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## Production and quality evaluation, sensory analysis of sugar-free gulabjamun prepared from gulabjamun mix by using skim milk powder, soy flour and low calorie sweeteners

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#### Abstract

In the present study, changes in compositional, sensory analysis (Flavour & taste, Body & texture, Colour & appearance and Overall acceptability) of sugar free gulabjamun, Prepared from Gulabjamun mix by using skim milk powder, Soy flour, maida, Vanaspati and backing powder to improve the qualities of gulabjamun mix. With packaging materials (LDPE and aluminium foil) 15 day interval (0-60 day) and low calorie sweeteners i.e. stevia, sucralose and herbal sugar. These treatment combination(G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub>, G<sub>4</sub>, G<sub>5</sub>, G<sub>6</sub>, G<sub>7</sub>, G<sub>8</sub>, G<sub>9</sub>, G<sub>10</sub>, G<sub>11</sub>, G<sub>12</sub>, G<sub>13</sub>, G<sub>14</sub>, G<sub>15</sub>, G<sub>16</sub>, G<sub>17</sub>, G<sub>18</sub>, G<sub>19</sub>, G<sub>20</sub>, G<sub>21</sub>, G<sub>22</sub>, G<sub>23</sub>, G<sub>24</sub>) used in the study were replicated five times. Sugar free gulabjamun were tested for Flavour & taste, Body & texture, Colour & appearance and Overall acceptability. Cost of the product was also worked out for different treatment combinations. The data obtained during investigation were statistically analyzed by using factorial design and critical difference between treatment combinations.

Keywords: sugar free gulabjamun, skim milk powder, Maida, vanaspati, soya flour and sugar

#### Introduction

India produces over 198 million metric tons of milk each year. 44.5 percent of milk is used to make fluid milk, while 55.5 percent of milk is used to make sweets. Because of its social, economic, religious, medical, and cultural value, traditional milk products such as rasogolla, gulabjamun, sandesh, and misti dahi have been manufactured in our country since ancient times. Gulabjamun, in particular, holds a special position in the Indian sweets landscape (Thakur and Chandra, 2015)<sup>[2]</sup>. Gulabjamun is a popular milk-based Indian dessert. It is typically made from cow or buffalo milk khoa by mixing smooth dough with wheat flour (Maida) and baking powder, portioning the dough, shaping it into spherical balls, deep frying the balls in oil till golden brown in color, and soaking the balls in sugar syrup overnight (vasava *et al.*, 2018)<sup>[1]</sup>.

Gulabjamun is a popular Khoa-based dessert. It's made by kneading Khoa and/or Maida (refined wheat flour), rolling them into balls, deep frying them in oil/hydrogenated oil/Ghee until golden brown, soaking them in sugar syrup, and serving them warm or cold. Gulabjamun was given its name because it resembles the monsoon fruit Jamun and is flavored with rose water (Patel *et al..*, 2020).

#### Skim milk powder

Evaporation and drying are the two most important processes in the manufacturing of milk powder. In the literature, the scientific underpinning of both operations is described in detail. Milk is usually dried using either a roller or a spray dryer. Spray drying involves spraying concentrated liquid milk into a regulated flow of heated air within a drying chamber to turn it into dried powder. The rapid evaporation rate is due to the enormous surface area of the spray droplets. Preconcentrated milk is dried on the surface of a hot drum in the roller drying process. A scraper removes the thin, dried milk coating from the drum as the water evaporates (Henning *et al..*, 2006).

#### Soy flour

Soybean is a fantastic nutritional gift from nature. It's one of the few plants that can deliver a complete protein while containing very little saturated fat. Soybean eating helps to prevent cancer, lower cholesterol levels, combat osteoporosis, and regulate menopause.

Soybeans include all three important macronutrients for optimum nutrition, including full protein (40%), carbohydrate (18%), fat (18%), and moisture (9%), as well as vitamins and minerals 4 (5%) such as folic acid, calcium, potassium, and iron (National Soybean Research Laboratory, 2008) (Singh *et al.*, 2011)<sup>[4]</sup>

## **Materials and Methods**

The experiment "Production and Quality Evaluation of Sugarfree Gulabjamun Prepared from Gulabjamun mix by using skim milk powder, Soy flour and low calorie sweeteners" was carried out in the research Lab of Warner college of Dairy Technology, Sam Higginbottom university of Agriculture, Technology and Sciences Prayagraj The experimental techniques were employed as under.

