



Rasgulla: A Review



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Abstract

Rasgulla is a popular sweetmeat prepared by chhana in South Asia. Rasgulla contains high amount of protein, fat, minerals and vitamins. Its quality depends on the method used to prepare chhana, quality of chhana and other process parameters. The present review discusses different unit operations followed to prepare rasgulla and basic parameters those give the textural and chemical quality to it.

Introduction

India accounts for nearly 18.6% of world milk production and is one of the largest milk producers. Moreover, according to an estimate 50-55% of the milk produced is converted to indigenous milk products such as yogurt, rasgulla, etc. Rasgulla (a sweet syrup cheese ball) most popular in the regions of South Asia, manufactured from Chhana (a precipitate obtained by heat and acid coagulation of milk) balls. Traditional Indian dairy products account for over 90% of all dairy products consumed in India [1]. It contains fat, high protein, minerals (mainly phosphorus and calcium) and vitamins (fat soluble - vitamin A and D) [2]. 100g of Rasgulla contains 186 calories and out of which carbohydrate, fat and protein provide 153, 17, and 16 calories, respectively. Rasgulla is defined as popular Indian sweetmeat with high textural values [3] and also common milk product [4]. Rasgulla is prepared in batch process by traditional and un-mechanized ways in local markets, but research have been done to mechanize the operation in preparing rasgullas by continuous process. The general flow diagram of manufacturing rasgulla is given below (Figure 1).

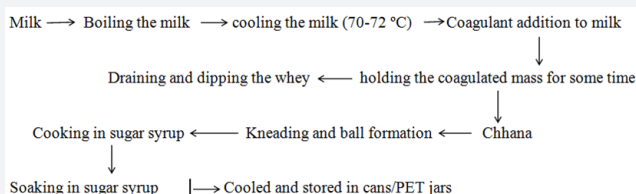


Figure 1: The general flow diagram of manufacturing rasgulla.

Chhana Preparation

Base material for preparing rasgulla is chhana. Texture and moisture content of chhana are important parameters for quality of rasgulla and they depend majorly on type of milk

and coagulant used, temperature, and pH of coagulation during preparation of chhana. It is reviewed that cow milk with fat content >3% is preferable to prepare chhana for manufacturing rasgulla because it gives soft and smooth textured chhana than buffalo milk [5-9]. Recommended a procedure for getting better quality chhana from buffalo milk in which they adjusted 4-5% fat in the milk.

Kundu & De [10] concluded that chhana obtained from buffalo milk was suitable for rasgulla preparation when milk with 5-6% fat was homogenized at 176kg/cm². Recommended 5% and 4% fat in buffalo and cow milk respectively to get great quality of chhana for rasgulla [11]. Studies showed that use of soy milk in rasgulla preparation along with cow and buffalo milk to increase nutrition in the product [12,13], Bhargava et al. [14]. studied the influence of fat level in goat milk (1-6% fat) on chhana and rasgulla and obtained that 3-4% fat in goat milk gave the best results.

To prepare chhana milk is boiled and cooled down to temperature of 70 °C. Traditionally lemon juice and sour whey were used to coagulate the milk [15]. Different types and strength of coagulants or organic acid salts such as citric acid (1-2%), lactic acid (1-2%), calcium lactate, mixture of citric and lactic acid etc. are used to coagulate the milk [6,16-18], Adhikari et al. [19].

Many researchers optimized the pH of buffalo and cow milk to 5.7 and 5.4 to make chhana required for rasgulla preparation and it was also observed that for fresh milk, pH 5 was best suitable [6,11,16] and Soni et al. [20]. Generally, the optimum temperature of coagulation for making chhana from cow milk and buffalo milk is 70°C and 50°C respectively [10,21]. The Bureau of Indian Standards has laid down the specification for canned rasgulla as shown in (Table 1) (IS: 4079 (1967)).

Table 1: BIS Specification for canned rasgulla.

