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Physico-Chemical Study of *Rasogolla* Prepared *by* Using *Isabgol* (*Plantago ovata*)

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ABSTRACT
Rasogolla was prepared by using isabgol powder at different proportions. The finished product was subjected for physico-chemical analysis. The acidity was 0.64, 0.49, 0.34 and 0.32 per cent; pH content was 6.05, 6.30, 6.37 and 6.52; fat 4.50, 4.42, 4.35 and 4.32 per cent; protein 4.80, 5.17, 5.27 and 5.39 per cent; total sugar content was 34.96, 34.90, 34.84 and 34.81 per cent; moisture 54.84, 54.54, 54.51 and 54.43 per cent; total solids content were found to be 45.16, 45.45, 45.48 and 45.56 per cent; ash per cent in isabgol rasogolla were 0.90, 0.97, 1.02 and 1.05 per cent and sugar syrup absorption was 78.73, 78.95, 79.92 and 81.00, for treatment T_1, T_2, T_3 and T_4 respectively. The textural properties of rasogolla were studied and recorded the score for hardness was found to be 2.627, 0.503, 0.358 and 0.958 g, cohesiveness was found to be 0.84, 1.51, 1.04 and 0.85, elasticity was found to be 69.74, 69.78, 69.793 and 69.79 mm, chewiness was found to be 153.89, 53.08, 26.06 and 57.17 kg per second (g/s) and gumminess of the finished product was found to 2.20, 0.75, 0.36 and 0.81 (kg) for treatment T_1, T_2, T_3 and T_4 respectively.
KEY WORDS*- Channa, Rasogolla, Isabgol (Plantago ovata) and physico-chemical analysis.*

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INTRODUCTION

Rasogolla is a famous indigenous dairy based sweet of India and very popular particularly in West Bengal and Odissa. It is snow white in colour, possesses a spongy, chewy body and smooth texture having ping-pong ball size and shape. On all festive occasions it is widely accepted as most popular sweet and all ages of people like it. [22]. Normally, cow milk is preferred for *channa* preparation due to it's a soft body and smooth texture, both of which make *channa* suitable for preparation of high grade sweets such as *rasogolla* and *Sandesh*. In general *rasogolla* is prepared from soft, fresh cow milk *chhana*. Kneading of *chhana* to smooth paste is first step in *rasogolla* making. The smooth paste is portioned and rolled between palms to form balls of about 15mm diameter each weighing about 8–10 g in weight. Each ball should have smooth surface without visible cracks on surface. On an average, one kg *chhana* yields 90 – 100 *rasogolla* balls. These *rasogolla* balls are cooked in sugar syrup of approximately 50° brix. Heating is regulated to maintain stability of the balls. Balls are cooked for 14–15 min. During cooking small amount of water is continuously added to maintain syrup concentration. This makes up for the loss of water due to evaporation. After cooking *rasogolla* balls are transferred to dilute sugar syrup at 60°C for texture and colour improvement. After 30min stabilized balls are transferred to 60° brix syrup for 1-2 hours, followed by final dipping in 50° brix syrup. *Rasogolla* prepared from three types of *channa* such as A (from cow milk), B (From Buffalo milk), and C (From a mixture of cow and Buffalo milk). They prepared *rasogolla* by using different ingredients *viz*., for a type *rasogolla* cow milk *channa*-240 g, sugar-1000 g, flour-17 g and water-1500 g, for B type *rasogolla* buffalo milk *channa*-280 g, sugar-1166.7 g and flour-20 g and water 1800 g. For C type *rasogolla channa*-260 g, sugar-1083 g, flour-18.5 g and water 1600 g [2]. Sugar free *rasogolla* developed by using three types of coagulants *viz*., lactic acid, sour whey and sour defatted & deproteinized whey and four type of cooking medium such as sugar syrup 50° brix, whey syrup 50°brix,

defatted & deproteinized whey syrup 50° brix and fresh whey without sugar. The three different type of dipping medium observed i.e. sugar syrup, fresh whey having nonnutritive sweetener and defatted & deproteinized whey syrup. They utilized the sour whey as coagulant, fresh whey (without sugar) as cooking medium and fresh whey having nonnutritive sweetener as dipping medium were found suitable for sugar free *rasogolla* preparation [6].