#### **Treatment combination**

The product (Gulabjamun mix) was manufactured by different treatment combination such as skim milk powder, maida, soy flour, Vanaspati, baking powder i.e.  $G_1$  (53:15:12:18:02),  $G_2$  (50:16:12:20:02),  $G_3$  (47:17:12:22:02), and  $G_4$  (44:18:12:24:02). The different treatment combinations used in the experiment were represented as follows:

**Formulation of Gulabjamun mix:** The mix was formulated from different ingredients in the following proportion:

The mix was formulated from different ingredients in the following proportion

	]	Percentage (%)				
Ingredients		Treatments				
	T <sub>1</sub>	T <sub>2</sub>	<b>T</b> 3	<b>T</b> 4		
Skim milk powder*	53	50	47	44		
Maida	15	16	17	18		
Soy Flour	12	12	12	12		
Vanaspati	18	20	22	24		
Baking powder	2	2	2	2		

\* Skim milk powder (spray dried)

#### **Packaging materials**

Low-density polyethylene (LDPE)
Thickness- 60µ of 100g capacity.

• PE (plotline) / Aluminum foil / PE lamented Thickness – 70µ of 100g capacity

## Details of sugar free gulabjamun treatment combination

Twenty four different combination of sugar free gulabjamun Prepared from Gulabjamun mix by using skim milk powder, Soy flour and low calorie sweeteners i.e. (stevia, sucralose and herbal sugar) the details of the prepared combination were as follows.

G<sub>1</sub>: Prepared by the combination of 53% Skim milk powder (spray dried), 15% Maida, 12% Soy flour, 18% Vanaspati and 2% Baking powder, Packed by LDPE, Stevia 50% brix sugar syrup.

G2: Prepared by the combination of 50% Skim milk powder (spray dried), 16% Maida, 12% Soy flour, 20% Vanaspati and 2% Baking powder, Packed by LDPE, Stevia 50% brix sugar syrup

**G3:** Prepared by the combination of 47% Skim milk powder (spray dried), 17% Maida, 12% Soy flour, 22% Vanaspati and 2% Baking powder, Packed by LDPE, Stevia 50% brix sugar syrup.

**G4:** Prepared by the combination of 44% Skim milk powder (spray dried), 18% Maida, 12% Soy flour, 24% Vanaspati and 2% Baking powder, Packed by LDPE, Stevia 50% brix sugar syrup.

G<sub>5</sub>: Prepared by the combination of 53% Skim milk powder (spray dried), 15% Maida, 12% Soy flour, 18% Vanaspati and 2% Baking powder., Packed by Aluminum foil , Stevia 50% brix sugar syrup.

**G6:** Prepared by the combination of 50% Skim milk powder (spray dried), 16% Maida, 12% Soy flour, 20% Vanaspati and 2% Baking powder, Packed by Aluminum foil , Stevia 50% brix sugar syrup.

**G7:** Prepared by the combination of 47% Skim milk powder (spray dried), 17% Maida, 12% Soy flour, 22% Vanaspati and 2% Baking powder, Packed by Aluminum foil, Stevia 50% brix sugar syrup.

**Gs:** Prepared by the combination of 44% Skim milk powder (spray dried), 18% Maida, 12% Soy flour, 24% Vanaspati and 2% Baking powder, Packed by Aluminum foil, Stevia 50% brix sugar syrup.

**G9:** Prepared by the combination of 53% Skim milk powder (spray dried), 15% Maida, 12% Soy flour, 18% Vanaspati and 2% Baking powder, packed by LDPE, Sucralose 50% brix sugar syrup.

G10: Prepared by the combination of 50% Skim milk powder (spray dried), 16% Maida, 12% Soy flour, 20% Vanaspati and 2% Baking powder, packed by LDPE, Sucralose 50% brix sugar syrup.

G11: Prepared by the combination of 50% Skim milk powder (spray dried), 17% Maida, 12% Soy flour, 22% Vanaspati and 2% Baking powder, Packed by LDPE, Sucralose 50% brix sugar syrup.

G12: Prepared by the combination of 44% Skim milk powder (spray dried), 18% Maida, 12% Soy flour, 24% Vanaspati and 2% Baking powder, Packed by LDPE, Sucralose 50% brix sugar syrup.

