J Bangladesh Agril Univ 19(4): 533–541, 2021 https://doi.org/10.5455/JBAU.108889

ISSN 1810-3030 (Print) 2408-8684 (Online)

Journal of Bangladesh Agricultural University

Journal home page: http://baures.bau.edu.bd/jbau

Original Article

Sensory and Physicochemical Properties of Doi and Rosogolla Manufactured from Hydrogen Peroxide Preserved Milk

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ARTICLE INFO

Article history
Received: 11 Aug 2021
Accepted: 28 Sep 2021
Published: 31 Dec 2021

Keywords
Hydrogen peroxide,
Sensory and physicochemical Properties,
Yoghurt,
Rosogolla

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ABSTRACT

This study was undertaken to envisage the effect of milk preservation by food grade hydrogen peroxide (H_2O_2) on sensory and physicochemical properties of doi and rosogolla prepared from that preserved milk. Cow milk was collected from the Bangladesh Agricultural University (BAU) Dairy farm. H_2O_2 was diluted at the ratio of 1:2.5 (H_2O_2: distilled water) before mixing with milk to reduce the concentration of H_2O_2 from 35% to 10%. Later on 0.14% (by volume of milk) H_2O_2 was added to milk samples and preserved to 18 h. The preserved milk samples were then used to manufacture doi (PMD) and rosogolla (PMR). Doi (FMD) and rosogolla (FMR) were also prepared from fresh cow milk without adding H_2O_2. Sensory properties and proximate composition of both FMD and PMD were found non-significant ($p>0.05$). Similar results were also found in the case of FMR and PMR. Acidity (%) of both types of products was found 0.05% higher in the fresh milk products. It may be concluded that 0.14% H_2O_2 treated milk is suitable to manufacture quality doi and rosogolla without any inimical effect on the sensory and physicochemical properties.

Introduction

Milk rich in nutritional elements is suitable for processing into different dairy products. Milk and milk products provide many of the essential nutrients necessary for the growth and maintenance of the human body (Drewnowski, 2011). Milk and dairy products are vital for human nutrition and are considered as the carrier of higher biological value proteins, calcium, essential fatty acids, amino acids and water-soluble vitamins (Khan et al., 2019). Traditional fermented milk and doi (yoghurt like product) have been used from ancient. Since doi is prepared from milk, it supplies protein, calcium, and other minerals, and a range of vitamins. The main probiotics starter culture in doi are *Lactobacillus bulgaricus* and *Streptococcus thermophilus* cultures (Freitas, 2017). The consumption of doi is growing fast due to its therapeutic properties besides its high nutritive value (Karagül-Yüceer et al., 2001). Rosogolla is a chhana based milk product obtained by the acid coagulation of boiled whole milk subsequent seepage of whey. Rosogolla is a dessert which is boiled and served in sucrose syrup. Cow milk is generally preferred for making chhana as it brings softness and smooth texture to rosogolla (Soni et al., 1980). Rosogolla of 100 g generally offers 186 kcal where carbohydrates provide 153 kcal, fat accounts for 17 kcal and protein adds the remaining 16 kcal. Rosogolla is easily digestible with high food value which is rich in protein content, calcium; phosphorus, vitamin A and D content (Tarafdar et al., 2002). Due to enormous nutritional and health

Cite This Article
Arefin, S., Sarker, M.A.H., Bari, M.S., Siddiki, M.S.R., Harun-ur-Rashid, M., Islam, M.A., Islam, M.N. Sensory and Physicochemical Properties of Doi and Rosogolla Manufactured from Hydrogen Peroxide Preserved Milk. *Journal of Bangladesh Agricultural University*, 19(4): 533–541. https://doi.org/10.5455/JBAU.108889

benefits these milk products are extensively consumed (Chavan et al., 2011; Sahu and Das, 2009).

