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Studies on physico-chemical properties of *Gulabjamun* prepared from cow milk *Khoa* blended with wheat bran

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ABSTRACT : In present investigation wheat bran was used for preparation of *Gulabjamun* with different per cent *i.e.* T_1 (control), T_2 (5 %), T_3 (10 %), T_4 (15 %), T_5 (20 %) with the main objective physico-chemical properties of *Gulabjamun* prepared from cow milk *Khoa* blended with wheat bran. During the study of chemical composition it was observed that, addition of wheat bran in *Gulabjamun* increased moisture, ash, carbohydrate and fibre content significantly in finished product while per cent ash, fat, protein and total solid content was decreased significantly due to increase in rate of addition of wheat bran. Texture profile analysis of product revealed that addition of wheat bran in *Gulabjamun* progressive decreased hardness towards higher of incorporation. 20 per cent level of wheat bran in *Gulabjamun* decreased the score for cohesiveness, adhesiveness, gumminess and chewiness.

KEY WORDS : *Gulabjamun*, Cow milk *khoa*, Wheat bran, Physico- chemical properties

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INTRODUCTION

Gulabjamun is highly nutritious *Khoa* based sweet product. It is prepared from mixture of *Khoa*, refined wheat flour (maida) and baking powder. Dhap *Khoa*, having 40-45 per cent moisture is conveniently used for *Gulabjamun* preparation. Though, there is large variation in the sensory quality of *Gulabjamun*. Mostly liked *Gulabjamun* colour is black or brown, free from both lumps and hard central core, uniform granular texture, mildly cooked and oily flavoured and fully succulent with sugar syrup. India is the highest milk producing country in the world with an annual growth rate of over 5 per cent. The milk production of India is 134.50 MT and per capita availability is 291 g/day, whereas in Maharashtra it is 206 g/day (NDDB statistics, 2014).

Now-a-day's dietary fibre is gaining more importance in human diet due to its important role in human health. According to WHO, requirement of dietary fibre is 23-27 g/day and as per National Institute of Food Nutrient, it is 40-50 g/day. Wheat is most important staple food, for more than 1/3rd of the world human population and it is considered as good source of protein, minerals, B-group vitamins and dietary fibre. Wheat bran is generally discarded product in the milling of the flour. The wheat bran is good source of B-complex vitamins (riboflavin, niacin and thiamine), trace minerals (Ca, K, P, Mg and Niacin) in small quantities and indigestible cellulose (Kumar *et al.*, 2011). Wheat bran is more wholesome and nourishing than flour itself. It is an excellent laxative and its laxative effect is much more superior to those of fruits or vegetables because cellulose of later is more

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easily broken by bacteria in intestine.

Hence, considering the benefits of supplementation of fibre in the diet; with respect to its nutritional and medicinal value, present investigation was planned and undertaken on "Studies on physico-chemical properties of *Gulabjamun* prepared from cow milk *Khoa* blended with wheat bran".

MATERIAL AND METHODS

The present investigation entitled "Preparation of *Gulabjamun* from cow milk *Khoa* blended with wheat bran" was carried out in the Department of Animal Husbandry and Dairy Science, Dr. PDKV, Akola during the year 2014-2015. In the present investigation wheat bran was used for the preparation of *Gulabjamun* with different per cent *i.e.* T_1 (control), T_2 (5 %), T_3 (10 %), T_4 (15 %), T_5 (20 %). The whole, fresh, clean cow milk was procured from the Dairy unit of the Department was used for preparation of *Khoa* as a base material then *Gulabjamun*s were prepared as per the method given by De (1991) and Aneja *et al.* (2002) in which wheat bran was blended as per treatments during preparation of dough.

Chemical analysis:

Moisture contain in *Gulabjamun* sample was determined as per procedure of ISI : 2785 (1964). Total solid content was determined as per the procedure described in ISI:1479 (Part II) 1961.Fat content was determined as per the method given by Aggrawal and Sharma (1961). Protein content was determined as per the procedure givan by ISI: 1479 (Part II) 1961. Ash content was determined as per the method described in ISI: 1981. Carbohydrate content of *Gulabjamun* samples was determined by subtraction method *i.e.* Carbohydrate = 100- (moisture + fat + protein + ash). The dietary fibre content of *Gulabjamun* sample was determined as per the method described in AOAC method (1975).