G13: Prepared by the combination of 53% Skim milk powder (spray dried), 15% Maida, 12% Soy flour, 18% Vanaspati and 2% Baking powder, Packed by Aluminum foil , Sucralose 50% brix sugar syrup.

G14: Prepared by the combination of 50% Skim milk powder (spray dried), 16% Maida, 12% Soy flour, 20% Vanaspati and 2% Baking powder, Packed by Aluminum foil , Sucralose 50% brix sugar syrup.

G<sub>15</sub>: Prepared by the combination of 47% Skim milk powder (spray dried), 17% Maida, 12% Soy flour, 22% Vanaspati and 2% Baking powder, Packed by Aluminum foil , Sucralose 50% brix sugar syrup.

G<sub>16</sub>: Prepared by the combination of 44% Skim milk powder (spray dried), 18% Maida, 12% Soy flour, 24% Vanaspati and 2% Baking powder, Packed by Aluminum foil , Sucralose 50% brix sugar syrup.

**G17:** Prepared by the combination of 53% Skim milk powder (spray dried), 15% Maida, 12% Soy flour, 18% Vanaspati and 2% Baking powder, Packed by LDPE, herbal sugar 50% brix sugar syrup.

**G18:** Prepared by the combination of 50% Skim milk powder (spray dried), 16% Maida, 12% Soy flour, 20% Vanaspati and 2% Baking powder, Packed by LDPE, herbal sugar 50% brix sugar syrup.

**G**<sub>19</sub>: Prepared by the combination of 47% Skim milk powder (spray dried), 17% Maida, 12% Soy flour, 22% Vanaspati and 2% Baking powder, Packed by LDPE, herbal sugar 50% brix sugar syrup.

G<sub>21</sub>: Prepared by the combination of 53% Skim milk powder (spray dried), 15% Maida, 12% Soy flour, 18% Vanaspati and 2% Baking powder, Packed by Aluminum foil, herbal sugar 50% brix sugar syrup.

G22: Prepared by the combination of 50% Skim milk powder (spray dried), 16% Maida, 12% Soy flour, 20% Vanaspati and

2%Baking powder, Packed by Aluminum foil, herbal sugar 50% brix sugar syrup.

G23: Prepared by the combination of 47% Skim milk powder (spray dried), 17% Maida, 12% Soy flour, 22% Vanaspati and 2% Baking powder, Packed by Aluminum foil, herbal sugar 50% brix sugar syrup.

**G24:** Prepared by the combination of 44% Skim milk powder (spray dried), 18% Maida, 12% Soy flour, 24% Vanaspati and 2% Baking powder., Packed by Aluminum foil, herbal sugar 50% brix sugar syrup.



Fig 1: Flow diagram for Preparation of Gulabjamun mix and packaging of gulabjamun mix for 15 day interval (0-60 days).



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Fig 2: Flow diagram for production of sugar frees Gulabjamun

Table 2: Sensory analysis of sugar free Gulabjamun prepared from Gulabjamun mix by using skim milk powder,	Soy flour and low calorie
sweeteners	

Treatment combination	Flavour& taste Score	Body and texture score	Colour & appearance score	<b>Overall Acceptability</b>
G1	8	8	8	8.00
G <sub>2</sub>	8	7	8	7.60
G3	7	7	7	7.00
G4	6	7	6	6.20
G5	8	8	8	8.00
G6	8	8	7	7.66
G7	7	7	7	7.00
G8	6	6	6	6.40
G9	8	8	8	8.00
G10	8	8	8	7.60
G11	7	7	7	7.00
G12	6	6	6	6.20
G13	8	8	8	8.00
G14	8	8	8	7.66
G15	7	7	7	7.00
G16	6	6	6	6.40
G17	8	8	8	8.00
G <sub>18</sub>	8	8	8	7.60
G19	7	7	7	7.00
G <sub>20</sub>	6	6	6	6.20
G <sub>21</sub>	8	8	7	8.00
G22	8	8	8	7.66
G23	7	7	7	7.00
G24	6	6	6	6.40

## **Results and Discussions**

Flavour & taste score

Effect of different treatment combination, packaging material and different low calorie sweeteners on flavour & taste Score of sugar free Gulabjamun