In our previous study, we used H_2O_2 as a preservative for raw milk by activating the lactoperoxidase (LP) system in milk (Arefin et al., 2017). LP is very effective against both gram-positive and gram-negative bacteria (Naidu, 2000; Marks et al., 2001). Hydrogen peroxide (H_2O_2) and thiocyanate are prerequisites for the activation of LP present in milk at a very low concentration. H_2O_2 is widely recommended by FAO/WHO as a method for inhibiting bacterial growth in raw milk (CAC/GL 13-1991) and this chemical must be destroyed before consumption either using catalase or by heat treatment (Ozer et al., 2003). H_2O_2 is well-accepted chemical for the preservation of raw milk by activating the LP system of milk (Ozer et al., 2003). In our previous study, different concentrations of H_2O_2 (10% dilution) were used as 0.02, 0.04, 0.06, 0.08, 0.10, 0.12 and 0.14% to preserve raw milk. From that study 0.14%, H_2O_2 was recommended to preserve milk for ensuring the fitness of consumption up to 18 h (Arefin et al., 2017). In this study, our objective was to investigate the effect of H_2O_2 on sensory and physicochemical (proximate composition and acidity) properties of doi and rosogolla prepared from whole cow milk treated with 0.14% H_2O_2.

Materials and Methods

Collection and analysis of raw milk

Raw whole cow milk sample was collected from Bangladesh Agricultural University (BAU) Dairy farm, Mymensingh. All hygienic measures were followed during the sampling of milk samples. The gross composition of milk was assayed by using an automated milk analyzer (Lactoscan, SLP, MILKOTONIC Ltd., Nova Zagora-8900, Bulgaria) at Dairy Chemistry and Technology Laboratory, Department of Dairy Science, BAU, Mymensingh. The proximate composition and acidity of raw whole cow milk are shown in Table 1.

Table 1. Proximate composition of cow raw milk

Parameters (%)	Unit measurements
Total solids (TS)	12.45±0.15
SNF	8.35±0.25
Fat	4.10±0.14
Protein	3.56±0.17
Carbohydrates	4.17±0.10
Ash	0.62 ± 0.02
Acidity	0.14±0.009

Dilution and addition of H_2O_2 to milk samples

Distilled water was added @ 2.5:1, (v/v) with the H_2O_2 (35% extra pure food grade, MERCK, Germany) to make it 10% H_2O_2. Then 0.14% H_2O_2 (by volume of milk) of diluted 10% H_2O_2 was added to the milk sample. If it is considered as ml/L then it implies 0.14 ml H_2O_2 per 1 L of milk. H_2O_2 at maximum 0.05% at any stage of the products is recommended by Food (preservatives in Milk) Regulations (1994). The shelf-life of the milk sample was extended up to 18 h (Arefin et al., 2017) at an average ambient temperature 28°C. Those milk samples were then used to prepare doi and rosogolla to investigate the effect of H_2O_2 on their physicochemical and sensory properties.

Preparation of doi

Two types of doi were prepared following the same procedure (Figure 1): type FMD (control) from raw fresh milk and type PMD from 0.14% H_2O_2 preserved whole cow milk. For the preparation of doi whole milk was heated to boil with continuous stirring. During boiling 12% sugar (ACI Pure Sugar, ACI Ltd. Bangladesh) was added to milk (w/v). The volume of milk was reduced by 20%. Then the temperature of the milk was lowered to 43°C and subsequently, lactic starter culture (*Streptococcus thermophilus: Lactobacillus bulgaricus* at 2:1) was mixed at 3% (Moazzem et al., 2018). After inoculation of mixed cultures, the content was incubated in an incubator (J.P. Selecta, Barcelona, Spain) at 40°C for 5 h. The prepared doi was then promptly transferred to a refrigerator and kept at 4°C until analysis.