Many innovations are developed in rasogolla and till research on it is being throughout the world. The major emphasis behind that is to develop nutrationality as well as functionality of the products.

Psyllium is known to help soften stool, it is an effective way to reduce the pain and discomfort associated with hemorrhoids. *Psyllium* causes a feeling of fullness, which can reduce our sensation of hunger. Short term placebo controlled studies showed that consumption of 7-10 g *Psyllium* /day lowers serum total cholesterol concentrations 4- 11 per cent and serum LDL cholesterol concentrations 6-18 per cent below placebo control concentrations. *Psyllium* was shown to stimulate bile acid synthesis (7 alpha hydroxylase activity) in animal models and in humans, which leads to reduction of serum cholesterol. In a study by [21], they proposed that the unfermented gel isolated from *Psyllium* containing stools functions as an emollient and lubricant. Other studies suggested that the various constituents of *Psyllium* (such as soluble fibers, linoleic acid, and alkaloids) can help lower blood sugar levels. The bakery products are prepared from different dosage of *Psyllium* husk and literature suggested that replacement of *Psyllium* husk up to 50 per cent might be possible without detrimental change in quality and also explained the hypo-cholesterolemic worth of *Psyllium* considering gender and hormonal status in men and pre and postmenopausal women In postmenopausal women, administrated *Psyllium* (15 g/day) for six weeks significantly lowered the total cholesterol concentration (5.2 per cent) whereas, in premenopausal women (1.3 per cent) whilst, no significant differences observed in triglycerides, apolipo protein A1 and apolipo protein B concentration in pre and postmenopausal women. They concluded that postmenopausal woman can be benefitted from addition of *Psyllium* husk in their diet for reducing coronary risk [10]. The high levels of soluble fiber and linoleic acid in *Psyllium* stimulate the production of cholesterol-lowering bile acids and reduce the amount of cholesterol absorption by the body [11]. The rheological characterization of *Isabgol* husk, gum katira hydrocolloids and their blends. The miscibility of isabgol husk and gum katira blends in equal proportions as well as in higher concentrations of one another was found at studied thermal conditions. The blends and their components such as *Isabgol* husk and gum katira were found to be pseudo plastic in viscosity behavior as, on increasing the shear stress, the viscosity was decreased down [24].

MATERIAL AND METHODS

The present investigation was carried out at the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, (MS). For this investigation, the material used and methods employed were as below.

Treatment Combinations

For preparation of *rasogolla* from cow milk *channa* kneading with isabgol powder following treatment combinations were finalized on weight basis as follows:

T_1 - Cow milk *channa*
TH_2 - Cow milk *channa* 99.5% + *isabgol* 0.5 %
TH_3 - Cow milk *channa* 99% + *isabgol* 1.0 %
TH_4 - Cow milk *channa* 98.5% + *isabgol* 1.5 %

The different levels were tried and compared with control (T1).

Preparation of *isabgol* added *chhana* for *rasogolla*

The *chhana* was prepared in combination with *isabgol* as per method describe by De [9] with slight modification. For this purpose the *isabgol* was added in two stage i.e. before addition of coagulant (First condition) and after addition of coagulant and before draining of whey (Second condition), whereas the control was carryout without *isabgol*.

Standardized Cow milk (4% fat and 8.5% SNF)
↓
Boiling of milk
↓
Cooling to 70-72 0C
↓
Addition of isabgol as per treatments combination (First Condition)
↓
Addition of Coagulant (@1% Citric acid) /Coagulation
↓

