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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) [11]. 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, gulabjamum, 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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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*

		F Value			
	DF	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 (Yand 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 Gangopadhytay, (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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