) and moisture (9%) apart from vitamins and minerals (5%), including folic acid, calcium, potassium and iron (National Soybean Research Laboratory, 2008; Singh *et* al., 2009).

Replacing maida with soy flour in the preparation of *gulabjamun* offers several nutritional and functional benefits, backed by scientific findings. Soy flour is rich in proteins, essential amino acids, and dietary fiber, whereas maida primarily comprises refined carbohydrates

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with minimal nutritional value. A nutritional comparison reveals that soy flour contains approximately 49.8g of protein and 16g of dietary fiber per 100g, significantly surpassing maida's 10.3g of protein and 2.7g of dietary fiber. This makes soy flour a nutrient-dense alternative. Additionally, the higher protein and fiber content in soy flour helps create a denser and less porous dough structure, reducing oil absorption during frying Another critical advantage of soy flour is its lecithin content, a natural emulsifier that enhances dough cohesiveness, consistency, and moisture retention. While specific studies on lecithin in *gulabjamun* are limited, its emulsifying properties are well-documented in other food applications. Furthermore, soy flour's antioxidant properties contribute to a slower rate of fat oxidation, potentially extending the shelf life of fried products. It also has a lower glycemic index compared to maida, making it a healthier option for individuals managing blood sugar levels. Studies confirm that soy flour's glycemic index is beneficial for blood sugar management compared to refined wheat flour.

Materials and Methods

Soybean : Good quality soybean was procured from local market in single lot.

Sugar : Clean crystalline suger was purchased from local market in single lot

Baking powder : Baking powder was procured from the local market in single lot.

Refined wheat flour (Maida) : Refined wheat flour was procured from local market in single lot.

Vegetable oil : Vegetable oil was procured from local market in single lot.

Optimization of ingredients

Selection form of Soybean : For these purpose flour prepared from soaked soybean and without soaked soybean were taken while, baking powder and khoa kept constant.

Treatments details as under

S_0 : *Khoa* + 100 per cent maida

S_1 : *Khoa* + 50 per cent maida + 50 per cent soaked soybean flour

S_2 : *Khoa* + 50 per cent maida + 50 per cent without soaked soybean flour

On the basis of sensory evaluation one best treatment combination was selected for further study

Selection Type of Soybean Flour : For this purpose, roasted flour was used (low flame) and compared with selected form of soybean flour and maida. In all the treatment combination khoa and baking powder were kept constant.

R_0 : *Khoa* + 100 per cent maida

R_1 : *Khoa* + 50 per cent maida+ 50 per cent selected form of soybean flour

R_2 : Khoa + 50 per cent maida+ 50 per cent roasted soybean flour

On the basis of sensory evaluation one best treatment combination was selected for further study.

Optimization of Level of Maida and Soybean Flour : During the phase of investigation, to optimize the levels of maida and soybean flour in the preparation of *gulabjamun*, khoa and baking powder were be kept constant across all treatment combinations.

Treatment details are T_0 : *Khoa* + 100 per cent maida, T_1 : *Khoa* + 75 per cent maida + 25 per cent soybean flour, T_2 : *Khoa* + 50 per cent maida + 50 per cent soybean flour, T_3 : *Khoa* + 25 per cent maida +75 per cent

soybean flour and T_4 : *Khoa* + 100 per cent soybean flour.

On the basis of sensory evaluation one best treatment combination was selected for further study. While sample were analysed for their physico-chemical and micr.

Sensory Evaluation : The sensory evaluation of *gulabjamun* samples prepared under experimental trails were by using 9 point Hedonic scale. A panel of five semi-trained judges was formulated for this purpose. The samples were coded every time to conceal their identity and were offered to the judges for evaluation of sensory attributes.

Procedure of *Gulabjamun* Preparation

Milk
↓
Preheating (38-40°C)
↓
Filtration/Clarification
↓
Standardization (4.5 per cent fat)
↓
Heating of milk in karahi
④
Continuous stirring-cum-scrapping with the help of kunthi
↓
Khoa
↓
Mixing of Soybean flour, refined wheat flour to khoa (as per treatments)
↓
Addition of baking powder (0.2 per cent)
↓
Dough
↓
Portioning 10-12 gm
↓
Ball forming
↓
Deep frying in iron karahi
↓
Soaking (2-3 hour) in sugar syrup (60 %)
↓
Packaging (Polysterene cup)
↓
Ash content was determined by procedure described in IS: 1479 (Part II, 1961). Storage at room temperature (30 ± 1°C)