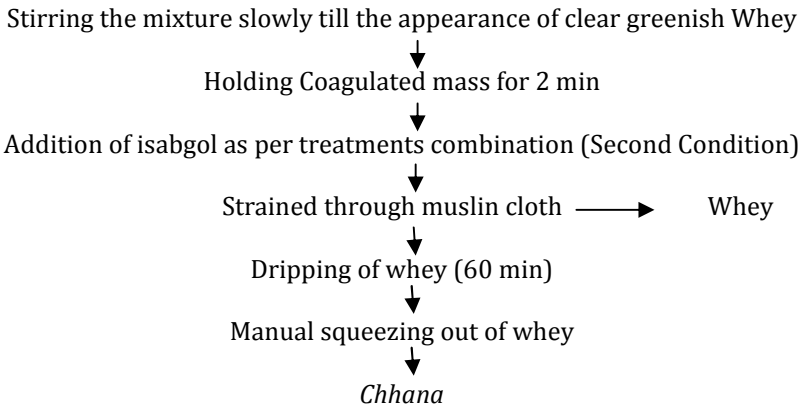

Fig.1 Flow chart preparation of *chhana*

Procedure :

In the investigation *chhana* was prepared by the traditional method from the standardized cow milk having 4% fat and 8.5% SNF as per method describe by De [9] with slight modification. During the preparation of *chhana* milk was boiled for two minutes on (liquid petroleum gas) stove and subsequently cooled to 70-72^{0}C. After that, the *isabgol* was added as per the treatment combination in two stage i.e. before addition of coagulant (First condition) and after addition of coagulant and before draining of whey (Second condition) through muslin cloth, every time only one condition was followed, the citric acid was added @ 1% citric acid and the mixture was stirred slowly till the appearance of clear greenish whey. Then whey was drained out through a double layer muslin cloth and left in the straining cloth for one hour for dripping out the whey. It was then manually squeezed so as to keep the moisture content between 55-65% and was weighed to get the yield value.

Preparation of rasogolla

The *rasogolla* was prepared by using *chhana* prepared in combination with *isabgol* as per method describe by Aneja and Mathur [3] as shown in flow diagram 2.

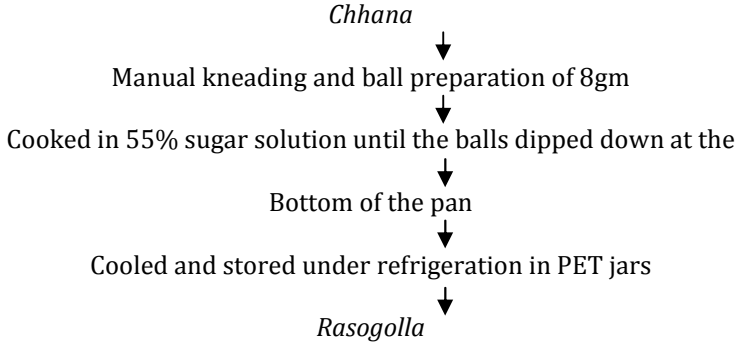

Fig. 2 Flow chart of preparation of *rasogolla*

Procedure

After the preparation of soft chhana by using isabgol @ 0.5, 1.0, and 1.5 gm as per the treatments then proper kneading of chhana was done to mix isabgol powder and then prepare ball equal size of 8-10 gm approximately ball form it. The ball were cooked in 55% sugar syrup until to dipped down at the bottom of the pan with slow steaming and stored under refrigerated in pet jar having sugar syrup of 40% sugar. After soaking ball in sugar syrup for 1 hrs and then physico-chemical studied was conducted of products.

Evaluation of physico-chemical of *rasogolla*

Rasogolla samples of different treatments were subjected for physic-chemical analysis *viz*., titratable acidity, pH, fat, protein, total sugar, moisture, total solid and ash.

Titratable acidity

Titratable acidity (%) of *rasogolla* was determined in IS: 1479 [14] Part-I.

$$\text{Titrable acidity (\% by volume)} = \frac{9 \times V_1 \times N}{V_2}$$

Where,

V_1 = Volume in ml of the standard sodium hydroxide solution required for titration.

V_2 = Volume in ml of *rasogolla* taken for the test.

N = Normality of the standard sodium hydroxide solution.

Determination of pH

The pH of *rasogolla* was measured by using digital pH meter at a temperature of 25^0C. Firstly the pH meter was standardized by using standard buffer solution of pH 4, 7.2 and 9. The electrode of pH meter was directly dipped into the diluted sample of *rasogolla,* dilution was done by using double distill water and records the reading show on the screen of pH meter.

