Development & Standardization of Low Calorie Rasogulla by using Artificial Sweeteners

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Abstract **- Rasogulla is a popular Indian confectionary product made from coagulating milk by citric acid. The experiment was carried out with the aim to formulate low calorie Rasogulla by using artificial sweeteners such as sorbitol and sucralose. Milk samples were standardized by using combination of skim milk & tonned milk. viz. 0% fat, 1.5% fat, 2% fat, 2.5% fat & 4% fat. Experimental samples and control samples of rasogulla are analyzed for physicochemical and sensory properties. The study was conducted to lower the calories in rasogulla by formulating sucralose and sorbital content of 0, 25, 50, 75, and 100g for both sweeteners. From formulation of sorbital content rasogulla sample 2 was selected according to physicochemical and sensory analysis as it contains 50% sorbital and 50% sugar. From sucralose formulation sample 2 was selected according to physicochemical & sensory analysis as it contains 50% sucralose and 50% sugar. Rasogulla prepared from sucralose provides 163.5 kCal / 100g and sorbitol rasogulla provides 172.34 kCal / 100g whereas control rasogulla made from cow's milk provide 213 kCal / 100g. Low calorie Rasgulla with acceptable quality can be prepared with 50:50 ratio of sorbitol to sugar & also 50:50 ratio of sucralose to sugar.**

Index Terms **- Artificial sweetener, Physico-chemical properties, Rasogulla, Sensory Analysis, Sorbitol, Sucralose.**

I.INTRODUCTION

Among the indigenous dairy products, chhana is a well-known coagulated milk product obtained by acid coagulation of hot milk, which is extensively used as a base material for preparation of variety of Indian delicacies. Cow milk is usually preferred since it yields a product with soft body and smooth texture, the quality of which varies depending upon type and composition of milk, conditions of coagulation, the amount of solids lost in whey and the moisture retained in the product.[3].

Channa, Indian counter part of soft cottage cheese, is a milk product obtained by acid coagulation of hot milk followed by drainage whey. It is a rich source of milk fat, protein, carbohydrate and vitamin A and vitamin D [9]. In the preparation of channa, the recovery of total milk solid and yield of channa is influenced by the heat treatment given to milk prior to acidification, acidity of milk acid mixture at the time of coagulation and residence time of coagulum before separation of milk solids, besides the type of milk and its initial composition [4]. Heating causes denaturation of whey protein and they get associated with casein micelles. The degree of denatured whey proteins depend on the time-temperature combination during the heating and is mainly determined by the maximum temperature to which milk is heated [12]. Rasogulla is the most important pleasant and charming foods to most of the people of the Indian In Eid, Puja, birthday, marriage ceremony and in any party or any kind of entertainment either in domestic or national level, rasogulla [14]. Varieties of rasogolla are available in the market. Each type differs from the other with respect to taste, body and texture, method of preparation and packaging. Canned rasogulla usually is made for sale to distant places and export purpose [11].

Rasogulla faces a problem of high sugar content (that is about 50%) as diabetic people cannot enjoy the sweet. Nonetheless, consumers who want the taste of sweeteners without added energy may select non-nutritive sweeteners to assist in the management of weight, diabetes and cardiovascular diseases [4]. Hence for diabetic and health-conscious consumers reformulation of rasogulla is required [11].

II. MATERIAL & METHODS

The experimental work on "Low calorie Rasgolla" was carried out in the laboratory of Department of food science and technology, Shivaji University, Kolhapur. Tonned milk, skim milk powder, maida, baking powder, sugar, citric acid, sorbitol and sucralose were purchased from local market.

STANDARDIZATION OF MILK

Standardization of milk is done by using Pearson's square method [6]. Five samples of milk were prepared viz. Skim milk (~ 0% fat), 2% fat milk, 2.5% fat milk and 3% tonned milk was shown in table 1.

Table 1: Standardization of milk

Samples	Tonned milk (ml)	Skim milk (ml)	Fat % of milk
(M_1) skim milk	-	100	0.007%
(M_2) 1.5% fat milk	50	50	1.5%
(M_3) 2.0% fat milk	66.66	33.33	2%
(M_4) 2.5% fat milk	83.33	16.66	2.5%

III. PREPARATION OF RASOGULLA

Experimental channa and rasogulla was prepared by the method as shown in figure no 1[11], while control rasogulla was prepared in the same manner except that the milk fat was standardized to 4%.