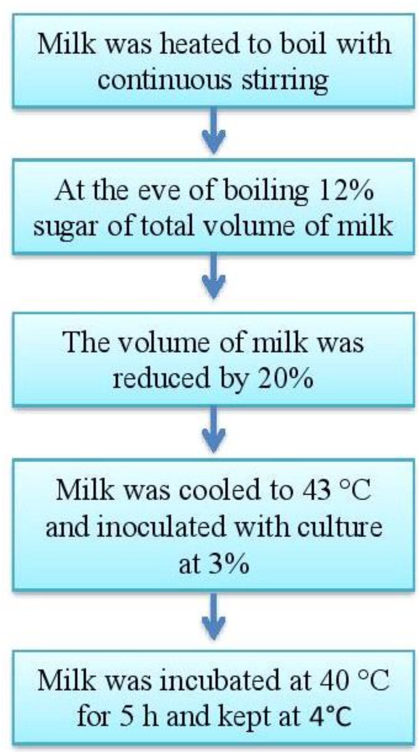

Figure 1. Manufacturing process of doi

Preparation of rosogolla

Two types of rosogolla were prepared following the same procedure (Figure 2): type FMR (control) from raw whole cow milk and type PMR from 0.14% H_2O_2 treated whole milk. Chhana is the basic material for preparing rosogolla. To prepare chhana, milk was boiled for few seconds and then cooled to 80°C. Thereafter, sour whey as coagulant was added slowly to milk with continuous gentle stirring. The addition of coagulant was continued until pH reached to 5.2 and milk coagulated showing a greenish-yellow tinge in the whey. Then coagulated mass was placed in a muslin cloth and whey was drained off by hanging for 15 to 20 min. The coagulated chhana was softened by messing and kneaded to homogeneous and smooth dough. This dough was then split up into 8 to 10 g weight and rolled between hand and palms to make chhana balls carefully to avoid crack on the surface (Yadav et al*.,* 2012). For cooking and soaking chhana balls, sugar syrup of 60% (w/v) and 40% (w/v) were prepared, respectively. The solutions were clarified by boiling with little milk for 2-3 min and filtered by muslin cloth before use. Then the sugar syrup (60%) was put into a stainless-steel pan and brought to boiling. The chhana balls were cooked in sugar syrup for 15 min. After cooking, the balls were transferred to the clarified 40% sugar syrup for soaking and kept for 10 h at room temperature to acquire desirable sweetness. Finally, the prepared rosogolla was kept at 4°C until analysis.

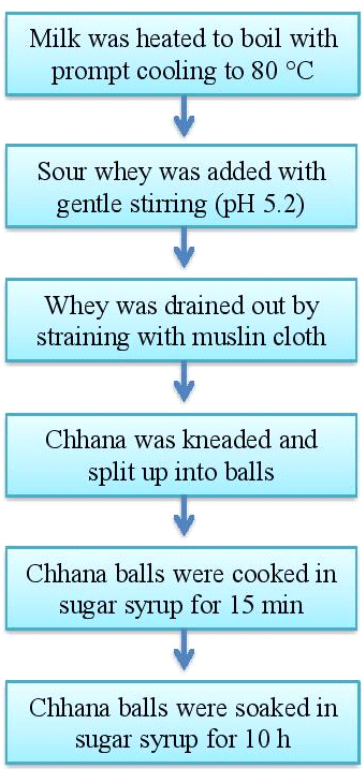

Figure 2. Manufacturing process of rosogolla

Analysis of doi and rosogolla

Organoleptic evaluation of doi (smell and taste, body and consistency, color and appearance, and taste) and rosogolla (flavor, body and texture, color and appearance) were carried out by using a score-card of 100 points with the help of an expert panel of judges of Department of Dairy Science, Bangladesh Agricultural University, Mymensingh. The total solids (TS) content of doi and rosogolla were estimated by oven [J.P. Selecta; S.A. ctra. Nil km: 585.1, Abrera, Barcelona, Spain] evaporating at 105°C for 24 h. To estimate ash, the dried samples were ignited at 600°C for 6 h by muffle furnace (VULCAN A-550, Ney®, USA). Babcock method, described by Aggarwala and Sharma (1961) was used to determine fat percent of doi and rosogolla and protein was determined by the Kjeldahl procedure (AOAC, 2003). Acidity was determined by titrating with 0.1 N sodium hydroxide solution.

Statistical analysis

Paired sample t-test was done to compare the products made from raw fresh cow milk and H_2O_2 treated milk based on sensory characters and physicochemical attributes. All the products were prepared three times and all the analyses were done in triplicate as well. The statistical analysis was done using Statistical Package for the Social Science (SPSS) version-16.

Results and Discussion

Sensory properties of doi

Smell and taste

Smell and taste of control doi (FMD) and doi (PMD) prepared from H_2O_2 treated milk was statistically indifferent (p<0.05) presented in Table 2. The control doi sample achieved a score of 48.33 out of 50 which was a 1.33 score higher compare to PMD. The smell and taste were good for both types of doi. A nearly similar score implies that there was no negative effect of H_2O_2 on milk and consecutively on smell and taste of doi. The smell and taste of doi greatly influence the consumer acceptance. Our result is consistent with previous studies reporting that smell and taste were 46 in the case of cow milk doi (Akter et al*.,* 2010). In another study, Islam et al. (2016) reported a 43.75 score for smell and taste in doi. Bhuiyan et al. (2010) also reported an almost similar score for doi. These minor variations of smell and taste score of doi samples may be due to differences in composition of milk, starter culture and manufacturing process.