- The treatment combination of sugar free Gulabjamun (Stevia and LDPE) i.e. G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub> and G<sub>4</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Stevia and PE/ALFOIL/PE) i.e. G<sub>5</sub>, G<sub>6</sub>, G<sub>7</sub> and T<sub>8</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval.
- The treatments combinations of sugar free Gulabjamun (Sucralose and LDPE) i.e. G<sub>9</sub>, G<sub>10</sub>, G<sub>11</sub> and G<sub>12</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Sucralose and

PE/ALFOIL/PE) i.e.  $G_{13}$ ,  $G_{14}$ ,  $G_{15}$  and  $G_{16}$  have mean value (0 to 60 days) respective 8.00, 8.00, 7.00 and 6.00 at 15 days interval.

- The treatments combinations of sugar free Gulabjamun (Herbal sugar and LDPE) i.e. G<sub>17</sub>, G<sub>18</sub>, G<sub>19</sub> and G<sub>20</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Herbal sugar and PE/ALFOIL/PE) i.e. G<sub>21</sub>, G<sub>22</sub>, G<sub>23</sub> and G<sub>24</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval.
- The treatments combination that has low Flavour & taste score is 6.00 and higher is 8.00. There are non-significant difference (P<0.05) between different sugar (Stevia, sucralose and herbal sugar), different packaging material, and there is significant difference (P<0.05) between different treatment combinations.



Fig 3: Average Flavour & taste score of sugar free gulabjamun by using low calorie sweetener

#### Body & texture score

Effect of different treatment combination, packaging material and different low calorie sweeteners on body & texture score of sugar free Gulabjamun.

- The treatment combination of sugar free Gulabjamun (Stevia and LDPE) i.e. G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub> and G<sub>4</sub> have mean value (0 to 60 days) respectively 8.00, 7.00, 7.00 and 7.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Stevia and PE/ALFOIL/PE) i.e. G<sub>5</sub>, G<sub>6</sub>, G<sub>7</sub> and T<sub>8</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval.
- The treatments combinations of sugar free Gulabjamun (Sucralose and LDPE) i.e. G<sub>9</sub>, G<sub>10</sub>, G<sub>11</sub> and G<sub>12</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Sucralose and PE/ALFOIL/PE) i.e. G<sub>13</sub>, G<sub>14</sub>, G<sub>15</sub> and G<sub>16</sub> have mean

value (0 to 60 days) respective 8.00, 8.00, 7.00 and 6.00 at 15 days interval.

- The treatments combinations of sugar free Gulabjamun (Herbal sugar and LDPE) i.e. G<sub>17</sub>, G<sub>18</sub>, G<sub>19</sub> and G<sub>20</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Herbal sugar and PE/ALFOIL/PE) i.e. G<sub>21</sub>, G<sub>22</sub>, G<sub>23</sub> and G<sub>24</sub> have mean value (0 to 60 days) respectively 8.00, 8.00, 7.00 and 6.00 at 15 days interval.
- The treatments combination that has low **Body and texture score** is 6.00 and higher is 8.00. There are nonsignificant difference (P<0.05) between different sugar (Stevia, sucralose and herbal sugar), different packaging material, and there is significant difference (P<0.05) between different treatment combinations.



Fig 4: Average Body & texture score of sugar free gulabjamun by using low calorie sweetener

#### Colour & Appearance score

Effect of different treatment combination, packaging material and different low calorie sweeteners on colour & appearance score of sugar free Gulabjamun.

- The treatment combination of sugar free Gulabjamun (Stevia and LDPE) i.e. G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub> and G<sub>4</sub> have mean value (0 to 60 days) respectively 8.00, 7.00, 6.00 and 8.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Stevia and PE/ALFOIL/PE) i.e. G<sub>5</sub>, G<sub>6</sub>, G<sub>7</sub> and T<sub>8</sub> have mean value (0 to 60 days) respectively 7.00, 7.00, 6.00 and 8.00 at 15 days interval.
- The treatments combinations of sugar free Gulabjamun (Sucralose and LDPE) i.e. G<sub>9</sub>, G<sub>10</sub>, G<sub>11</sub> and G<sub>12</sub> have mean value (0 to 60 days) respectively 8.00, 7.00, 6.00 and 8.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Sucralose and PE/ALFOIL/PE) i.e. G<sub>13</sub>, G<sub>14</sub>, G<sub>15</sub> and G<sub>16</sub> have mean

value (0 to 60 days) respective 8.00, 7.00, 6.00 and 8.00 at 15 days interval.