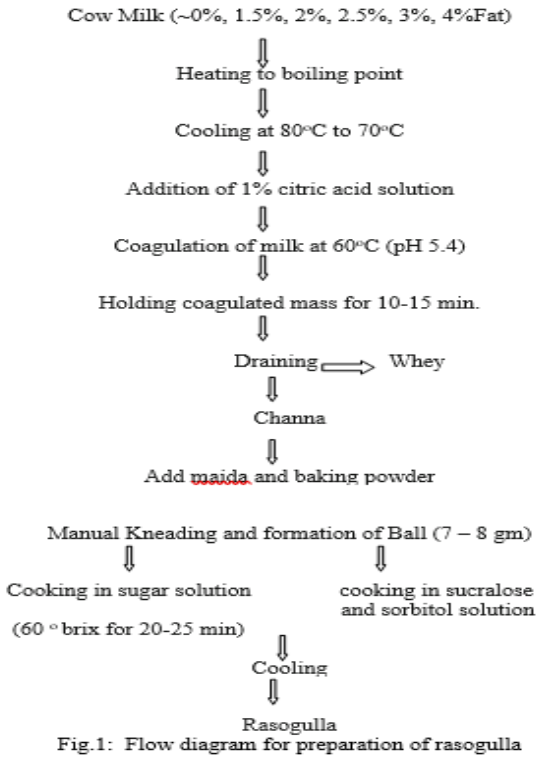

Fig.1: Flow diagram for preparation of rasogulla

IV. PHYSICO-CHEMICAL ANALYSIS OF STANDARDIZED CHANNA

Channa was prepared by using standardized milk samples. The amount of moisture content of all the four formulated samples was higher than that of control sample.

The protein content sample C_1 - 17.70 was higher than control C_0 -11.34, because of the C_1 contains 100% skim milk which was rich source of protein. As sample C_2 contains 14.26 % protein which was due to incorporation of 50% tonned milk and 50% skim milk, but it was higher than control sample. Sample C_3-12.01 was higher than control sample C_0 -11.34, because it contains 66.66% tonned milk and 33.333% skim milk. The sample C_4 contains 11.69 % protein which was near to the control sampleC_0 11.34% protein due to it contains 83.33%tonned milk and 16.66% skim milk.

The fat content sample C_1 – 1.5 was lower than control C_0 -6.8, because of the C_1 contains 100% skim milk which was poor source of fat. As sample C_2 contains 3% fat which was due to incorporation of 50% tonned milk and 50% skim milk, but it was lower than control sample. Sample C_3-3.58 was lower than control sample C_0 -6.8, because it contains 66.66% tonned milk and 33.33% skim milk. The sample C_4 contains 4.2 % fat which was near to the control sample C_0 6.8% fat due to it contains 83.33%tonned milk and 16.66% skim milk.

Carbohydrate content of formulated samples was lower than control C_0 sample and the values were 23.67%, 28.14%, 32.75%, 29.98% and 36.87%.

Ash content of four formulated samples was lower than control C_0 sample and the values were 0.73%, 1.2%, 0.9%, 0.88% and 1.39%. And values were given in table 2.

Table 2: Physico-chemical analysis of standardized channa

Sample	Moisture (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Ash (%)
C_0	43.60	11.34	6.8	36.87	1.39
C_1	56.4	17.70	0.1	23.67	0.73
C_2	53.4	14.26	3	28.14	1.2
C_3	50.76	12.01	3.58	32.75	0.9
C_4	53.25	11.69	4.2	29.98	0.88

Physico-chemical analysis of standardized Rasogulla:

The values given in table 3 shows that the moisture content of rasogulla sample R_1 55.44%and R_2 59.50%were compared with control R_0 54.86% samples it was observed that there was slight increase in the values of moisture content, but the sample R_3 and R_4 contains 50.74% and 53.23% moisture was lower than control sample R_0- 54.86%.

The protein content of different rasogulla samples varied significantly the protein content of all four samples were higher than control sample that is R_1, R_2, R_3, R_4 and control R_0 was 17.76%, 18.65%, 21.31%, 23.09% and 8.56% and these reported values are nearby previous research [11].

There was significant difference among the fat content of different types of rasogulla samples observed table 3 it was observed that control sample R_0 had the highest fat content because it content more fat than that of tonned milk and skim milk.

