

Evaluating The Quality of Rasogulla as Cheese Balls in Sugar Syrup Prepared by Different Milk Types

Eman F. Mohamed and Neamah R. Attala

Animal Production Research Institute , Agriculture Research Center, Giza , Egypt.

Rasogulla as a cheese balls in sugar syrup was manufactured by using buffalo, cow and goat milk. The experiment was carried out with the aim to assess the quality of prepared Rasogulla. Chemical, microbiological and organoleptic properties of three types of Rasogulla samples were evaluated. Moisture, protein, fat, carbohydrate, total solids and ash contents of Rasogulla from buffalo milk recorded the highest values followed by Rasogulla prepared from goat and cow milk, respectively. Also, it can be observed that Rasogulla prepared from buffalo milk had significantly gained the highest yield than the other two types of milk. Microbiological analysis showed an absence of all pathogenic bacteria. On the other hand, organoleptic properties recorded that Rasogulla prepared from cow milk gained the highest scores, followed by goat Rasogulla and the lowest score was noted by buffalo Rasogulla.

Keywords: Rasogulla, Cheese balls, Yield of Rasogulla, Physico-chemical parameters

Introduction

Milk is the most versatile of all the animals desired food commodities and is a basic source for many of its physical forms like cheese, yoghurt, ice cream, ghee, powder milk and many other forms of fluid milk (Khan et al., 2007). Rasogolla 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, rasogolla (Tarafdar et al., 2002). It is very nutritious for accounts of its fairly high protein, fat, minerals specially calcium and phosphorus and also fat-soluble vitamins particularly vitamin A and D. Despite and Datto (1993) reported that rasogulla as the most popular Indian sweetmeats that are valued for its characteristics texture. The original Oriya Rasogullas tend to be cream-colored. Rasogulla are usually served at room temperature or colder. Modern Indian households also tend to serve them chilled. A popular variant

in Orissa and Bengal is freshly prepared hot Rasgullas. (Karunanithy et al., 2007). In Orissa, it is not uncommon to embed a single raisin or cashew inside each Rasogulla. Cardamom seeds may also be embedded to create a fragrant version. In northern India, the dish comes flavored in saffron, rosewater, and sometimes garnished with chopped pistachios. Still now no research work has yet been done in our country on the quality, and manufacturing process of Rasogulla. So the present study was planned to assess the differences in Rasogulla cheese prepared from the three types of milk which largely consumed in Egypt.

Materials and Methods

Fresh cow, buffalo and goat milk were obtained from El-Serw Animal Production Research Institute, Ministry of Agriculture.

Sugar, vinegar, rose water were obtained from local market of Giza, Egypt. Chemical composition of three types of milk was recorded in Table 1.

TABLE 1. Gross chemical composition of milks used in Rasogulla manufacture

Chemical composition	Buffalo milk	Cow milk	Goat milk
Fat%	6.1	3.5	3.97
Protein %	3.7	3.2	3.5
T.S %	15.7	12.1	12.9
pH value	6.60	6.51	6.54

Preparation of Rasogulla as cheese balls in sugar syrup

Experimental Rasogulla was prepared by the method which was modified from the methods as reported by various scientists (Aneja et al., 2002, Arora et al., 1996 and Chavan et al., 2009). Fresh buffalo's, cow's and goat's milk were Rasogulla. individually heated at 90°C and cooled at 70°C. Acid coagulation was achieved by using 1% vinegar to form sweet curd (chhana) and whey was drained by using muslin cloth and undertaking moderate pressure to remove whey. The operation carried out on chhana for Rasogolla preparation is the kneading of chhana to a smooth mass. Generally kneading is done manually by putting the chhana on a wooden plate and, forming it into small balls of about 6 to 7 g each. For the cooking of chhana balls, sugar syrup (50%) was prepared. The syrup was heated and when it started boiling, the balls were put into it. The chhana balls were cooked for a time ranged 15 - 25 min. After every 5 min ;about 30 ml water was added to take care of the evaporation loss of water from the syrup. After the cooking, Rasogulla balls were kept in sugar syrup and all samples were frish analysed.