- The treatments combinations of sugar free Gulabjamun (Herbal sugar and LDPE) i.e. G<sub>17</sub>, G<sub>18</sub>, G<sub>19</sub> and G<sub>20</sub> have mean value (0 to 60 days) respectively 8.00, 7.00, 6.00 and 7.00 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Herbal sugar and PE/ALFOIL/PE) i.e. G<sub>21</sub>, G<sub>22</sub>, G<sub>23</sub> and G<sub>24</sub> have mean value (0 to 60 days) respectively 8.00, 7.00, 6.00 and 7.00 at 15 days interval.
- The treatments combination that has low Colour& appearance score is 6.00 and higher is 8.00. There is significant difference (P<0.05) between different sugar (Stevia, sucralose and herbal sugar), different packaging material, and there is significant difference (P<0.05) between different treatment combinations.



Fig 5: Average Colour & appearance score of sugar free gulabjamun by using low calorie sweetener ~ 353 ~

#### **Overall Acceptability score**

Effect of different treatment combination, packaging material and different low calorie sweeteners on overall Acceptability score of sugar free Gulabjamun

- The treatment combination of sugar free Gulabjamun (Stevia and LDPE) i.e. G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub> and G<sub>4</sub> have mean value (0 to 60 days) respectively 8.00, 7.20, 7.00 and 6.20 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Stevia and PE/ALFOIL/PE) i.e. G<sub>5</sub>, G<sub>6</sub>, G<sub>7</sub> and T<sub>8</sub> have mean value (0 to 60 days) respectively 8.00, 7.60, 7.00 and 6.40 at 15 days interval.
- The treatments combinations of sugar free Gulabjamun (Sucralose and LDPE) i.e. G<sub>9</sub>, G<sub>10</sub>, G<sub>11</sub> and G<sub>12</sub> have mean value (0 to 60 days) respectively 8.00, 7.20, 7.00 and 6.20 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Sucralose and PE/ALFOIL/PE) i.e. G<sub>13</sub>, G<sub>14</sub>, G<sub>15</sub> and G<sub>16</sub> have mean

value (0 to 60 days) respective 8.00, 7.60, 7.00 and 6.40 at 15 days interval.

- The treatments combinations of sugar free Gulabjamun (Herbal sugar and LDPE) i.e. G<sub>17</sub>, G<sub>18</sub>, G<sub>19</sub> and G<sub>20</sub> have mean value (0 to 60 days) respectively 8.00, 7.20, 7.00 and 6.20 at 15 days interval. The treatment combination of sugar frees Gulabjamun (Herbal sugar and PE/ALFOIL/PE) i.e. G<sub>21</sub>, G<sub>22</sub>, G<sub>23</sub> and G<sub>24</sub> have mean value (0 to 60 days) respectively 8.00, 7.60, 7.00 and 6.40 at 15 days interval
- The treatments combination that has low Overall Acceptability score is 6.20 and higher is 8.00. There are non-significant difference (P<0.05) between different sugar (Stevia, sucralose and herbal sugar), different packaging material, and there is significant difference (P<0.05) between different treatment combinations.



Fig 6: Average Overall Acceptability score of sugar free gulabjamun by using low calorie sweetener

#### Conclusion

Products (gulabjamun mix) packed was LDPE and aluminium foil for 15 day interval (0-60 days) and make the gulabjamun ball and dip low calorie sugar syrup. the basis of sensory analysis, the sugar free Gulabjamun in treatment G<sub>1</sub>, G<sub>5</sub>, G<sub>8</sub>, G<sub>12</sub>, G<sub>16</sub>, G<sub>20</sub>, (53:15:12:18:2) The best values of Flavour & taste, Body & texture, Colour & appearance and Overall Acceptability of freshly prepared sugar free Gulabjamun. Result findings also revealed that out of three different levels of sugar used, almost equal results and were superior to Stevia, Sucralose and Herbal sugar. Result findings also revealed that different levels of packing with LDPE and aluminium foil of Packaging materials were used, almost also equal results were LDPE and aluminium foil packaging level.

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