Fig. 1. Flow diagram for preparation of *gulabjamun* blended with soybean flour

Physical property analysis

Fat : As per the method described in AOAC (2002). Protein content of *gulabjamun* was estimated by Micro-Kjeldhal method, AOAC (1992). Reducing sugar of *gulabjamun* sample were estimated by Lane and Eynon method (1923) with slight modification suggested by Ranganna (1986). The non-reducing sugar was determined by subtracting the reducing sugar from total sugar percentage. Total sugar content of *gulabjamun* was determined as per Lane-Eynon's method given in IS: SP:18, (Part XI) 1981. Moisture content of *gulabjamun* was determined as per SP:18 (Part - XI), 1981. Ash content was determined by procedure described in IS: 1479 (Part II, 1961). Total solids content of *gulabjamun* was determined as per the method described in IS: SP (Part XI) 1981.

Textural Profile Analysis of *Gulabjamun* : The mechanical textural properties like hardness, cohesiveness, springiness, gumminess, and chewiness was determined using an Instron Texture Analyzer of Stable Micro System equipped with a 50 kg load cell samples tempered at 20°C for one hr. and cut to cylindrical sizes (15 mm height and 19 mm diameter) by a cheese tier and compressed to 26.70 per cent of their initial height at a cross-head speed of 50 mm min^{-1} (at a chart speed of 250 mm min^{-1}) and the results was expressed per unit cross-sectional area (i.e. mm^2) of the sample. A textural property was measured in Department of Agriculture Processing Engineering, Dr. Annasaheb Shinde College of Agriculture Engineering and

Technology, MPKV, Rahuri. The analyser was linked to a computer that recorded the data via a software programme.

Statistical Analysis : Data generated during the course of investigation was analyzed with the help of statistical design namely Completely Randomized Design (CRD) for experimental trials and Factorial Completely Randomized Design (FCRD) for storage study as per Snedecor and Cochran (1967).

Result and Discussion

Sensory Quality of Lassi Samples : Table 1 show that the mean score of overall acceptability of addition of 50 per cent soybean flour and 50 per cent of maida added in khoa were most optimum to prepare *gulabjamun* i for the treatments T_0, T_1, T_2, T_3 and T_4 7.63, 7.59, 8.30, 8.16, and 8.0 respectively. The highest overall acceptability score was observed in treatment T_2 (8.30). The results are in accordance withMistry *et al.* (2017) who reported that as the level of moringa leaves powder in *lassi* increased, the overall acceptability of the lassi increases up to certain limits and Pagthinathan *et al*. (2020) noted that the highest scores for odour, taste, and overall acceptability were found in paneer containing 0.6% curry leaves extract after storage.

Chemical Quality of *gulabjamun* Samples

Moisture content : The result presented in Table 2 showed that the moisture content of fresh *gulabjamun* samples ranged from 31.90 to 28.81 per cent. The moisture content differed significantly (P<0.05) due to the level of soybean incorporation. Treatment T_0, which did not contain soybean, had the highest moisture content at 31.90 per cent, while the moisture content decreased significantly (P<0.05) as the level of soybean increased. This decrease in moisture content can be attributed to the increase in solute concentration in the *gulabjamun* samples as soybean content increased.

Fat : The values recorded in respect of fat content of the *gulabjamun* are shown in Table 4.17. The average fat content of *gulabjamun* samples for treatments T_0, T_1, T_2, T_3 and T_4 were 11.23, 11.78, 12.04, 12.35 and 12.93 per cent, respectively. The fat content of *gulabjamun* samples were significantly (P<0.05) differed by addition of different level of soybean flour. T_4 had highest fat per cent (12.93) whereas the T0 had lowest fat per cent (11.23)

Protein : The protein content in soybean *gulabjamun* is a crucial nutritional component, providing plant-based proteins. The protein content values of *gulabjamun* are shown in Table 4.18. These ranged from 7.23 to 8.12 per cent. Treatment T_4 (8.12) exhibited a significantly higher protein content compared to treatments T_0 (7.23), T_1 (7.33), T_2 (7.66), T_3 (7.80) and T_4 (8.12). The protein content of the *gulabjamun* samples increased significantly (P<0.05) as the level of soybean flour was increased.

Ash : The values recorded were found to be increasing order from treatment T_0 to T_4. Ash per cent of fresh *gulabjamun* samples for treatments T_0, T_1, T_2, T_3 and T_4 were 1.44, 1.45, 1.53, 1.58 and 1.88, respectively.

