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Sensory and microbiological attributes of *Danadar* marketed at three adjacent markets of West Bengal

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Abstract

Danadar is a famous *chhana* based traditional dairy product of West Bengal. For the process optimization and nutritional up gradation of *Danadar*, it was essential to get the feedback of the local products and consumers choice or liking. So, it was decided to collect the samples from the three adjacent markets of West Bengal namely Kolkata (North), Nadia (Mohanpur) and North 24-Pargana (Kanchrapara) and their surrounding area. Wide variations in the sensory and microbiological attributes of the three samples of *danadar*, especially in respect of color & appearance, flavor, body & texture and overall acceptability were observed. Wide variations in the microbiological attributes as Total viable count, Coliform, Yeast & Mold and Staphylococcus count were also found. The significant difference was observed between the mean values of sensory and microbiological attributes within the markets at 0.05. The variations in sensory and microbiological attributes may be due to use of different types of milk, sugar concentration, adulteration of milk and preparation of *Danadar* under unhygienic condition respectively. The chemical composition was almost similar and may be due to facts that, the markets were adjacent to each others.

Keywords: *Danadar*, sensory and microbiological attributes

Introduction

India has emerged as the largest milk producing country of the world. In 2014-15 about 146.3 million metric tons/ year of milk is produced in India (Srivastava, 2016) ^[1]. Out of which, 45 per cent of milk is used as fluid milk which is fresh, unprocessed; of the balance 30-35 per cent of milk produced is handled by traditional vendors. It is 20-22 per cent of the milk produced that enters the organized dairy sector (Khanna, 2016) ^[9].

Various traditional milk products like *rasogolla*, *gulabjamun*, *sandesh*, *burfi*, *peda*, *balusahi*, *danadar*, *misti dahi* etc. are made in our country since ancient times because of their social, economic, religious, medicinal and cultural activities. Sweetmeats are typical in Bangla cuisine. The sweetmeats that are available in the markets are mostly *chhana*-based milk products and palatable. Sweetmeats have a significant role in our culture. There is no such ceremony and festival which goes without sweetmeats. Among these, *danadar* occupies a unique place in the local area of West Bengal.

Danadar is a popular *chhana* based sweet. Indigenous milk products have a big potential of the emerging dairy industry in the organized sector.

Danadar is usually sold in spherical form. It is golden and white in color and has a semi hard to firm body with granular texture. It is boiled in the sugar syrup till golden color develops. Sugar soaked *danadar* is rolled on sugar granules. *Danadar* was originated by Dwarik's sweet shop of Shyama Pukur Street in Kolkata. The shop used to sell *danadar*.

Material & Methods

Sample collection

The 20 samples were collected from each famous sweet seller of three different markets of West Bengal namely Kolkata (North), Nadia (Mohanpur) and North 24-Pargana (Kanchrapara) and their surrounding area. The samples were drawn in presterilized plastic pot of the laboratory, Faculty of Dairy Technology, Mohanpur, Nadia. All conical flasks, volumetric flasks, measuring cylinders, pipettes and burettes etc. used were made of *Borosil*.

Sensory analysis

Representative sample of *danadar* was tested for sensory attributes as color and appearance, flavor, body & texture and overall acceptability.

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The procedure adopted for sensory evaluation was Nine Point Hedonic scale. About 50 g of *danadar* was finely ground and kept in capped plastic sample cups at refrigeration temperature (7 ± 1 °C) till analysis was completed.

Microbiological analysis

The total viable, yeast and mold, coliform and staphylococcus counts in the samples were determined as per the methods suggested in APHA (1984). The stored samples of enrobed cow milk *danadar* were opened in an inoculation chamber, presterilized with ultraviolet irradiation. 11 g of enrobed cow milk *danadar* was aseptically weighed and transferred to a sterile mortar containing 99 ml of sterile 0.9% NaCl dilution blank. The sample was homogenized for 2 min using a sterile pestle to make 10^{-1} dilution. Further, dilutions were made using 0.9% NaCl water as diluents. To prepare 10^{-2} dilution, 1 ml from 10^{-1} dilution was mixed with 9 ml of 0.9% NaCl, water and so on. Preparation of sample and serial dilution were done near flame.

Media used

Nutrient Agar: It is used for the cultivation of microbes supporting growth of a wide range of non-fastidious organisms. Nutrient agar is popular because on its variety of microorganism can grow. The medium is recommended for use in the TVC analysis of milk and other dairy products.

VRB Agar: It is a selective medium used to detect and enumerate lactose-fermenting coliform microorganisms. The medium is recommended for use in the microbiological analysis of milk and other dairy products.

Potato Dextrose Agar (PDA): It is used for the cultivation of fungi. PDA is a general purpose medium for yeasts and molds that can be supplemented with acid or antibiotics to inhibit bacterial growth. It is recommended for plate count methods for foods, dairy products and testing cosmetics. The

nutritionally rich base (potato infusion) encourages mold sporulation and pigment production in some dermatophytes.