Physico-chemical parameters

Rasogulla cheese samples were tested for some physico-chemical parameters. Total solids, fat, crude protein, and ash were determined according to AOAC (2009). Carbohydrate was calculated. The pH value was measured using pH-meter (jenway LTD. Felted Dunnow, Essex, UK). Yield of Rasogulla (g/L of milk) was calculated by taking difference of weight of Rasogulla after soaking and milk weight.

Microbiological examinations

Total bacterial count (T.B.C), yeast and mould count, total coliform count, *Listeria monocytogenes*, *Bacillus cereus*) were determined according to Marshall (1993).

Organoleptic properties

The organoleptic properties were judged by nine judges from the staff members of the Dairy Department at Animal Production Research Institute. A panel of judges evaluated Rasogulla samples using a score card containing 45 points for body and texture, 35 points for flavor and 20 marks points for color and appearance as recorded by Rupesh et al., (2011).

Statistical analysis

Statistical analyses of the obtained data were carried out by using Completely Randomized Design (CRD) with one factor in MSTAT program. The differences among sample means were compared by calculating LSD value with the help of Least Significant Difference (Gomez and Gomez, 1984).

Results and Discussion

Physico-chemical parameters

The different samples of Rasogulla cheese were analyzed for their Moisture, Protein, Fat, Carbohydrate, Ash contents and their yield. The results are presented in Table 2. There were significant difference ($p < 0.05$) within the moisture contents of different types of Rasogulla samples. The moisture per cent of Rasogulla from buffalo, cow and goat milk were 43.60 ± 0.02 , 53.89 ± 1.0 and 51.55 ± 0.71 , respectively. Average moisture content was the highest for Rasogulla from cow milk, followed by Rasogulla from goat milk and buffalo Rasogulla was the lowest. These differences might be due a difference in the level of total solids of milk types (Haque, et al., 2003). Bhattacharya and Des Raj (1980) agreed with these results; they reported that the acceptable quality of Rasogulla contains up to 53.80% moisture.

Protein contents of different types of Rasogulla samples are presented in Table 2. Statistical analysis showed that protein content of different types of Rasogulla samples significantly

TABLE 2. Comparison of chemical composition of Rasogulla f prepared from Buffalo, Cow, and Goat milk

Chemical composition (%)	R.B	R.C	R.G
Moisture	43.60±0.2 ^c	53.89±1.0 ^a	51.55±0.71 ^b
Protein	6.31±0.3 ^a	5.01±0.11 ^c	5.61±0.51 ^b
Fat	8.4±0.60 ^a	5.5±0.20 ^c	5.9±0.42 ^b
Ash	1.1±0.01 ^a	0.88±0.03 ^c	0.92±0.32 ^b
Carbohydrate	40.56±0.21 ^a	34.51±0.21 ^c	35.57±0.63 ^b
Yield	58.24±0.17 ^a	46.89±0.71 ^c	51.93±0.63 ^b

Mean values bearing different superscripts within columnss are significantly different ($P < 0.05$)

(R.B) : Rasogulla from buffalo milk.

(R.C) : Rasogulla from cow milk.

(R.G) : Rasogulla from goat milk.

varied ($p < 0.05$). Buffalo Rasogulla contained the highest protein, followed by goat Rasogulla and the lowest protein content was noted in cow Rasogulla. These findings are in agreement with Haque et al. (2003).

Fat contents of different types of Rasogulla samples are demonstrated also in Table 2. Differences were highly significant ($p < 0.05$) among those mean values. It was observed that buffalo Rasogulla had significantly greater amount of fat than the other samples contained. Highest fat content of buffalo Rasogulla indicated that it was made from high quality chhana which is rich in milk fat. Meanwhile these results are in agreement with those reported by Haque et al. (2003). Desi, et al. (1993) also reported that 5.41% fat content results in Rasogulla of a better quality. From the same table it could be noticed that there was significant difference ($p < 0.05$) in the carbohydrate contents of different types of Rasogulla samples. Maximum carbohydrate percent was seen in buffalo Rasogulla, followed by goat Rasogulla and the lowest carbohydrate content was noted in cow Rasogulla. Haque et al. (2003) agreed with these results. Desi; et al. (1993) reported that 35.16% carbohydrates remain in better quality sponge Rasogulla that supports the current result.