The sample R_1 (1.5%) rasogulla has lowest fat content as compared control R_0 (7.16%) sample as it was made up of 100% skim milk. The sample R_2 (3.5%)rasogulla has lowest fat content as compared to control sample R_0 (7.16%) as it was made up of 50% skim mil 50% tonned milk. The sample R_3 (4%) rasogulla has lowest fat content as compared to control sample R_0 (7.16%) as it was made up of 33.33% skim mil 66.66% tonned milk. The sample R_4 (4.6%) rasogulla has lowest fat content as compared to control sample R_0 (7.16%) as it was made up of 16.66% skim milk 83.33% tonned milk.

The carbohydrate content of rasogulla sample R_2 - 17.35% and R_4 -18.28%, was lower than control sample R_0-28.58% because R_2 sample content was being increased due to moisture content (59.50%) and sample R_4 content higher protein (23.09%) which may affect the carbohydrate content. The sample R_1 (24.57%) and R_3 (23.35%) were near by the control R_0 (28.58%).

The ash content control R_2-1 % was found higher than control and other experimental samples.

Table 3: Physico-chemical analysis of standardized rasogulla

Sample	Moisture (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Ash (%)
R_0	54.86	8.56	7.16	28.58	0.84
R_1	55.44	17.76	1.5	24.57	0.73
R_2	59.50	18.65	3.5	17.35	1
R_3	50.74	21.31	4	23.35	0.6
R_4	53.23	23.09	4.6	18.28	0.8

Average sensory evaluation of standardized Rasogulla

1. Color

It was not differed among three samples (R_0, R_2, and R_3- 8.42) of rasogolla stastically though it was little low in R_4 -7.14. The variation in the color was probably due to formulations of milk samples. The sample R_1-7.42 scored low as control R_0-8.42 due to it is made from 100% skim milk.

2. Taste

There was no significant difference among the taste score of samples R_0-8.14, R_2-8, and R_3-8.14.the sample R_1-6.14 and R_4-6.42 shows lower score than control R_0-8.14.

3. Texture

The highest score was found for sample R_3-8 due to soft body and smooth texture. As sample R_1-6 and R_4-5.71was found poor in texture as compared to Control sample R_0-7.5. The sample R_2-7.21 was slightly soft in texture.

4. Mouthfeel

The highest score was found for R_2- 8.14. The sample R_1-5.57 and R_4-5.57 scores very low as compared to control R_0-7.5.the sample R_3-7.85 score was slightly higher to the control R_0-7.5.

5. Overall acceptability

Although there was little difference among all samples, but all the samples were accepted by the panelist and stastically difference within overall score of different sample were not significant.

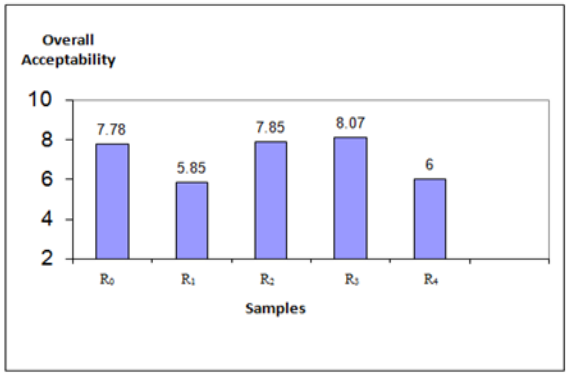

Figure 2: Graphical representation of sensory scores of standardized Rasogulla

V. FORMULATION OF SUCRALOSE AND SORBITOL

For low calorie rasogulla, sugar was replaced with sucralose and sorbitol

Table 4: Formulation of Sucralose

Sample	Sucralose (g)	Sugar (g)
R_0	-	100
Su_1	25	75
Su_2	50	50
Su_3	75	25
Su_4	100	-

Table 5: Formulation of Sorbitol

Sample	Sorbitol (g)	Sugar (g)
R_0	-	100
So_1	25	75
So_2	50	50
So_3	75	25
So_4	100	-

Average sensory analysis of low calorie rasgulla with sorbitol

1. Color

It was found that sample So_4 -8.45, So_2 8.57 and So_1 8.5 were relatively same in color as compared to control sample 8.5. But the sample So_3 varies with all the experimental sample as well as control sample. As sorbitol content increases there was decrease in sugar content.

2. Taste

There was no significant difference among the first two samples and control sample R_0. The value of So_1 8.14 and So_2 8.35 and control sample R_0 8. But the sample So_3 6.25 and sample So_4 7.28 were very low than R_0 8.

3. Texture

The texture properties of experimental values of rasgulla with sorbitol were nearby the control sample R_0 8. But sample So_2 7.9 was quite good in texture as compared to other experimental sample and it was most acceptable by the panel members.