Determination of fat

Fat content of *rasogolla* was determined Gerber's method described in IS: 1224 [13].

Determination of protein

The protein content of *rasogolla* was determined by method described in A.O.A.C. [1].

$$\% \text{ N in sample} = \frac{\text{Sample burette reading (ml) - Blank reading (ml)}}{\text{Weight of sample (g)}} \times 100$$

Protein (%) = Percent nitrogen in sample x 6.38

Determination of total sugar

Total sugar content of *rasogolla* was determined by the volumetric (lane-Eynon) method as a described in IS: SP: 18 (Part XI) [16].

$$\text{Sucrose \%} = \frac{20\ W_1}{W_2} \left[\frac{2f_2}{V_2} - \frac{f_1}{V_1} \right]$$

Where,

W_1= Weight in mg of sucrose corresponding to 10 ml of Fehling's solution

W_2= Weight in gm of the material taken for the determination

f_1= Dilution factor for solution A_2 from A_1

f_2= Dilution factor for solution B_2 from B_2

V_1= Vol. in ml of solution B_2 corresponding to 10 ml of Fehling's solution

V_2= Vol. in ml of solution A_1 corresponding to 10 ml of Fehling's solution

Determination of moisture

Moisture content of *rasogolla* was determined by the method described in IS: SP (Part XI) [16].

$$\text{Moisture\% (by weight)} = \frac{\text{Loss in weight of } \textit{rasogolla}}{\text{Weight of } \textit{rasogolla} \text{ sample taken}} \times 100$$

Determination of total solid

Total solids of *rasogolla* was determined by the method described in IS: SP (Part XI) [16].

$$\text{Total solids \%} = \frac{\text{Weight of residue}}{\text{Weight of sample}} \times 100$$

Determination of ash

The ash content of *rasogolla* was determined by the method described in IS: SP (Part XI) [16].

$$\text{Total Ash \% (by weight)} = \frac{W_1 - W}{W_2 - W} \times 100$$

Where,

W=weight of the empty crucible

W_1=weight of the crucible with ash

W_2=weight of the crucible with in gm

Statistical Analysis

In all four replications were carried out. The data obtained were analyzed statistically by using completely randomized design (CRD) as per Panse and Sukhatme [23] and software developed by D.S. Hooda & R.C. Hasija as Statistical Software Package for Agricultural Research Workers.

RESULT AND DISCUSSION

Physico-chemical properties of *isabgol rasogolla*

In present investigation on an average acidity was recorded 0.64, 0.49, 0.34 and 0.32 per cent for treatment T_1, T_2, T_3 and T_4, respectively. The treatments T_1 was found significantly differed from others. It was further observed that the highest acidity was observed in treatment T_1 (0.64) which was significantly superior over the treatment T_2, T_3 and T_4 and then decreased continuously in experimental treatment

indicate that due to isabgol acidity is lower down might be due the destructions and absorption of ionic molecules by the addition of *isabgol*.

Recorded result similar finding with Haque *et al*. [12] studied comparison of *rasogolla* made from cow milk, buffalo milk and mixture of cow and buffalo milk and noticed that acidity of *rasogolla* of cow milk was 0.75%, buffalo milk *rasogolla* acidity 0.70% and mixture of cow and buffalo milk acidity was 0.71% and David [8] studied effect of different level of whey protein concentrate on yield and physico-chemical properties of *rasogolla* and observed that as Whey Protein Concentrate increased from 1.0 % to 1.5% acidity of *rasogolla* was decreased from 0.18 % to 0.16%. The fluctuation in acidity with other scientist, which was found than the present findings might be due to the different ingredients that the present study.

The average pH was examined 6.05, 6.30, 6.37 and 6.52 for treatment T_1, T_2, T_3 and T_4, respectively. It was further observed that the highest pH was observed in treatment T_4 (6.52) and lower in treatment T_1.

Similar findings were observed with Haque *et al*. [12]. He reported from the comparison of *rasogolla* made from cow milk, buffalo milk and mixture of cow and buffalo milk that pH of *rasogolla* of cow milk was 6.60, buffalo milk was 6.7 and mixture of cow and buffalo milk was 6.50.

The average fat content in *rasogolla* was found to be 4.50, 4.42, 4.35 and 4.32 per cent for treatment T_1, T_2, T_3 and T_4 respectively. The average range of fat content in *rasogolla* was 4.32 to 4.50 per cent. The highest fat content was recorded for treatment T_1 i.e. 4.50 and the lowest fat content was recorded for treatment T_4 i.e. 4.32 per cent. The control treatment recorded highest fat per cent as compared to other treatments, which reduced subsequently in *isabgol* added treatments. Above observations clearly indicate that, as the adding of *isabgol* in to the cow milk was increased, the fat content in the finished product was decreased might be due to the lower content of fat in *isabgol* than the milk.

The scientist worked on different aspects of *rasogolla* were found somewhat similar values for ash content in *rasogolla* studied Lokhande *et al*. [20] and Islam *et al*. [17].

The average protein content of the finished product was found to be 4.80, 5.17, 5.27 and 5.39 per cent for treatment T_1, T_2, T_3 and T_4, respectively. All four treatments were significant among each other indicate that the *isabgol* contributed protein contents of rasogolla in increasing order. The highest protein content was recorded for treatment T_4 i.e. 5.39 per cent which decreased sequin-sly in treatment T3, T_2 and T_1. The lowest protein content was recorded for treatment T_1 i.e. 4.80 per cent. Similar findings were observed with Garg *et al*. [11]. They studied development of mucilaginous spongy desert – A herbal *rasogolla* prepared from cow milk and noticed that protein percentage was more (13.8%) with addition of *isabgol* powder than control i.e. without *isabgol* powder (6%).

The average total sugar content *rasogolla* were 34.96, 34.90, 34.84 and 34.81 per cent. The total sugar content was found to be highest in treatment T_1 (34.96) which were significantly higher than T_2, T_3 and T_4 respectively. The values recorded for total sugar content in the present investigation were comparable with Lokhande *et al*. [20] revealed the formulation of *rasogolla* from cow milk blended with safflower milk and noticed that as percentage of safflower milk increased from control (100% cow milk + 0% safflower milk) to 50% cow milk + 50% safflower milk, the total sugar content was decreased from 43.12 to 39.89%.

The average moisture content of the product *isabgol rasogolla* was found to be 54.84, 54.54, 54.51 and 54.43 per cent for treatments T_1, T_2, T_3 and T_4, respectively. All treatments were not significantly differed from each other except T_1. It was also observed that the moisture content was in decreasing order from treatment T_1 to T_4. This might be due to the increase in the proportion of *isabgol*. The values recorded in moisture content in the present investigation were comparable with Kumar and Chandra [19] studied standardized the technology for preparation of *channapodo* and noticed that as the ratio buffalo milk was increased from 1:1 with cow milk to 1:3 the moisture percent was decreased from 29.030% to 27.003%.

The average total solids content of the finished product were found to be 45.16, 45.45, 45.48 and 45.56 per cent for treatment T_1, T_2, T_3 and T_4, respectively. The highest total solids content was recorded for treatment T_4 i.e. 45.56. The lowest total solids contents was recorded for treatment T_1 i.e. 45.16. It was observed from above findings that as the adding of *isabgol* increased the total solids content of the finished product from treatment T_2 to T_4. Control was significantly differed with the other treatments. The values recorded in total solid content in the present investigation were comparable with Haque *et al*. [12]. He reported from the comparison of *rasogolla* made from cow milk, buffalo milk and mixture of cow and buffalo milk that total solid content in *rasogolla* of cow milk was 45.08, buffalo milk was 58.20 and mixture of cow and buffalo milk was 51.45.