Body and consistency

Body and consistency are both important parameters for consumer acceptance of doi. The body and consistency score of FMD and PMD was non-significant (p>0.05). Doi prepared from 0.14% H_2O_2 treated milk had smooth, glossy surface and solid texture with no wheying off and good mouth-feel that was similar to control doi. The score of control FMD was 28 out of 30 which was 0.34 score higher than PMD. This difference is negligible to consider. It means that the presence of H_2O_2 in milk has no impact on the structural quality of doi. The scores found in our results are in agreement with the other studies (Bhuiyan et al*.,* 2010; Islam et al*.,* 2016). Plain doi of general consumer acceptance should have a smooth, uniform and spoonable texture and be free from lumps and wheying off (Lucey& Singh, 1997; Lucey, 2004).

Color and appearance

Color and appearance are other major factors of doi quality, influencing consumer's acceptability. These are important characteristics which make perception in senses and are used by consumers for the judging of the quality of foodstuffs (Giusti and Wrolstad, 2003). The difference in color and appearance score was non-significant (p>0.05) of control doi (FMD) and doi prepared from H_2O_2 treated milk (PMD). This score in FMD was 18.66 out of 20 whereas PMD had only 0.33 lower score which is minor to think about. The scores found in this study for both types of doi are in the line reported by (Bhuiyan et al*.,* 2010; Islam et al., 2016; Akter et al*.,* 2010). PMD had a natural milk color, smooth and glossy surface similar to type FMD. The colour of the curd depends on the colour of milk or caramelization which is obtained during the heating of milk.

Total score

Total score signifies the sum of average scores of smell and taste, body and consistency, and color and appearance of doi. Statistical analysis showed that no significant difference (p>0.05) existed in the overall score of FMD and PMD. This score of control doi was 93.90 out of 100 and 93.76 for doi prepare from H_2O_2 treated milk. Both types of doi were very close with regard to total scores which suggest that the addition of H_2O_2 in milk for preservation has no significant impact on organoleptic parameters of doi. Here it is advisable to use H_2O_2 to preserve milk without hampering the sensory features of doi. The total score of both types of doi was higher than the reported score by others (Islam et al*.,* 2016; Akter et al*.,* 2010) which means better quality in terms of sensory evaluation.

Table 2. Sensory properties (mean± SD) of doi

Parameters of score	Types of doi		*p*-value
	FMD	PMD	
Smell and taste(50)	48.33±0.57	47.00±1.00	0.057
Body and consistency(30)	28.00±1.00	27.66±0.57	0.423
Color and appearance(20)	18.66±0.57	18.33±0.57	0.423
Total score (100)	93.90±0.31	93.76±0.70	0.823

FMD (control): doi from raw fresh milk; PMD: doi from 0.14% H_2O_2 preserved milk

Proximate composition and acidity of doi

Total solids (TS)

From the result, it was found that in the case of TS content there was no significant difference (p>0.05) between type FMD and PMD doi (Table 3). The total solids content of type FMD and PMD were 230.68 and 228.80 g/kg, respectively. Doi sample FMD had narrowly 1.88 g/kg more TS content compare to PMD. From the result, it is manifested that the addition of H_2O_2 as a milk preservative did not affect the TS content of doi and milk treated with H_2O_2 can be used in the manufacturing of good quality doi. The TS content of the two types of doi obtained in the present study varied in a much narrower range in accordance with the values reported by (Islam et al*.,* 2016; Akter et al*.,* 2010; Dey et al*.,* 2011). The reported value of TS in this study concurs with Isanga and Zhang (2009) who found 211 g/kg TS content of doi.

Fat

The mean fat content for type FMD doi and type PMD doi were 52.33 and 50.73 g/kg, respectively (Table 3). Statistical analysis showed that there was no significant difference (p>0.05) between the two doi samples. Here it implies that both types of doi were the same in terms of fat content and it also reveals that H_2O_2 has no considerable impact on the fat content of doi. The fat content found in doi in our study is in agreement with the findings reported by Ammar et al. (2015) and Akter et al. *(*2010). The reported values of fat content in cow milk doi by Temebayeva et al. (2018); Islam et al. (2016); Dey et al. (2011); Salwa et al. *(*2004) are little further down which can be attributed mainly to milk composition. According to the codex standard (codex standard 243-2003) doi should contain less than 15% milk fat.

Protein

The protein content of doi is a great deal of consumer interest and considerably responsible for textural quality and taste and notably, dairy protein is beneficial for health (Jørgensen et al., 2019). Statistical analysis showed that the protein content of type FMD doi was significantly higher ($p<0.05$) compare to type PMD doi (Table 3). The notable difference was 1.88 g/kg doi which is not so high. According to the codex standard (codex standard 243-2003) doi should contain a minimum of 2.7% milk protein. The protein content found in our study in both types of doi coincides with studies of (Dey et al., 2011; Bhuiyan et al., 2010) where found protein content was within similar ranges. Isanga and Zhang (2009); Islam et al. (2016); Temebayeva et al. (2018); Costa et al. (2019) reported the protein content of cow milk doi as 359 g/kg, 380 g/kg, 390 g/kg and 318 g/kg, respectively where this diminished value can be ascribed to a difference in milk composition used for doi making.

Ash

The ash content is an index of mineral content of doi originated from milk. In this experiment, the observed ash content of doi was found as 11.88 and 11.65 g/kg for type FMD and PMD, respectively (Table 3). No significant difference ($p>0.05$) was found between two types of doi for ash content. Here, it can be said the addition of H_2O_2 in milk as preservative did not affect total ash content in doi. The ash content found in our study of both types of doi is in line with Isanga and Zhang (2009) who reported 11 g/kg ash in cow milk doi. Akter et al., 2010 reported 9.11 g/kg ash content in cow milk doi which is in a much narrower range. Other studies (Bhuiyan et al., 2010; Dey et al., 2011; Ammar et al., 2015; Chetachukwu et al., 2019) reported different levels of ash content in doi ranging from 8.72 to 15.2 g/kg which entirely depend on the concentration in milk and rate of evaporation of moisture.

Acidity

The number of hydrogen ions neutralized by titrating a standard base to an endpoint (Darias-Martin et al. 2003) is referred to as titratable acidity. The average acidity of type FMD and PMD type doi was 0.60 and 0.55%, respectively (Table 3). Here, the acidity % and formation of doi indicate that H_2O_2 is decomposed through heat treatment of milk otherwise it will inhibit the growth of starter bacteria to ferment lactose. The observed acidity % in this study is in agreement with other studies (Bhuiyan et al., 2010; Dey et al., 2011; Akter et al., 2010; Costa et al., 2019; Januário et al., 2017; Pimentel et al., 2012).

Table 3. Proximate composition and acidity (mean ± SD) of doi

Parameters	Types of doi		*p*-value
	FMD	PMD	
Total solids(g/kg)	230.68±2.19	228.80±3.131	0.276
Fat(g/kg)	52.33±1.52	50.73±2.05	0.371
Protein(g/kg)	54.65±0.60	52.84±0.72	0.015
Ash(g/kg)	11.88±0.83	11.65±0.67	0.189
Acidity (%)	0.60±0.01	0.55±0.02	0.001

FMD (control): doi from raw fresh milk; PMD: doi from 0.14% H_2O_2 preserved milk

Sensory properties of rosogolla

Flavour

Flavour of control rosogolla (FMR) and rosogolla prepared from H_2O_2 treated milk (PMR) was statistically indifferent ($p>0.05$) presented in Table 4. The control FMR had a 0.17 higher score than PMR which is negligible to consider. It implies that flavor was satisfactory for both types of rosogolla. Consumer perception is very much important in the case of flavor. Here it is evident that H_2O_2 has no significant effect on the natural flavor of rosogolla. The flavor scores of rosogolla found in this study are in agreement with the findings reported by Ahmad et al. (2017); Suryawanshi et al. (2020); Tarafdar et al. (2002).

Body and texture

Body and texture are two important parameters of rosogolla. The statistical analysis indicated a non-significant ($p>0.05$) difference between FMR and PMR (Table 4). In FMR and PMR rosogolla, body and texture availed 28.00 and 27.66 score out 30, respectively. Only 0.34 higher body and texture score was found in FMR compare to PMR which means H_2O_2 has no unfavorable effect on the body and texture of rosogolla. A higher body and texture score indicates the soft and spongy body whereas the lower score indicates a coarse body of rosogolla. In general, cow milk chhana having a soft body and smooth texture is the most suitable for rosogolla preparation. The result found for body and texture is in the line showed by Ahmad et al. (2017); Suryawanshi et al. (2020); Tarafdar et al. (2002); Haque et al. (2003); Sengupta et al. (2016).