4. Mouthfeel

No significant difference was found in the respect of Mouthfeel score of different rasgulla sample although the score was slightly higher sample So_2 8.21 than control sample R_0 8.

5. Overall acceptability

Graph showed that So_2 8 had the higher score of overall acceptability and the sample So 6.9 was very low as compared to other experimental sample as well as control sample although there was little difference among sample So_3 7.64 and So_4 7.42 then control sample R_0.

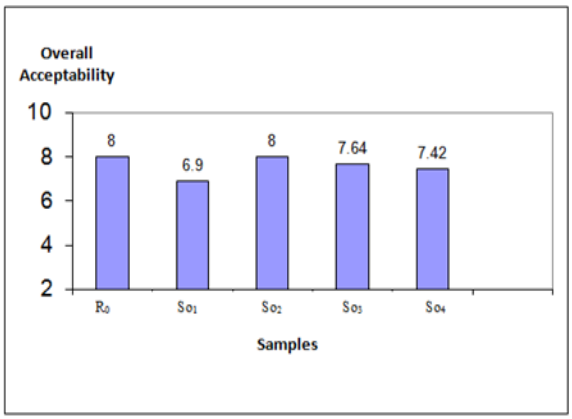

Figure 3: Graphical representation of sensory scores of Rasogulla with sorbitol

From the above average sensory evaluation it was observed that sample So_2 and So_3 were nearby values of control sample, but mostly selected sample So_2 was scored as same as R_0.

Average sensory analysis of low calorie rasgulla with sucralose

1. Color

The variation in the color varies as per the sugar content decreases and sucralose content increases. As sample Su_1-7.7, Su_2-8, Su_4-7.2 was similar to the control sample Ro- 8.5.The Su_3 -6.9 samples was very low as compared to control sample.

2. Taste

There was significant difference among the experimental samples as compared to control sample. Sample Su_2-7.8 and Su_3- 7 were similar in taste as that of control sample. The sample Su_1-6.42and Su_3-6.5 was low and poor in taste as compared control Ro-8.Due to variation in the ratio of sugar and sucralose content.

3. Texture

Sample Su_2-8 was as same as control sample Ro-8. The sample Su_1-7 was quite good in texture. For Su_3-6.5, Su_4-6.6 was very poor in texture as compared to control sampler Ro-8.

4. Mouthfeel

The sample Su_2-7.5 and Su_4-7.2 was similar value to the control sample Ro-8, but Su_1-7 and Su_3-6.5 was lower than control value.

5. Overall acceptability

Graph showed that Su_2-8 was as same as control sample Ro-8 and other samples Su_1-7.9, Su_3-6.5 and Su_4- 6.4 were less acceptable by the panel members.

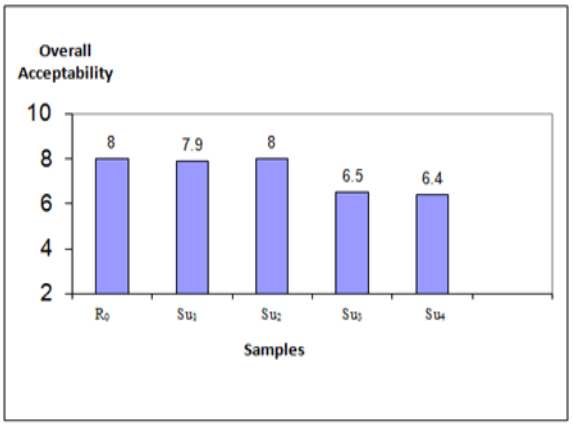

Figure 4: Graphical representation of sensory scores of rasogulla with Sucralose

VI. CONCLUSION

Rasogulla faces a problem of high sugar content (that is about 50%) as diabetic people cannot enjoy the sweet; therefore use of artificial sweeteners was used in the preparation of rasogulla. Rasogulla made from formulated standardized milk sample shows low fat content than rasogulla made from 100% cow milk. The fat was reduced up to 3% by using 50% tonned milk and 50% skim milk which was mostly accepted by the panel members. Sucralose and sorbitol were used during preparation of low calorie rasogulla; the sample 2 was selected from both sweeteners because it contains 50% sweetener and 50% sugar. These sweeteners assist in the management of weight, diabetes and cardiovascular diseases. Rasogulla prepared from sucralose provides 163.5 kCal / 100g and sorbitol rasogulla provides 172.34 kCal / 100g whereas control rasogulla made from cow's milk provide 213 kCal / 100g. A calorie reduction is possible as compared to control sample without affecting the acceptability in terms of organoleptic properties.

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