Textural analysis of *Gulabjamun*:

The textural property was evaluated using the Instron Texture analyzer of Stable Micro System equipped with 50 kg load cell. The analyzer is linked to a computer that recorded the data via a software programme (Nalawade, 2014)

Test mode		**Compression**
Pre-test Speed	:	5.0 mm/sec
Test speed	:	5.0 mm/sec
Post-test speed	:	5.0 mm/sec
Target mode	:	Strain
Distance	:	5.0 mm

The textural properties of *Gulabjamun* was determine by using following textural parameters.

Hardness :

It is defined as the value of the peak force of the first compression of the product, Hardness, g (H) = maximum force of first compression.

Cohesiveness

Extent to which a material can be deformed before it ruptures depending on the strength of internal bonds. (ratio of the positive force areas under first and second compressions).

$$\text{Cohesiveness (ch)} = \frac{\text{Area under the } 2^{nd} \text{ compression } (A_2)}{\text{Area under the } 1^{st} \text{ compression } (A_1)}$$

Adhesiveness :

Force necessary to remove the material that adheres to the mouth when eating food. Adhesiveness, g, mm (A_3) = Negative area in the gap.

Springiness :

Height that the food recovers during the time that elapses between the end of the first bite and the start of the second bite.

Gumminess :

Energy required to disintegrate a semi-solid food product to a state ready for swallowing.

$$\text{Gumminess} = \text{Hardness x Cohesiveness} \left(H \times \frac{A_2}{A_1} \right)$$

Chewiness :

Energy required for masticating a solid food product to make it ready for swallowing.

$$\text{Chewiness, g (Cw)} = \text{Gumminess x Springiness} \left(H \times \frac{A_2}{A_1} \right) \times D_1$$

Data obtained in present investigation was analyzed statistically by using Completely Randomized Design (CRD) as prescribed by Panse and Sukhatma (1985).

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Proximate chemical composition:

The chemical analysis of control and treatments samples of *Gulabjamun* was carried out to determine moisture, total solid, fat, protein, ash, fibre, carbohydrate, SNF (solid not fat) and the results in respect to mean values are presented in Table 1 and discussed in following paragraphs.

Moisture:

Moisture content of control *Gulabjamun* T_1 (27.05 %) was significantly lower than *Gulabjamun* blended with Wheat bran T_2, T_3, T_4 and T_5, respectively. Among the treatments (T_2, T_3, T_4 and T_5) values increased significantly as the level of wheat bran increased from 5 to 10 per cent. Higher moisture content in *Gulabjamun* blended with wheat bran could be due to soaking of water by the wheat bran during *Khoa* preparation. The results are in agreement with previous research worker Nalawade (2014) who reported addition of wheat bran in *Gulabjamun* increased moisture content from 27.12 to 28.30 per cent, respectively

Total solid:

Total solid content of control *Gulabjamun* T_1 (72.95 %) was significantly higher than *Gulabjamun* blended with Wheat bran T_2, T_3, T_4 and T_5 (71.58, 70.99, 70.69, 70.48), respectively. The result showed that highest total solid content was recorded in control T_1 (72.95 %) and lowest total solids contents was recorded for treatment T_5 (70.48 %). All the treatments were found to be differed significantly from each other. Moisture content was increased due to increase in rate of addition of wheat bran, which absorb more sugar syrup and that results in decrease in total solid of final product. Nalawade (2014), who reported that addition of wheat bran in *Gulabjamun* decrease total solid content from 72.88 to 71.70 per cent, respectively.

Fat :

Fat content of control *Gulabjamun* T_1 (15.02 %) and *Gulabjamun* blended with wheat bran T_2, T_3, T_4 and T_5 were (13.45, 13.15, 12.82, 12.20), respectively. The highest fat content was recorded in control T_1 (15.02 %) and lowest fat contents was recorded for treatment T_5 (12.20 %). Significant decrease in fat content of *Gulabjamun blended* with wheat bran as compared to control *Gulabjamun* was recorded this might due to replacement of *Khoa* by low fat content wheat bran as well as more moistures absorption capacity of wheat bran, that absorb more sugar syrup and increase moisture content of final product and combine result in decreases of fat content of final product. The results are in agreement with previous research worker Singh *et al*. (2011) studies on efficacy of defatted soy flour supplement in *Gulabjamun* and reported fat content of control 22.12 per cent and 10 per cent level soy flour supplementation *Gulabjamun* content 13.86 per cent fat.