BPA: It is formulated on the principle that staphylococci are able to reduce tellurite to tellurium and to detect lecithinase from egg lecithin. Components like Casein enzymatic hydrolysate, meat extract and yeast extract provides nitrogen, carbon, sulphur and vitamins. Pyruvate and Sodium pyruvate not only protects injured cells and helps recovery but also stimulates the growth of *Staphylococcus aureus*. Lithium chloride and potassium tellurite act as inhibitor agents for contaminating microflora. The tellurite additive is toxic to egg yolk-clearing strains other than *S. aureus* and imparts a black color to the colonies.

Procedure

The samples were aseptically drawn in a sterilized chamber of U.V. radiation. Appropriate dilutions of samples were transferred into petridish in duplicate. The molten Nutrient, VRB, PDA and BPA media were poured into each petridish and allowed to solidify for TVC, Coliform, Yeast & Mould and Staphylococcus counts respectively. On solidification of the second layer, the petridishes were incubated at the respective temperature and time combination mentioned on media bottle and results were expressed as log cfu/g of sample.

Statistical analysis

The Data obtained were statistically analyzed.

Result and Discussion

All samples of *danadar* were procured from each market of three places of West Bengal. The sensory and microbiological analysis of *danadar* samples were performed in Faculty of Dairy Technology, Mohanpur, Nadia. The Data obtained during testing were tabulated in the Table No 1

Table 1: Sensory and microbiological characteristics of *danadar* procured from different markets of West Bengal.

PARAMETERS	Markets					
	KOLKATA (M1)*		NADIA (M2)**		NORTH 24-PARGANAS (M3)***	
	Range	Mean	Range	Mean	Range	Mean
Flavor	6.00-8.50	7.69	6.50-7.80	7.17	6.20-7.20	6.61
Color and appearance	7.20-8.00	7.51	6.00-7.50	6.69	6.00-6.80	6.49
Body and texture	7.00-8.50	7.66	6.00-7.00	6.61	6.00-7.00	6.34
Overall acceptability	7.00-8.50	7.52	6.50-7.00	6.62	6.00-7.00	6.50
Total viable counts (log cfu/g)	4.87-5.90	5.44	3.457-5.56	4.36	5.09-5.90	5.60
Coliform counts (log cfu/g)	2.03-2.44	2.17	1.23-2.32	1.74	2.22-2.58	2.44
Yeast and mold counts (log cfu/g)	2.11-2.27	2.23	1.35-2.11	1.77	2.12-2.55	2.41
Staphylococcus counts (log cfu/g)	5.00-5.69	5.46	3.43-4.77	4.03	5.25-5.95	5.70

* M1- Kolkata

** M2- Nadia

*** M3-North -24- Parganas

Sensory quality

The sensory quality of *danadar* samples indicates towards the difference of practices that were adopted during production of

milk, addition of different proportion of ingredients, preparation of *danadar* and storage.

Table 2: ANOVA for sensory attributes of market samples of *danadar*

		F Value			
	DF	Color and appearance	Flavor	Body and texture	Overall acceptability
Model	2	35.00*	28.96*	60.62*	22.47*
Error	57				
Total	59				

* Significant at $P \leq 0.05$

Color and appearance

Whiteness in fluid milk is due to the scattering of light in the visible spectrum by the colloidal particles, such as milk fat globules and casein micelles present in the milk (Fox and McSweeney, 1998) [5]. It was reported that heating of milk above 60 °C increased the whiteness of milk owing to the denaturation of whey protein. Denatured serum protein tends to form aggregate into particle of high length to breadth ratio (Burton, 1994) [2], responsible for scattering more light into visual spectrum. In addition, denatured whey protein also increased the size of casein micelles by interacting with them (Burton, 1994) [2].

The color and appearance of any product makes it attractive. From Table-1, it was found that the mean values of color and appearance score in *danadar* samples of M1, M2 and M3 were 7.51, 6.69 and 6.49, respectively. Similarly, their range varied from 7.2-8.0, 6.0-7.5 and 6.0-6.8, respectively. It was observed that the color and appearance score in *danadar* sample M1 was higher than other samples. Data for mean score in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the color and appearance in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-2.

Flavor

Apart from the rich flavour of fat, milk fat also functions as the solvent of many aroma compounds. Fat is known to retard the release of these flavour compounds from food matrix. Frost and Janhoj (2007) mentioned about the faster flavour release in low fat products.

It was observed from Table-1 that the mean values of flavor in *danadar* samples of M1, M2 and M3 were 7.69, 7.17 and 6.61, respectively. Similarly, their range varied from 6.0-8.5, 6.5-7.8 and 6.2-7.2, respectively. It was observed that the flavor score in *danadar* sample M1 was higher than other samples. Data for mean score in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the flavor in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-2.

