PREPARATION OF DAHI FOR DIABETIC PATIENT

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Abstract

In this experiment, an attempt was made to prepare dahi for diabetic patient and also to monitor the quality of prepared dahi by using different tests. For this purpose, artificial sweeteners such as sac-sweet and sucrol were added with milk to prepare dahi for diabetic patient. Milk sample was collected from the Bangladesh Agricultural University Dairy Farm. Three different types of dahi (A- dahi with sugar, B- dahi with sac-sweet and C- dahi with sucrol) were prepared by using the milk. From the results of physical scores it was found that overall score of A, B and C type dahi samples were 92.44 ± 1.83, 86.99 ± 4.70 and 86.45 ± 7.65, respectively ($P > 0.05$). Average total solids, fat, protein and ash content of A, B and C type dahi samples were 243.43 ± 2.7, 149.73 ± 2.6 and 149.83 ± 2.5 ($P < 0.01$); 44.33 ± 2.1, 49.00 ± 2.6 and 49.00 ± 2.6 ($P > 0.05$); 36.17 ± 1.3, 40.07 ± 1.1 and 40.07 ± 1.1 ($P < 0.05$); 7.67 ± 0.2, 8.43 ± 0.2 and 8.43 ± 0.2 ($P < 0.01$) g/kg, respectively. It was observed that the values of above parameters (except total solids) for dahi prepared by using sac-sweet and sucrol were nearly similar to the dahi prepared by using sugar. But higher level of total solids for A type dahi was due to addition of 10% sugar with milk during dahi preparation. On the other hand, very small amount of artificial sweeteners were used in B and C type dahi just to increase the sweetness which had no or little effect to increase the totals solids content. So it can be suggested that acceptable quality dahi could be prepared by using artificial sweeteners like sac-sweet and sucrol for diabetic patient.

Introduction

Dahi is the curd resulting from lactic fermentation of milk. It is a highly nutritious product containing all the nutrients present in milk. It has been demonstrated that acid milk is somewhat easily digestible than normal milk. For some individuals, dahi has definite therapeutic value, especially who usually suffer from stomach and intestinal disorders. This assumption is probably due to the fact that the acid fermenting bacteria and lactose of milk are able to create conditions in the intestinal tract which are unfavourable for the growth of putrefactive bacteria and thereby prevents the formation of gas and a condition known as "autointoxication" (Rangappa and Achaya, 1974). Dahi is also effective in lowering the blood cholesterol level (Mann and Spoetry, 1974). Since dahi is made from milk, it contains all the nutrients which are present in milk with the exception of lactose. Dahi contains lower

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level of lactose, as because a portion of lactose of milk undergoes fermentation. At the same time, some intermediate products which are produced during fermentation further help to assimilate lactose. For this reason, people who are suffering from lactose intolerance syndrome can digest dahi easily. Diabetes is a metabolic disorder that results from the body, inability to produce insulin. Insulin moves sugar in the blood into cells where it is converted into energy for life. People who have diabetes are now advised to eat a "normal" balanced diet, including moderate amount of sugar. An important part of diabetes management is to keep blood sugar levels within healthy limits. It was found that low caloric sweetener helps by providing sweet taste without increasing the blood sugar levels. Artificial sweeteners like sac-sweet, sucrol, aspartime etc. are available in the market and are being used by diabetic patient for making tea and coffee. It was observed that side effect of aspartame is much higher than sac-sweet and sucrol. For this reason, sac-sweet and sucrol were selected to prepare dahi for diabetic patient. Artificial sweeteners in moderate level are recommended by scientists to use for diabetic patient. Although it is suggested that these type of sugars also have some side effects on diabetic patient when they use them with tea or coffee, recently it is observed that if the artificial sweeteners are added to any food items below 40°C then the side effects could be less or very minimum. As we know that temperature of hot tea and coffee is around 100°C but dahi could be prepared by maintaining at temperature of below 40°C. To authors' knowledge, the use of sac-sweet or sucrol for manufacturing dahi or yoghurt has not yet received attention of the researchers. For this reason the present research work was undertaken with sac-sweet or sucrol for the preparation of dahi.

Materials and Methods

Site of the experiment
The present experiment was carried out at the Dairy Technology and Dairy Microbiology Laboratory of the Department of Dairy Science, Bangladesh Agricultural University (BAU), Mymensingh.

Collection of raw milk
Whole milk was collected from the Bangladesh Agricultural University Dairy Farm.

Chemical analysis of whole milk
Before preparation of dahi, the quality of whole milk was measured with the help of following tests. The total solids (g/kg), protein (g/kg) and ash content (g/kg) were determined as per the methods described in the AOAC (2003). The fat (g/kg) and acidity (%) were determined by using the procedure described by Aggarwala and Sharma (1961). The specific gravity of milk samples was determined by using Quevenne lactometer.

Preparation of dahi
The whole milk was heated to boiling temperature until its volume was reduced by approximately 20% of the weight of milk. Thereafter the milk sample was divided into three

equal portions. In one portion sugar was added at the rate of 10% of weight of milk. This sample was considered as controlled dahi and designated as A type dahi. On the other hand, the remaining two portions of milk were allowed to reduce the temperature up to 35°C and at that temperature sac-sweet and sucrol was added separately in two samples, and they were designated as B type and C type dahi, respectively. Thereafter 2% culture was added in each of the three portions. Starter culture was dissolved nicely by stirring it and then milk was poured in several plastic cups of about 100 ml sizes for incubation.

The plastic cups were pre-washed with boiled water before use. The samples were incubated at 37°C until the complete coagulation of samples. After complete coagulation, the samples were taken out from incubator and stored at about 4-5°C in refrigerator until served.

Sugar commonly referred to as table sugar, is a disaccharide comprising glucose and fructose and providing 4 calories per gram or about 16 calories per teaspoon. Sac-sweet which contains saccharin, is a white crystalline compound, it is 300 to 550 times sweeter than sugar and it contains no calories. Sucrol contains aspartame which is widely used as tabletop sweetener. It contains four calories per gram and it is 200 times sweeter than sugar, very little aspartame is needed to adequately sweeten foods, and hence adds minimal calories to foods.

Testing of dahi

Organoleptic, chemical and microbiological tests were done immediately after preparation of dahi.

a. **Organoleptic tests:** A panel of experienced judges examined the samples according to the organoleptic parameters, like smell and taste (50 marks), body and consistency (30 marks), colour and texture (20 marks) etc.

b. **Chemical tests:** All the samples were chemically analyzed for measuring the following parameters, such as pH value, acidity (%), total solids content (g/kg), fat content (g/kg), protein content (g/kg), ash content (g/kg) etc.

c. **Microbial test:** All the samples were tested for their microbial qualities using the total viable bacterial count (Standard plate count method).

Data analysis

Data obtained from different parameters were analyzed statistically designed in Completely Randomized Design (CRD) using the SPSS statistical package programme. Analysis of variance (ANOVA) test was done to find out the statistical difference among the different treatments. In case of significant differences LSD test was performed to monitor the significant differences with treatment means.

Results and Discussion

Initial quality of whole milk

The collected whole milk samples were analyzed just after taking to the laboratory to get idea about the quality of milk.

Quality of dahi

The quality of prepared dahi samples were monitored with the help of different tests. