Journal of Animal Research: v.7 n.3, p. 553-558. June 2017

DOI: 10.5958/2277-940X.2017.00082.1

Quality Evaluation of Milk Products Retailed in Hisar City of Haryana State

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Received: 23 Feb., 2017 **Revised:** 15 May, 2017 **Accepted:** 16 May, 2017

ABSTRACT

The present study was aimed to determine the chemical quality and microbiological safety of some selected milk products retailed in Hisar city of Haryana state. Samples of burfi, paneer, rasogolla and gulabjamun were collected three times from five different sweet shops of Hisar city. The chemical and microbiological analysis of samples were carried out and compared with Indian standard (IS) as given by Bureau of Indian Standard (BIS). Significant ($P<0.05$) deviation in moisture, titratable acidity and lactose content of burfi from specification were observed. Chemical analysis of paneer, rasogolla and gulabjamun also indicated a variation from the specification. Microbiological safety was assessed by determining standard plate count (SPC) and coliform counts. SPC of rasogolla samples was reported significantly ($P<0.05$) higher than specification. The coliform count was found under specified limit by BIS. The higher bacterial load indicated poor hygiene practices during preparation and packaging of products and which may cause serious health hazards to consumers.

Keywords: Milk products, burfi, paneer, chemical analysis, Indian standard

Indigenous dairy products have played an important role in the socio-economic life of Indians since time immemorial. Indigenous products account for over 90% of all dairy products consumed (Aneja *et al*., 2002; Singh *et al*., 2007; Kumbhar *et al*., 2009). India continues to be the largest producer of milk in the world. India's annual milk production during 2015-16 was 155.5 million tonnes (DAHDF, Annual Report 2016-17, India).

Approximately 50% of the milk produced is consumed as fresh or boiled, one sixth as yoghurt or curd and remaining is utilized for the manufacturing of indigenous varieties of milk products and milk made sweets (Randhawa and Chahal, 2008). Almost the entire activity of indigenous milk products is dominated by halwai's who use the batch method to cater the local demands (Rajorhia *et al*., 1991). The manufacture of these products is based on the traditional method without any regard to the quality of raw material used. Although, the physico-chemical properties of milk show some natural variations depending upon factors like method of manufacture, age and condition of the sample, species, breed, individuality of animal, stage of lactation, number of lactation age of animal, season of the year, region of the country and feed of the animal etc. (Aneja *et al*., 2002). The unhygienic conditions at the production units lead to contamination of products with different types of microorganisms leading to a low shelf life of the finished products and may contain pathogens which can result in the serious health hazards. The most of the products are sold in the market without proper packaging and unduly exposing them to atmospheric contamination (Khan, 2006). Thus, microbiological quality of indigenous milk products is usually far from satisfactory. Lack of process standardization and quality control in small scale milk products manufacturing resulted in quality deviation. Hence, the present study was conducted to evaluate the chemical and microbiological quality of burfi, paneer, rasogolla and gulabjamun with reference to Indian standard as given by Bureau of Indian Standard.

MATERIALS AND METHODS

Sample collection

Five different retail shops from Hisar city of Haryana were selected randomly for collection of paneer, burfi, gulabjamun and rasogolla samples. The samples (250 g each product) were collected in sterilized container and brought to the Department of Livestock Products Technology, Lala Lajpat Rai University of Veterinary Sciences and Animal Husbandry. Samples were collected three times from each shop and analysed for chemical and microbiological parameters. The samples were presented in coded form as B, P, R and G followed by suffix 1, 2, 3, 4 and 5 for burfi, paneer, rasogolla and gulabjamun respectively.

Chemical analysis

Moisture, fat, protein, sucrose and titratable acidity were estimated as per the method of BIS (1989). Moisture content was measured by using drying oven method. Fat content was estimated by using Mojonnier fat extraction apparatus. Protein content was estimated by the Micro-kjeldahl method. Sucrose was estimated as per Lane-Eynon Method. Lactose content was determined by using the colorimetric method as described by Nickerson *et al*. (1976).

Microbiological analysis

The microbiological evaluation was done according to APHA (1984). One gram sample was homogenized with 9 ml of 0.85% NaCl solution to make an initially dilution 10^{-1}. Serial dilutions of the suspended samples were performed and 0.1 mL aliquots of the appropriate dilution were spreaded on media plated in duplicate. Standard plate count and coliform count were determined using plate count agar and violet red bile agar respectively.

Statistical analysis

Results were statistical analysed for analysis of variance (ANOVA) using SPSS 16 for Windows. Duncan's multiple range test at 5% significance level was applied to find out significant differences in mean and results were expressed as mean ± standard deviation.

RESULTS AND DISCUSSION

Chemical quality

The moisture content of burfi ranged from were 11.53 to 21.85 % (Table 1). This variation might be due to the difference in heat treatment during preparation or due to variation in raw milk used. In sample B1, B4 and B5 the moisture content was found significantly ($P<0.05$) higher

Table 1: Chemical and microbiological quality characteristics of burfi

Sample	Moisture %	Fat %	Titratable acidity %	Sucrose %	Lactose %	SPC (log cfu/g)	Coliform count (log cfu/g)
IS	15.00^{d} (max)	12.50^{c} (min)	0.35^{a} (max)	48.00^{a} (max)	15.00^{b} (min)	4.48^{bc} (max)	NA
B1	16.42^{c} ±0.83	11.45^{d} ±0.79	0.39^{a} ±0.06	31.21^{d} ±1.20	14.50^{b} ±0.99	4.70^{b} ±0.32	ND
B2	11.53^{e} ±0.67	17.39^{a} ±1.11	0.25^{b} ±0.05	38.13^{b} ±1.13	15.97^{a} ±0.92	4.21^{d} ±0.42	ND
B3	15.37^{d} ±0.71	13.28^{c} ±0.66	0.36^{a} ±0.05	34.47^{c}±0.98	14.07^{b} ±0.83	4.43^{bc} ±0.35	ND
B4	21.85^{a} ±1.05	15.80^{b} ±0.87	0.41^{a} ±0.08	33.53^{c} ±1.44	12.00^{c} ±0.63	3.88^{d} ±0.45	ND
B5	18.49^{b} ±0.93	17.44^{a} ±0.95	0.28^{b} ±0.07	34.95^{c} ±1.79	12.89^{c} ±0.82	5.72^{a} ±0.35	ND

(n=6, Mean ± SD)

Means with different superscripts within a column differ significantly ($P<0.05$)

IS- Indian standard for burfi as per BIS; max- maximum; min- minimum

B1, B2, B3, B4 and B5- burfi samples procured from 5 retail shops

ND- not detected; NA- not applicable

than Indian standard. Shete *et al*. (2012) reported moisture of burfi ranging from 10 to 25.87%. The fat content of sample B1 was significantly (P<0.05) lower than the specification. It might be due to the use of substandard milk for the preparation of burfi. Shete *et al*. (2012) also reported the fat content in range 10.05 to 18.02%. Titratable acidity of burfi was observed from 0.28 to 0.41% as compare to Indian standard of 0.35%. This might be due to use of high acidic milk for the preparation of burfi. Rajorhia *et al.* (1991) also found 0.53% titratable acidity in burfi. Sucrose content of burfi was observed within BIS specification of 48% maximum. Rao and Arora (1997) reported sucrose content in burfi ranging from 25.51 to 48.8 %. Sucrose content in burfi influenced by consumer acceptance of sweetness. The lactose content of sample B4 and B5 were significantly (P<0.05) lower than the 15% minimum Indian standard and it was probably due to use of substandard milk in burfi preparation.

Moisture content of paneer sample P3 and P4 was significantly (P<0.05) higher than Indian standard limit of 60% maximum moisture but other samples had moisture content within specification (Table 2). The higher moisture content in paneer might be due to less drainage of whey from paneer. Similarly, Desale *et al*. (2009) reported 42.62 to 60.39% moisture content in paneer. The fat content from all samples was found as per Indian standard. Titratable acidity of paneer ranged from 0.34 to 0.50% and was found as per BIS specification. Goyal *et al*. (2007) reported titratable acidity from 0.30 to 0.45%. Moisture content of rasogolla samples was found between 41.49 to 49.58% and was significantly lower than the Indian standard of 55.00% maximum moisture content (Table 3). Chavan *et al*. (2009) and Arora *et al*. (1996) also reported a similar result. The protein content from source R3 and R5 was found significantly (P<0.05) lower than the BIS specification. It might be due to the lower protein content in channa used for rasogolla preparation. Fat content from R2 and R3 were observed significantly (P<0.05) lower than Indian standard. It might be due to lower fat content in channa used for the preparation of rasogolla. Chavan *et al*. (2009) also indicated similar result but Arora *et al*. (1996) reported slightly higher (7.3%) fat content than the result of the present study. Sucrose content of rasogolla was found significantly (P<0.05) lower than the Indian standard of 45% maximum sucrose content. Similar results were also reported by Chavan *et al.* (2009).

The moisture content gulabjamun sample G2 and G4 was found significantly (P<0.05) higher than the Indian standard of 30% maximum moisture content (Table 4). The higher moisture content might be due to high moisture content in khoa used for the preparation of gulabjamun. Chetana *et al.* (2004) also reported the similar range of moisture (25 to 31%) in gulabjamun. Protein content (5.16 to 5.52%) of gulabjamun was found significantly lower than 8% minimum BIS specification. It might be due to use of substandard milk for khoa making which was an ingredient in the preparation of gulabjamun. Similarly, Chetana *et al.* (2004) reported protein content of gulabjamun from 6.1 to 6.9%. The fat content of gulabjamun was found from 7.34 to 11.35% as compare to

Table 2: Chemical and microbiological quality characteristics of paneer

Sample	Moisture %	Fat % on dry basis	Titratable acidity %	SPC (log cfu/g)	Coliform count (log cfu/g)
IS	60.00^{c} (max)	50.00^{c} (min)	0.50^{a} (max)	4.70^{c} (max)	1.95^{a} (max)
P1	$60.75^{bc} \pm 1.61$	$55.32^{a} \pm 1.38$	$0.47^{ab} \pm 0.07$	$4.83^{bc} \pm 0.31$	$0.85^{d} \pm 0.38$
P2	$55.11^{d} \pm 1.45$	$51.21^{bc} \pm 0.72$	$0.34^{d} \pm 0.07$	$4.62^{c} \pm 0.41$	$1.08^{bc} \pm 0.40$
P3	$62.30^{ab} \pm 1.55$	$55.75^{a} \pm 2.31$	$0.40^{bc} \pm 0.04$	$5.17^{ab} \pm 0.43$	$1.28^{abc} \pm 0.39$
P4	$63.78^{a} \pm 1.94$	$52.18^{b} \pm 1.95$	$0.50^{a} \pm 0.07$	$4.14^{d} \pm 0.42$	$0.96^{bc} \pm 0.31$
P5	$55.01^{d} \pm 1.75$	$54.48^{a} \pm 0.86$	$0.44^{ab} \pm 0.07$	$5.58^{a} \pm 0.33$	$1.34^{ab} \pm 0.35$

(n=6, Mean ± SD)

Means with different superscripts within a column differ significantly (P<0.05)

IS- Indian standard for paneer as per BIS; max- maximum; min- minimum

P1, P2, P3, P4 and P5- paneer samples procured from 5 retail shops

Table 3: Chemical and microbiological quality characteristics of rasogolla

Sample	Moisture %	Protein %	Fat %	Sucrose %	SPC (log cfu/g)	Coliform count (log cfu/g)
IS	55.00^{a} (max)	5.00^{b} (min)	5.00^{b} (min)	45.00^{a} (max)	2.70^{d} (max)	0
R1	47.10^{c} ±0.84	4.75^{bc} ±0.53	5.22^{b} ±0.42	35.69^{c} ±1.44	3.55^{c} ±0.35	ND
R2	48.82^{b} ±0.81	5.92^{b} ±0.50	4.32^{c} ±0.44	34.30^{c} ±1.77	3.71^{c} ±0.38	ND
R3	41.49^{e} ±1.30	4.26^{c} ±0.38	3.83^{c} ±0.53	37.24^{b} ±1.40	4.14^{b} ±0.32	ND
R4	49.58^{b} ±1.34	6.65^{a} ±0.45	6.01^{a} ±0.57	34.90^{c} ±1.78	3.08^{d} ±0.35	ND
R5	44.02^{d} ±1.79	3.69^{e} ±0.42	5.21^{b} ±0.67	37.40^{b} ±1.43	4.54^{a} ±0.46	ND

(n=6, Mean ± SD)

Means with different superscripts within a column differ significantly (P<0.05)