The ash content of Rasogulla from buffalo, cow and goat milk samples were 1.1 ± 0.01 , 0.88 ± 0.03 and 0.92 ± 0.032 , respectively (Table 2). Significant differences ($p < 0.05$) were found among those mean values. Maximum ash percent was seen in buffalo Rasogulla, followed by goat Rasogulla and the lowest was in cow Rasogulla because Buffalo milk contained higher amount of total solids than cow and goat milk. In an experiment, Katra and Bhargava (1990) reported that higher ash and total carbohydrate decreased the sponginess of the product.

The yield of Rasogulla, obtained by using buffalo, cow and goat milk was recorded just after preparation of the product. Yield of different types of Rasogulla samples are demonstrated in Table 2. Differences were highly significant ($p < 0.05$) among those mean values. It was observed that buffalo Rasogulla had significantly high amount of yield than the other samples. Highest yield content of buffalo Rasogulla indicated that it was made from high quality chhana rich in total solids of milk. In our experiment the variations of yield of Rasogulla was mainly due to different types of milk used in the study. This is in agreement with Joshi et al. (1991) who mentioned that the yield of chhana recorded the highest values in buffalo milk and the lowest was chhana from cow milk.

Microbiological quality

The total bacterial count of different types

of Rasogulla prepared from buffalo, cow and goat milk were shown in Table 3. The highest total bacterial count was recorded for buffalo Rasogulla, the lowest was for goat Rasogulla. The total bacterial count of different types of Rasogulla was found to increase with the increase in storage period. The present investigation is partially supported by the result of Singh et al. (2007) and Chavan et al. (2009). On the other hand as well as yeast and mould count, total coliform bacteria count, *Listeria monocytogenes* and *Bacillus cereus* were absent in all types of Rasogulla samples up to 8 days of storage at 7 ± 2 °C. This is due to the hygienic conditions present during the manufacturing of Rasogulla. These results were in agreement with what was found by Chavan et al. (2009) who found that Rasogulla samples were free from total coliform bacteria count and yeasts and moulds up to 10 days of storage at 7 ± 2 °C.

Organoleptic properties

Statistical analysis showed that there were highly significant differences between the Body and texture scores of different types of Rasogulla sample (Table 4). Body and texture score of Rasogulla from buffalo, cow and goat milk were 37.89 ± 0.09 , 43.22 ± 0.25 and 42.17 ± 1.4 , respectively. Average Body and texture score of cow Rasogulla was the highest, followed by goat Rasogulla and buffalo Rasogulla was the lowest. Higher body and texture score indicates the soft and spongy body whereas the lower score indicates coarse body of prepared chhana balls. Joshi et al. (1991) and Mohanta et al. (2015) reported that chhana prepared from buffalo milk had hard body and coarse texture than chhana prepared from cow milk or goat milk. These results are consistent with those of Andrew (2010) who reported that each type of milk imparts the characteristic quality of cheese made from it and the resulting cheese will differ in its properties, body texture and flavor.

Significant difference ($p < 0.05$) was observed within the flavor score of different types of Rasogulla samples. Maximum flavor score percent was seen in cow Rasogulla, followed by goat Rasogulla and the lowest flavor score was noted in buffalo Rasogulla. This is agreed with Alam (1999) and Haque (2000) who mentioned that flavor scores of other dairy products made from buffalo milk were lower than the products made from cow milk, like- dahi and rasomalai. This may be due to the variation in the volatile constituents of milk of different species as Marsili (2003) reported that the volatile constituents in milk make the strongest contribution to its aroma and flavor.

TABLE 3. Comparison of Total bacterial count(log cfu g⁻¹) of Rasogulla f prepared from Buffalo, Cow, and Goat milk during storage period at 7±2 0C

Parameter	Storage period	R.B	R.C	R.G
Total bacterial count	Fresh	8.20±0.02	5.90±0.03	5.80±0.05
	4days	8.64±0.03	6.30±0.02	6.20±0.02
	8days	9.31±0.02	6.80±0.01	6.40±0.03

(R.B) : Rasogulla from buffalo milk.

(R.C) : Rasogulla from cow milk .

(R.G) : Rasogulla from goat milk.