Protein:

Protein content of control *Gulabjamun* T_1 (14.82 %) and *Gulabjamun* blended with wheat bran T_2, T_3, T_4 and T_5 were (14.65, 14.41, 14.24, 13.72), respectively. The highest Protein content was recorded in control T_1 (14.82 %) and lowest protein contents was recorded for treatment T_5 (13.7 %). Significant decrease in protein content of *Gulabjamun* blended with wheat bran as compared to control *Gulabjamun* was due to protein

Table 1 : Mean values of chemical composition of *Gulabjamun* blended with wheat bran

Chemical constituent (%)	Treatments					F Test	S.E.±	C.D. (P=0.05)
	T_1	T_2	T_3	T_4	T_5			
Moisture	27.05	28.42	29.01	29.23	29.52	Sig.	0.031	0.095
Total solid	72.95	71.60	70.99	70.69	70.48	Sig.	0.071	0.21
Fat	15.02	13.45	13.15	12.82	12.20	Sig.	0.019	0.059
Protein	14.82	14.65	14.41	14.24	13.72	Sig.	0.017	0.052
Ash	2.08	2.33	2.54	2.74	2.94	Sig.	0.021	0.065
Fibre	0.55	1.74	2.88	3.98	5.03	Sig.	0.019	0.058
Carbohydrate	38.48	39.04	39.92	40.59	41.27	Sig.	0.040	0.121
SNF(solid not fat)	57.92	58.12	57.83	57.87	58.27	Sig.	0.077	0.233

content in cow milk *Khoa* is 19.1 per cent which is replaced by wheat bran which content protein 9 per cent and increase in moisture content of final product. BIS recommended minimum protein content of packaged *Gulabjamun* as 8.00 per cent. Rahate (1993) reported that protein content of rasogolla was varied according to starches used as binding material.

Ash :

The mean ash content in the finished product was found to be 2.08, 2.33, 2.54, 2.74, 2.94 per cent for treatment T_1, T_2, T_3, T_4 and T_5, respectively. This shows increasing trend in ash content of *Gulabjamun* blended with wheat bran. The ash content of control treatment (T_1) was significantly lower than the treatments (T_2, T_3, T_4, and T_5), as the per cent addition of wheat bran increased there is significant decrease in ash content. This may be due to wheat bran contents 20 per cent minerals.

Fibre :

Fibre content of control *Gulabjamun* T_1 (0.55 %) and *Gulabjamun* blended with wheat bran T_2, T_3, T_4 and T_5 were (1.74, 2.88, 3.98, 5.03), respectively. The results showed that fibre content of control *Gulabjamun* is significantly lower than *Gulabjamun* blended with T_2, T_3, T_4 and T_5 wheat bran. Among the treatments fibre content increased significantly as the per cent level of added wheat bran increased from 5 to 20 per cent. This may be due to the high fibre content (44.00g/100g) in wheat bran. The results are in agreement with previous research worker Nalawade (2014) who reported addition of wheat bran in *Gulabjamun* increased fibre content from 0.55 to 3.25 per cent, respectively.

Carbohydrate:

Carbohydrate content of control *Gulabjamun* T_1 (38.48 %) and *Gulabjamun* blended with wheat bran T_2, T_3, T_4 and T_5 were (39.04, 39.92, 40.59, 41.27), respectively. The lowest carbohydrate content was recorded for treatment T_1 (38.48 %). The highest Carbohydrate content was recorded for treatment T_5 (41.27 %). The carbohydrate content of *Gulabjamun* blended with wheat bran obtained in the different treatment combinations were found to be in significantly increasing order from T_1 to T_5. This may due to wheat bran contents 12 per cent (64 g) carbohydrates.

SNF (Solids Not Fat) :

SNF (Solids Not Fat) content of control *Gulabjamun* T_1 (57.92 %) and *Gulabjamun* blended with wheat bran T_2, T_3, T_4 and T_5 were (58.12, 57.83, 57.87, 58.27), respectively. The treatment T_5 (58.27) was significantly higher than T_2 (58.12), T_3 (57.83) and T_4 (2.74). All the treatments were found to be differed significantly from each other. Ramesh and Ranu Prasad (2006) reported that the filled milk *Gulabjamun* prepared from 3 per cent vegetable oil and 8.5 per cent SNF (T_1) was most acceptable in terms of flavour and taste, body and texture, colour and appearance as well as with higher overall

Table 2(a) : Description of values obtained by textural analysis of *Gulabjamun* blended with wheat bran

Sample No.	Peak positive force (cycle:1) kg	Positive area (Cycle:1) kg. sec	Positive area (Cycle:2) kg. sec	Negative area (Cycle:1) kg. sec	Distance from start to peak of Cycle:2 (mm)
	H	A_1	A_2	A_3	D_1
T_1	2.150	3.219	0.860	0.058	18.298
T_2	2.010	2.110	0.700	0.052	15.610
T_3	1.804	2.000	0.570	0.042	14.990
T_4	1.670	1.720	0.430	0.036	15.100
T_5	1.530	1.810	0.400	0.012	14.400

Table 2 (b) : Textural properties of *Gulabjamun* blended with wheat bran

Sample no.	Hardness (kg)	Cohesiveness	Adhesiveness	Springiness (mm)	Gumminess	Chewiness
	H	A_2/A_1	A_3	D_1	H x A_2/A_1	(H x A_2/A_1) x D_1
T_1	2.154	0.2660	0.060	18.400	0.5775	10.620
T_2	2.000	0.2550	0.056	16.200	0.5810	9.200
T_3	1.900	0.2500	0.48	15.010	0.5335	8.005
T_4	1.790	0.2460	0.30	16.100	0.4730	7.680
T_5	1.520	0.2400	0.10	14.800	0.4110	7.300

acceptability score. Thus it may be concluded that the filled milk *Khoa* based *Gulabjamun* (T_1) prepared from milk having 3 per cent vegetable oil and 8.5 per cent SNF was the best.

Textural properties of *Gulabjamun*:

Texture is an important attribute of *Gulabjamun* that contributes in deciding the acceptability by the consumers. Instron textural profile analysis (TPA) of *Gulabjamun* was taken at different stage. A P36R cylindrical probe with 5 mm/s and 50 per cent compression was taken for TPA. From the resulting force-time curves, various textural characteristics such as, hardness, cohesiveness, adhesiveness, springiness, gumminess and chewiness were calculated using the Texture Expert Exceed software (v 2.55) supplied by the manufacturer along with the instrument. The results pertaining to textural properties of *Gulabjamun* is presented in following Table 2 (a) and (b) and discussed in following paragraphs.

Hardness :

The hardness of control *Gulabjamun* (T_1) was found highest compared to other treatment and treatment T_5 was least hard. This represents that addition of wheat bran reduces the hardness of *Gulabjamun*. Highest hardness of T_1 treatment may be due to higher *Khoa* content of *Gulabjamun* and lower moisture content. Hardness of *Gulabjamun* depends upon various factors including moisture content and mineral content. Yawale and Rao (2012) studied textural profile analysis of effect of maida and baking powder level in *Khoa* powder *Gulabjamun* mix and reported that hardness ranged 2.65 to 4.90 and 2.75 to 4.81 N, respectively.

Cohesiveness :

Cohesiveness is the ratio of area under the second bite curve before reversal compression to that under the first bite curve. In terms of cohesiveness, T_2 treatment of *Gulabjamun* showed superior results with highest cohesiveness. Adhikari (1993) studied the textural characteristics of *Khoa* and *Gulabjamun* made from cow's milk reported that cohesiveness of laboratory and market *Gulabjamun* 0.35 and 0.39, respectively. Yawale and Rao (2012) studied textural profile analysis of effect of maida level in *Khoa* powder *Gulabjamun* mix and reported that cohesiveness ranged 0.25 to 0.30.

Adhesiveness :

Adhesiveness is related to the sensory stickiness and indicated by a negative peak following the first peak. Adhesiveness is highest for treatment T_1 and lowest for treatment T_5. Adhikari (1993) studied the textural characteristics of *Khoa* and *Gulabjamun* made from cow milk *Khoa* reported that adhesiveness of laboratory and market *Gulabjamun.* Rasane *et al*. (2012) reported that variation in adhesiveness of market samples of *burfi* may be due to variation in sugar content.

Springiness :

The springiness depends on factors such as heat treatment and degree of firmness. There was significant difference among the treated sample T_1, T_2, T_3, T_4 and T_5. However, the treatment T_1 showed highest score as compared to treatments T_2, T_3, T_3 and T_5. Yawale and Rao (2012) studied textural profile analysis of effect of maida and baking powder level in *Khoa* powder *Gulabjamun* mix and reported that reduce the level of maida decrease springiness of *Gulabjamun*.

Gumminess :

Gumminess is related to primary parameters of hardness and cohesiveness and is obtained by multiplication of these two parameters. Among all treatments, T_2 containing highest gumminess, while lowest values were observed in case of treatment T_1, T_3, T_4 and T_5. Patel *et al*. (2006) reported that very high gumminess in plain peda prepared by traditional method.