Body and texture

Mottar *et al.* (1989) reported that formation of coaggregates at high heat treatment contributed to better properties in gel particles and a fine structure of the product. The formation of fine structured gel with less porosity and the reduced propensity to wheying-off with increasing pasteurization temperature may increase the body and texture score significantly. The increase in body and texture score with the increase in fat content may be due to smoothness of milk fat which gave softness to the product (Bansal, 2015) [1].

From Table-1, it was observed that the mean values of body and texture score in *danadar* samples of M1, M2 and M3 were 7.66, 6.61 and 6.38, respectively. Similarly, their range varied from 7.0-8.5, 6.0-7.0 and 6.0-7.0, respectively. It was observed that the body and texture score in *danadar* sample M1 was higher than other samples. Data for mean score in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the body and texture in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-2.

Overall acceptability

Overall acceptability of *danadar* is a combined effect of color & appearance flavor and body & texture score respectively. From Table-1, it was observed that the mean values of overall acceptability in *danadar* samples of M1, M2 and M3 were 7.52, 6.615 and 6.5, respectively. Similarly, their range varied from 7.0-8.5, 6.5-7.0 and 6.0-7.0, respectively. It was observed that the overall acceptability score in *danadar* sample M1 was higher than other samples. Data for mean score in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the overall acceptability in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-2.

Microbiological quality

The microbiological quality of *danadar* samples indicates towards the hygienic practices that were adopted during production of milk, preparation of *danadar* and storage.

Table 3: ANOVA for microbiological attributes of market samples of *danadar*

	DF	F Value			
		TVC	Y and M	Coliform	Staphylococcus
Model	2	70.55*	108.90*	68.18*	270.15*
Error	57				
Total	59				

* Significant at $P \leq 0.05$

Total viable count

The TVC of the product is presented in Table-1 and observed that the mean values of TVC in *danadar* samples of M1, M2 and M3 were 5.44, 4.36 and 5.61 in log cfu/g, respectively. Similarly, their range varied from 4.87-5.90, 3.46-5.56 and 5.09-5.90 in log cfu/g, respectively. It was observed that the TVC in *danadar* sample M3 was higher than other samples. Data for mean count in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the TVC in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-3.

Yeast and Mold count

From Table-1, it was observed that the mean values of yeast and mold (Y and M) in *danadar* samples of M1, M2 and M3 were 2.23, 1.77 and 2.41 in log cfu/g, respectively. Similarly, their range varied from 2.11-2.27, 1.35-2.11 and 2.12-2.55 in log cfu/g, respectively. It was observed that the Y and M in *danadar* sample M3 was higher than other samples. Data for mean count in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the Y and M in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-3.

Coliform count

The coliform count of market samples were presented in Table-1. Coliform are considered as indicator organisms because their presence in food indicates some form of contamination. Poor hygiene, contaminated water, unsanitary milking practices and improperly washed and maintained equipment can lead to higher coliform count in the product. If

coliform found in the product, it indicates that processed product was not properly processed and may cause high health risk to consumers.

From Table-1, it was found that the mean values of coliform count in *danadar* samples of M1, M2 and M3 were 2.17, 1.74 and 2.44 in log cfu/g, respectively. Similarly, their range varied from 2.03-2.44, 1.23-2.32 and 2.22-2.58 in log cfu/g, respectively. It was observed that the mean count of coliform in *danadar* sample M3 was higher than other samples. Data for mean count in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the coliform count in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-3.

Staphylococcus count

From Table-1, it was observed that the mean value of staphylococcus count in *danadar* samples of M1, M2 and M3 were 5.46, 4.04 and 5.70 log cfu /g, respectively. Similarly, their range varied from 5.00-5.69, 3.43-4.77 and 5.25-5.95 log cfu /g, respectively. It was observed that the staphylococcus count in *danadar* sample M3 was higher than other samples. Data for mean count in *danadar* were statistically analyzed to find out significant difference between different markets with regard to the staphylococcus count in *danadar* samples. A significant difference was observed among the mean values of M1, M2 and M3 ($P \leq 0.05$) of the three market samples as shown in Table-3.

All values were in range of analysis conducted by Chakarbarti and Gangopadhyay, (1990) [3].

Conclusion

Twenty samples from three different markets M1, M2 and M3 were collected and found that the sensory score of M1 was higher than M2 and M3 where as the microbiological score of M2 was higher than M1 and M3 respectively. The significant difference was observed between the mean values of sensory and microbiological attributes within the markets at 0.05. The variations in sensory and microbiological attributes may be due to use of different types of milk, sugar concentration, adulteration of milk and preparation of *Danadar* under unhygienic condition respectively.

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