IS- Indian standard for rasogolla as per BIS; max- maximum; min- minimum

R1, R2, R3, R4 and R5- rasogolla samples procured from 5 retail shops

ND- not detected

Table 4: Chemical and microbiological quality characteristics of gulabjamun

Sample	Moisture %	Protein %	Fat %	Sucrose %	SPC (log cfu/g)	Coliform count (log cfu/g)
IS	30.00^{b} (max)	8.00^{a} (min)	8.00^{de} (min)	40.00^{c}(min)	3.48^{d} (max)	1.69 (max)
G1	27.56^{c} ±0.86	5.30^{b} ±0.40	9.92^{b} ±0.53	51.00^{a} ±1.52	3.75^{cd} ±0.39	ND
G2	31.91^{a} ±1.13	5.41^{b} ±0.59	7.34^{e} ±0.74	47.44^{b} ±1.66	4.29^{ab} ±0.47	ND
G3	30.56^{ab} ±1.18	5.57^{b} ±0.38	8.35^{d} ±0.66	48.95^{b} ±1.82	4.02^{bc} ±0.43	ND
G4	31.85^{a} ±1.45	5.16^{b} ±0.46	9.16^{c} ±0.70	48.03^{b} ±1.72	3.30^{d} ±0.30	ND
G5	25.56^{d} ±1.27	5.52^{b} ±0.43	11.35^{a} ±0.65	52.11^{a} ±1.44	4.68^{a} ±0.42	ND

(n=6, Mean ± SD)

Means with different superscripts within a column differ significantly (P<0.05)

IS- Indian standard for gulabjamun as per BIS; max- maximum; min- minimum

G1, G2, G3, G4 and G5- gulabjamun samples procured from 5 retail shops

ND- not detected

8% minimum BIS specification. Chetana *et al.* (2004) also reported the fat content of gulabjamun from 6.4 to 10.3% which agreed with the present study. Sucrose content of gulabjamun ranged from 48.03 to 51% as compare to 40% minimum BIS requirement. All samples showed significantly (P<0.05) higher sucrose content than Indian standard. Yawale *et al*. (2012) also observed the similar result in their study. Higher sucrose content might be a profit driven attribute by the manufacturer.

Microbiological quality

Standard plate count of burfi ranged from 3.88 to 5.72 log cfu/g as compared to 4.48 log cfu/g maximum BIS specification (Table 1). The SPC of sample B5 was found significantly (P<0.05) higher than specification. The variability in the SPC might be attributed to the varying conditions under which these products were prepared and marketed. Chatli *et al*. (2014) and Neetu *et al*. (2012) also reported 2.73 to 5.83 log cfu/g in burfi. The SPC of paneer sample P3 and P5 was found significantly (P<0.05) higher than 4.70 log cfu/g maximum BIS specification (Table 2). Desale *et al*. (2009) and Chatli *et al*. (2014) also reported a higher SPC in paneer samples in their respective studies. The SPC of rasogolla samples except R4 was found significantly (P<0.05) higher than 2.70 log cfu/g maximum BIS specification (Table 3). Chatli *et al.* (2014) reported a similar result but Singh *et al.* (2007)

reported 2.74 log cfu/g standard plate count in rasogolla. The SPC of Gulabjamun sample G2, G3, and G5 were found significantly ($P<0.05$) higher than the 3.48 log cfu/g maximum BIS specification (Table 4). Results suggested unhygienic practices during processing and packaging of gulabjamun and use of contaminated ingredients for the preparation of gulabjamun. Neetu *et al.* (2012) reported a higher (4.53 to 5.96 log cfu/g) SPC count in gulabjamun. The food handlers in sweet shops play an important role in cross contamination which leads to higher microbial load.

Coliform counts were found absent in all samples of burfi, rasogolla and gulabjamun. Absence of coliform in samples indicated no faecal contamination during production and packaging. Chavan *et al*. (2009) and Singh *et al.* (2007) also reported coliform counts nil in their respective studies. But in paneer samples, coliforms were ranged from 0.85 to 1.28 log cfu/g as compared to 1.69 log cfu/g maximum BIS specification. The presence of coliforms in paneer samples indicated faecal contamination which might arise due to unhygienic preparation conditions in most of the sweetmeat shops or it might be from the food handlers. Goyal e*t al*. (2007) reported 1.61 to 2.08 log cfu/g and Desale *et al*. (2009) reported 4.1 to 4.36 log cfu/g coliform counts in paneer.

CONCLUSION

The comparative analysis of sample milk products with Indian standard provided an idea about chemical and microbiological quality standards of collected samples. The majority of burfi samples had higher moisture and lower lactose content than Indian standard. The chemical analysis of paneer samples indicated the good quality and rasogolla samples had higher SPC. So, it can be concluded that good packaging and looks of milk products does not promise a safe and quality product. Besides the manufacturer own quality control, regulatory systems should examine market samples to ensure the product quality and safety of intended consumers.

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