Chewiness :

Chewiness refers to the energy required to masticate food into a state ready for swallowing and is a product of gumminess and springiness. Chewiness is one of the most important textural properties of *Gulabjamun*. The addition of wheat bran significantly affected the chewiness of *Gulabjamun*. Among all treatment, T_5 showed lowest chewiness while highest values were observed in case of control *Gulabjamun* T_1. Adhikari (1993) studied the textural characteristics of *Khoa* and *Gulabjamun* made from cow's milk reported that chewiness of laboratory and market *Gulabjamun* 12.35 and 17.53 mN mm, respectively.

Conclusion:

From the data of present investigation it was observed

that, addition of wheat bran in *Gulabjamun* increased moisture, ash, carbohydrate and fibre content significantly in finished product while Per cent ash, fat, protein and total solid content was decreased significantly due to increase in rate of addition of wheat bran. Texture profile analysis of product revealed that addition of wheat bran in *Gulabjamun* progressive decreased hardness towards higher of incorporation. 20 per cent level of wheat bran in *Gulabjamun* decreased the score for cohesiveness, adhesiveness, gumminess and chewiness.

LITERATURE CITED

Adhikari, A.K. (1993). Microstructure and Texture of Khoa and Gulabjamun Made from Cow's Milk. Heat Induced Changes During Processing and Frying. *J. Sci. Food Agric.*, **61**: 7-15.

Aggrawal, A.C. and Sharma, R.M. (1961). *A laboratory manual of milk inspection* 4th Ed. Asia Publishing House, Bombay.

Aneja, R.M., Mathur, B.N., Chandan, R.C. and Banerjee, A.K. (2002). *Desiccated milk based products in technology of Indian milk products*. Published by P. R. Gupta,Dairy India Yearbook, Delhi (India): 122-125.

A.O.A.C. (1975). *Official methods of analysis*, 12th Ed. Association of Official Analytical chemists, Washington, DC.

BIS 1997. IS: 11602 (1986), Reaffirmed 1997 . Compositional specifications for packed guiabjamun. Indian standard institution, ManakBhavan, New Delhi (INDIA).

De, S. (1991). *Indian dairy products*. Outline of Dairy Technology. Oxford University Press, Bombay: 385- 516.

ISI: 1479 (Part II) (1961). Chemical Analysis of Milk. Indian Standard Institution, ManakBhavan, New Delhi (INDIA).

ISI: (2785) (1964). Specification for Ice-cream, Indian Standard Institution, ManakBhavan, New Delhi (INDIA).

ISI: (1981). *Hand Book of Food Analysis*. XI Indian Standard Institution, ManakBhavan, New Delhi (INDIA).

Kumar, P., Yadava, R. K., Gollen, B., Kumar, S., Varma, R. K. and Yadava, S. (2011). Nutritional Content and Medicinal Properties of Wheat: A Review. *Life Sci. & Medicine Res*. (LSMR), **22**: 1-10.

Nalawade, M.R. (2014). Studies on Preparation of Gulabjamun Blended with Wheat Bran M.Sc. (Ag.) Thesis, Marathwada Agricultural University, Parbhani, M.S. (INDIA).

Panse, V. G. and Sukhatma, P. V. (1985). *Statistical methods for agricultural workers*. 4th Ed. ICAR Publication, New Delhi (INDIA).

Patel, H.A., Salunke, P. and Thakar, P.N. (2006). Chemical, microbiological, rheological and sensory characteristics of Peda made by traditional machanized methods. *J. Food Sci. & Technol.*, **43** (2): 196-199.

Rahate, R.C. (1993). Effect of binding material from different sources on quality of Rassogolla. M.Sc. Thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, M.S. (INDIA).

Rasane, P., Arvind and Jha, A. (2012). Sensory and textural profile analysis of *Burfi* sample manufactured in Varanasi. *J. Dairying Foods & H.S.*, **3** (3): 168-172.

Singh, A.K., Kadam, D.M., Saxena, M. and Singh, R.P. (2011). Effect of soy flour supplementation on the quality and shelf life of *Gulabjamuns*. *Internat. J. Sci. & Nutrition Engg.*, **1**(1) : 11-17 (DOL:10.5923/j.food.20110101.04)

Yawale, P.A. and Rao, J.K. (2012). Development of *Khoa* powder based Gulabjamun mix. *Indian J. Dairy Sci.*, **65** (5):361-367.

WEBLIOGRAPHY

NDDB Statistics (2014). Milk Production in India, *www.nddbstatistics.com*. Gujarat.

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