Color and appearance

Cooking of chhana ball in sugar syrup remarkably alters the color of rosogolla and is an important characteristic which aids in consumer preference (Giusti and Wrolstad, 2003). The difference of color score was non-significant ($p>0.05$) between FMR and PMR. This score in FMR was 8.83 out of 10 whereas PMR had only 0.33 lower score which is trivial to consider. The color score found in this experiment is in consistent with the finding reported by Mohamed et al. (2017); Haque et al. (2003); Sengupta et al., (2017).

Taste

The taste score of the two types of rosogolla is shown in Table 4. In FMR and PMR, taste scores did not show any significant difference ($p>0.05$). In control rosogolla, the taste score was 8.50 out of 10 which was 0.17 score higher than the rosogolla made from H_2O_2 treated milk. Here, it is manifested that H_2O_2 does not affect the normal taste of rosogolla. Tarafdar et al. (2002) found an 8.93 taste score in the laboratory made rosogolla from cow milk. In a different study, Haque et al. (2003) reported an 8.11 taste score in rosogolla prepared from cow milk. These findings are more or less similar to the taste score found in this experiment.

Total score

Total score implies the sum of average scores of flavor, body and texture, color and appearance; and taste of rosogolla. Statistical analysis revealed that no significant difference ($p>0.05$) exists in the overall score between FMR and PMR. The total score of control rosogolla was 92.11 out of 100 and 91.77 for rosogolla prepared from H_2O_2 treated milk. Both types of rosogolla in terms of total score were almost the same which suggests that the addition of H_2O_2 in milk for preservation has no significant impact on the sensory properties of rosogolla.

Table 4. Sensory properties (mean± SD) of rosogolla

Parameters of score	Types of rosogolla		*p*-value
	FMR	PMR	
Flavor (50)	47.50±0.89	47.33±0.96	0.650
Body and texture (30)	28.00±1.00	27.66±0.57	0.643
Color and appearance (10)	8.83±0.28	8.50±0.50	0.529
Taste (10)	8.50±0.50	8.33±0.76	0.808
Total score (100)	92.11±0.67	91.77±0.75	0.527

FMR (control): rosogolla from raw fresh milk; PMR: rosogolla from 0.14% H_2O_2 preserved milk

Proximate composition and acidity of rosogolla

TS content of control rosogolla (FMR) and rosogolla made from H_2O_2 treated milk (PMR) were found statistically indifferent ($p>0.05$) presented in Table 5. The TS content of type FMR and type PMR were 480.59 and 478.92 g/kg, respectively. The FMR rosogolla was found with 1.67 g more TS content compare to PMR rosogolla. From the result, it is evident that the addition of H_2O_2 as a milk preservative did not affect the total solids content of rosogolla. The TS content of two types of rosogolla obtained in the present study varied with the values reported by other studies where Suryawanshi et al. (2020); Mohamed et al. (2017) and Sengupta et al. (2017) reported 451, 462 and 537 g/kg TS in rosogolla from cow milk. This difference may be for the addition of flour during the preparation of rosogolla.

Fat

The mean fat content for type FMR doi and type PMR rosogolla were 42.50 and 41.90 g/kg, respectively (Table 5). Statistical analysis showed that there was no significant difference between two types of rosogolla ($p>0.05$). Here it implicates that both types of rosogolla were the same in terms of fat content and it also reveals that H_2O_2 has no considerable effect on the fat content of rosogolla. The quality of rosogolla is mainly influenced by milk composition. In several studies, Haque et al. (2003); Mohamed et al. (2017); Tarafdar et al. (2002); and Suryawanshi et al. (2020) reported a range from 45.0 to 55.0 g/kg fat content in rosogolla which is very likely with our findings. On the other hand, Sengupta et al. (2017); Gurveer and Goswami (2017) reported 78 and 75 g/kg fat in cow milk rosogolla, respectively. This variation in fat content of rosogolla can be attributed mainly to the milk composition of rosogolla. In a study, Bhattacharya and Raj (1980) revealed that the high fat content of milk leads to a higher fat content in rosogolla which makes rosogolla soft and improves the textural quality.