TABLE 4. Comparison of various Organoleptic characteristics of Rasogulla prepared from Buffalo, Cow and Goat milk

Parameter (point)	R. B	R. C	R.G
Body& Texture(45)	37.89±0.9 ^c	43.22±0.25 ^a	42.17±1.4 ^b
Flavor (35)	31.42±1.9 ^c	34.96±1.48 ^a	33.0±1.2 ^b
Color & Appearance (20)	15.06±0.92 ^c	18.75 ±0.28 ^a	17.0±0.52 ^b
Overall acceptability(100)	84.37±0.47 ^c	96.93± 1.3 ^a	93.55±0.18 ^b

Mean values bearing different superscripts within columnss are significantly different (P<0.05).

(R.B) : Rasogulla from buffalo milk

(R.C) : Rasogulla from cow milk

(R.G) : Rasogulla from goat milk

Color and appearance score of Rasogulla from buffalo, cow and goat milk were 15.06±0.92, 18.75±0.28 and 17.0 ± 0.52, respectively (Table 4). Statistical analysis showed that there was a significant difference (P<0.05) between them. Similar results were recorded by Rao et al. (1989). This variation may be due to the variation in carotene content of milk. Jainudeen (2003) stated that the buffalo converts the yellow pigments β-carotene into vitamin A, which is colorless, and is passed into the milk. Therefore, buffalo milk is distinctively whiter than cow's milk; the latter is not only pale creamish-yellow but also the milk fat is golden yellow.

Finally ; average of overall acceptability of Rasogulla from buffalo , cow and goat milk were, 84.37±0.47, 96.93±0.1.3 and 93.55±0.18, respectively (Table 4) . Average scores for all the physical parameters of cow Rasogulla were highest than goat Rasogulla and buffalo Rasogulla. The highest scores indicates that

Rasogulla manufactured from cow milk was superior to Rasogulla from goat milk and the lowest was noted in Rasogulla from buffalo milk.

Conclusion

Rasogulla prepared from buffalo milk had the highest yield, while Rasogulla from cow milk gave the lowest yield. The best organoleptic evaluation were recorded for the Rasogulla prepared from cow milk followed by Rasogulla prepared from goat, and buffalo milk . Analysis of variance of the effect of milk types on physical properties, yield and chemical composition was highly significant. From the result of overall analysis, it could be advocated that Rasogulla made from cow milk was the best among the Rasogulla made from goat and buffalo milk. Although buffalo and goat milk Rasogulla ranked second and third position, respectively, but its nutrient content were also excellent.

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تقييم جودة Rasogulla Cheese (كرات الجبن في شراب السكر) التي تم اعدادها من ثلاثة أنواع مختلفة من الالبان

إيمان فؤاد محمد ونعمه رائف رائف عطالله

قسم تكنولوجيا الالبان-معهد بحوث الانتاج الحيواني- مركز البحوث الزراعيه

تعتبر Rasogulla (كرات الجبن في شراب السكر) من أكثر الأطعمة المشهورة في الهند . في هذا البحث تم تصنيع الكرات الجبن من ثلاث أنواع مختلفة من الألبان (الجاموسي والبقرى والماعز) وإجراء التحاليل الكيميائية والميكروبيولوجية والحسية بهدف تقييم جودة المنتج . ووجد أن الكرات الجبن المصنعة من اللبن الجاموسي كانت أعلى في المحتوي من حيث نسب كلاً من الجوامد الكلية والبروتين والدهون والكاربوهيدرات والرماد يليها الكرات المصنعة من لبن الماعز ثم المصنعة من اللبن البقرى . وكذلك من حيث نسبة التصافي . ومن ناحية أخرى كانت نتائج التحاليل الميكروبيولوجية أن جميع المعاملات خالية من بكتريا القولون وكذلك البكتريا المرضية . كما تم ملاحظة أن كرات الجبن المصنعة من اللبن البقرى سجلت أعلى الدرجات في التقييم الحسي من حيث القوام والتركييب والنكهة واللون والمظهر يليها كرات الجبن المصنعة من لبن الماعز وأدناها المصنعة من اللبن الجاموسي . وعلى الرغم من أن الكرات المصنعة من اللبن الجاموسي والماعز كانت في المرتبة الثانية والثالثة علي التوالي لكن من حيث المحتوي الغذائي كانت ممتازة .