Characteristics	Specifications
Moisture	45-55%
Milk fat	5%
Sucrose	45%
Protein	5%
Acidity of syrup (pH)	6
Concentration of syrup, max	55 °C Brix

Kneading and Ball Formation of Chhana

Kneading of chhana is a process of mixing and folding the mass to smoothen it to give better and soft rheology to the product. Chhana is kneaded traditionally by putting it on the hard surface [5]. Manual kneading is possible for batch production of rasgullas. After kneading chhana balls were made by rolling chhana (8-10g) in between palms.

Chhana kneading and ball formation process is mechanized by researchers to reduce manual efforts and time of producing rasgullas. Disc grinder was used to knead the chhana by Tarafdar [22,23]. Optimized the disc grinder speed to 0.89 m/s to knead chhana for preparing rasgulla. Chhana kneader cum ball former was designed based on mixing index of chhana Karunanithy et al. [24,25].

Cooking and Soaking of Chhana Balls

Strength and concentration of sugar syrup primarily depend on the desired sweetness and shelf-life of rasgulla. Many studies showed that strength of sugar syrup for cooking should be in the range of 50 to 55 °CBrix [7,10]. Ten hove & Das [23] studied the effect of cooking syrup strength on volume expansion of chhana

balls. Optimized the cooking syrup concentration to 4°C Brix [26].

Kundu & De [10], Singh & Ray [16], De [11] and Soni et al. [20] recommended 40 °C Brix concentration of sugar syrup during soaking and kept the balls overnight in syrup. Goel and Agrawal [27] observed that 40% sugar concentration for 16 h under room temperature gave proper texture development to rasgulla. Mohanta & Shrivastava [26] optimized the concentration of soaking sugar syrup and time of soaking to 35°C Brix and 14.37 h respectively.

Texture of Rasgulla

Texture of rasgulla is an important parameter to acceptability and quality of rasgulla. Rasgulla should be soft and spongy according to consumer preference and rasgulla with spongy texture is valuable according to market price. Adhikari et al. [19] showed that rasgulla prepared from buffalo milk had higher values of textural parameters than that from cow milk. Goel & Agrawal [27] studied the effect of cooking temperature on texture of rasgulla and found that lower temperature of cooking gave spongy texture to rasgulla while higher temperature led to harder rasgulla. Karunanithy et al. [28] observed that rasgulla prepared by machine gave better textural results than that of commercial rasgulla.

Chemical Composition of Rasgulla

Specification of chhana for rasgulla preparation should be in the range as mentioned in IS: 5162 (1969).

The chemical composition of rasgullas estimated by various researchers is shown in (Table 2).

Table 2: Chemical composition of rasgulla made in the various laboratories.

Milk Type	Moisture (%)	Fat (%)	Protein (%)	Carbohydrates/ Sucrose (%)	References
Cow milk	47.52-52.06	7.1-7.5			Bhattacharya & Des Raj [8]
Buffalo milk	37	4.2	6.8	51.9	Soni et al. [20]
Goat milk	48-52.3	6.42-7.58			Bhargava et al. [12]
Cow + Soy milk (70.30)	44.59	5.92	6.12	41.34	Thakur et al. (2013)
Cow milk	54.86	4.9	5.05	34.35	Haque et al. (2003)
Buffalo milk	41.8	7.9	5.58	43.83	

Conclusion

Rasgulla, a soft and spongy syrupy dessert famous in Indian subcontinent and South Asia is made from chhana by cooking and soaking in sugar syrup. Wide range of chemical and physical composition was observed by many researchers due to usage of varieties of milk and ingredients to prepare the product and optimization parameters of processing. Good quality of rasgulla

was obtained from chhana (3-4% fat in cow milk, 1-2% citric acid as coagulant and coagulation temperature of 72°C) by kneading it properly with binding starch and then cooking the chhana balls in sugar syrup of 50°C Brix followed by soaking the balls in 40°C Brix sugar syrup. Hygienic practices during manufacturing of rasgulla at small scale and unorganized sector should be enforced for adequate shelf life of the product and to ensure public health safety.

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