Protein

Rosogolla is made from ball-shaped dumplings of chhana (an Indian cottage cheese) in which protein comprises 13.86% (Menghwar et al., 2019) and in particular, dairy protein is beneficial for health (Jørgensen et al., 2019). From the study, statistical analysis indicated that the protein content of type FMR and PMR type rosogolla were non-significant ($p>0.05$) (Table 5) where FMR and PMR type had 81.55 and

80.30 g/kg protein, respectively. As per BSTI standard (1993) minimum protein content of rosogolla should be 50.0 g/kg which indicates that the protein content of prepared rosogolla was quite above this minimum value. Our results are consistent with the previous finding reported by Sengupta et al*.,* (2017) who revealed 82.4 g/kg protein content in cow milk rosogolla. The protein content obtained in the present study varied in a much narrower range in accordance with the values reported by several studies (Gurveer and Goswami, 2021; Tarafdar et al*.,* 2002; Mohamed et al*.,* 2017) ranged from 59.50 to 68.2 g/kg where this diminished value can be ascribed to a difference in milk composition used for rosogolla making.

Ash

Ash content in rosogolla is rich in K, Ca and Mg (Pal et al*.,* 2019) and these minerals help in reducing the risk of hyper-tension, building strong and dense bones and functioning of ATP, DNA and RNA. In this experiment, no significant difference (p>0.05) was found between the two types of rosogolla in ash content. The observed ash content was found as 8.41 and 8.36 g/kg for type FMR and PMR, respectively (Table 3). The found ash content of both types of rosogolla is in the range of the BSTI standard (1993) suggesting maximum of 0.9% ash content in rosogolla. The trend found in our result is in agreement with the study where Prodhan et al. (2017) reported 8.4, 8.2, 8.0 g/kg ash content in different source of cow milk rosogolla. Sengupta et al. (2017) and Gurveer and Goswami (2017) revealed 10.4 and 10.06 g/kg ash content in cow milk rosogolla, respectively. This variation in ash content of rosogolla might be for the composition of milk used to prepare rosogolla.

Acidity

The average acidity of type FMR and PMR type doi was 0.50 and 0.45%, respectively (Table 5). Statistically, there were no significant differences (p>0.05) between the acidity of the two types of rosogolla. The normal range of acidity % of FMR rosogolla indicates that the milk was well preserved with H_2O_2 and it has no adverse effect on the freshness of rosogolla. In this study, the found acidity % of FMR and PMR type rosogolla were lesser than the reported acidity by other studies (Haque et al*.,* 2003; Suryawanshi et al*.,* 2020; Tarafdar et al*.,* 2002).

Table 5. Proximate composition and acidity (mean ± SD) of rosogolla

Parameters	Types of rosogolla		p-value
	FMR	PMR	
Total solids(g/kg)	480.59±0.60	478.92±0.68	0.866
Fat(g/kg)	42.50±0.20	41.90±0.51	0.132
Protein(g/kg)	81.55±0.58	80.30±0.60	0.061
Ash (g/kg)	8.41±0.32	8.36±0.28	0.135
Acidity (%)	0.50±0.00	0.45±0.00	0.184

FMR (control): rosogolla from raw fresh milk; PMR: rosogolla from 0.14% H_2O_2 preserved milk

Conclusion

Based on the results, doi and rosogolla manufactured from H_2O_2 preserved milk can be a very suitable dairy product while adding H_2O_2 to preserve milk to ensure the fitness of consumption with a prolonged period. This study indicates that H_2O_2 had an adverse effect neither on physicochemical nor on the sensory properties of doi and rosogolla. Hence, H_2O_2 is safe for public health at maximum 0.5 ml/L of milk thereby; H_2O_2 preserved milk can be safely used for making dairy products like doi and rosogolla ensuring nutritional quality and sensory properties.

Contributions of the authors

Conceptualization and methodology, SA, MAI and MNI, formal analysis and investigation, SA, MAHS, MAI and MNI, data curation, SA, MAHS and MAI, writing-original draft preparation, SA and MAHS, writing-review and editing, MSB, MSRS, MHR and MAI, supervision, MNI.

Acknowledgement

The authors would like to thank the National Science and Technology Fellowship, Ministry of Science and Technology, The Government of the People's Republic of Bangladesh for providing NST fellowship to SA.

Conflict of Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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