The average ash per cent in *isabgol rasogolla* were 0.90, 0.97, 1.02 and 1.05 per cent, respectively. All the treatments were found to be significantly differed from each other. The values recorded were found to be increasing order from treatment T_1 toT_4. This might be due to adding of *isabgol* in increasing level. The ash per cent was highest in T_4 samples i.e. 1.05 and lowest in control sample 0.90 percent in *isabgol*

rasogolla. The scientist worked on different aspects of *rasogolla* were found somewhat similar values for ash content in *rasogolla* studied by [4-7, 12, 18, 19].

Table.No.1. Physico-chemical properties of *rasogolla* prepared by using *isabgol* powder score recorded mention blow table.

Sr. No.	Parameters	Treatments					
		T_1 Control	T_2 0.5%	T_3 1%	T_4 1.5%	S.E. ±	C.D. at 5%
1)	Acidity	0.64^{a}	0.49^{b}	0.34^{c}	0.32^{c}	0.010	0.030
2)	pH	6.05^{c}	6.30^{b}	6.37^{b}	6.52^{a}	0.031	0.095
3)	Fat	4.50^{a}	4.42^{ab}	4.35^{b}	4.32^{b}	0.038	0.117
4)	Protein	4.80^{d}	5.17^{c}	5.27^{b}	5.39^{a}	0.021	0.065
5)	Total sugar	34.96^{a}	34.90^{b}	34.84^{c}	34.81^{c}	0.009	0.029
6)	Moisture	54.84^{a}	54.54^{b}	54.51^{b}	54.43^{b}	0.057	0.177
7)	Total solids	45.16^{b}	45.45^{b}	45.48^{a}	45.56^{a}	0.056	0.175
8)	Ash	0.90^{d}	0.97^{c}	1.02^{b}	1.05^{a}	0.004	0.013

The observations are the average of four replications

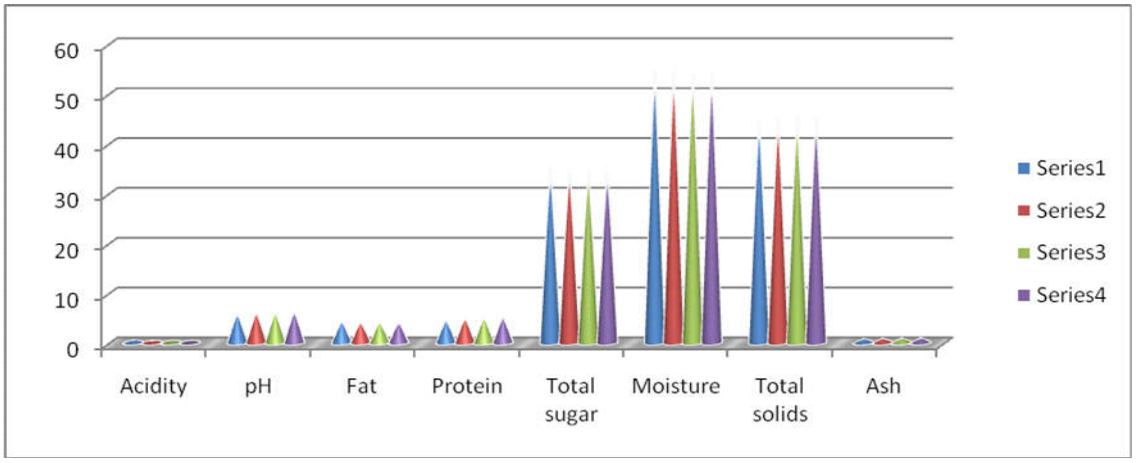

Fig.No. 1 Graph on physico-chemical analysis of *rassogalla* preapared by using *isabgol* powder

CONCLUSION

In present investigation concluded that the cow milk is preferred to prepared *rasogolla* due to the soft structure of cow milk casein. The *rasogolla* prepared by using *isabgol* has thirty per cent more yield as compared to the cow milk *rasogolla* without depleting the sensory and physico-chemical properties of original *rasogolla* and supplemented the health benefit effect of *isabgol*. This study also give hint for further study on suitability of buffalo milk for the preparation of *rasogolla* or other *chhana* based milk products by using *isabgol*, which might be help for softening the structure of *chhana*.

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