Table 1. Sensory Quality of *gulabjamun* Samples

Treatments	Mean (Score)			
	Colour and appearance	Flavour	Body and texture	Overall acceptability
T_0	7.65^{d}	7.66^{d}	7.59^{e}	7.63^{d}
T_1	7.50^{e}	7.52^{e}	7.75^{d}	7.59^{e}
T_2	8.21^{a}	8.25^{a}	8.44^{a}	8.30^{a}
T_3	8.05^{b}	8.0^{b}	8.35^{b}	8.16^{b}
T_4	7.91^{c}	7.85^{c}	8.25^{c}	8.0^{c}
S.E.(±)	0.0041	0.0137	0.022	0.035
CD @ (5%)	0.0125	0.0414	0.067	0.107

Table 2. Chemical composition gulabjamun samples

Treatment	Mean							
	Moisture content (%)	**Fat**	**Protein**	**Ash (%)**	**Reducing sugar (%)**	**Non-reducing sugar (%)**	**Total sugar (%)**	**Total solids (%)**
T_0	31.90^a	11.23^a	7.23^e	1.44^d	22.46^a	25.73^e	48.19^c	68.09^e
T_1	31.24^b	11.78^d	7.33^d	1.45^d	22.44^b	25.76^d	48.20^{bc}	68.76^d
T_2	30.55^c	12.04^c	7.66^c	1.53^c	22.42^c	25.79^c	48.21^b	69.44^c
T_3	30.01^d	12.35^b	7.80^b	1.58^b	22.41^{cd}	25.82^b	48.23^a	69.96^b
T_4	28.81^e	12.93^a	8.12^a	1.88^a	22.40^d	25.84^a	48.24^a	71.17^a
S.E. (±)	0.0066	0.0065	0.0064	0.0067	0.0063	0.0066	0.0062	0.0065
CD at 5 (%)	0.0197	0.0195	0.0196	0.0194	0.0194	0.0197	0.0186	0.0193

Highest ash per cent was found in treatment T_4 (1.88 %). As the per cent of soybean increased there is significant ($P<0.05$) increased in ash content could be due to soybean contain various nutrients like iron, zinc, dietary fiber, etc.

Reducing suger : Reducing sugar content in *gulabjamun* under treatments T_0, T_1, T_2, T_3 and T_4 were varied with significant values 22.46, 22.44, 22.42, 22.41 and 22.40 per cent, respectively. It is revealed that reducing sugar content in *gulabjamun* samples was decreased from treatment T_0 to T_4.

Non -reducing suger : the average non-reducing sugar content of *gulabjamun* ranged from 25.73 to 25.84. The results show that the non-reducing sugar percentage was significantly ($P<0.05$) lowest in treatment T0 (25.73) and highest in treatment T4 (25.84).

Total sugars : All the treatments are significantly ($P<0.05$) differed from each other. Highest total sugar per cent was recorded in treatment T_4 (48.24). Treatment T_0 (48.19) showed lowest total sugar per cent. It was observed that total sugar content was found in increasing order for treatments T_0, T_1, T_2, T_3 and T_4 as 48.19, 48.20, 48.21, 48.23 and 48.24 per cent, respectively.

Total solid : The total solids content ranged from 68.09 to 71.17. The highest total solids content was recorded in treatment T4 (71.17), while the lowest was observed in treatment T0 (68.09). It was noted that as the percentage of soybean flour increased, there was a significant rise in the total solids content. This increase can be attributed to the higher fat, total sugar, high water binding capacity and ash content in the *gulabjamun* samples.

Textural Properties of Fresh *Gulabjamun* Samples : It was observed that, all textural properties *viz.*, hardness, cohesiveness, springiness, gumminess and chewiness of fresh *gulabjamun* samples under different treatment combinations were significant. The experimental *gulabjamun* samples analyzed for textural properties and values were ranged from 3.65 kg to 4.75N for hardness, 0.20 to 0.27 for cohesiveness, 6.60 to 8.51 mm for springiness, 0.13 to 0.21kg for gumminess and 0.95 to 1.17 kg mm for chewiness.

Conclusion

Among the different compositional variables tried, the best quality soybean *gulabjamun* can be prepared by using 50 per

cent soaked raw soybean flour and 50 per cent maida. It was liked very much by the panel of semi-trained judges.The optimized soybean *gulabjamun* had physico-chemical composition as 30.55, 12.04, 7.66, 1.53, 22.42, 25.79, 48.21, 69.44 per cent, moisture, fat, protein, ash, reducing sugar, non-reducing sugar, total sugar,and total solid ,respectively.

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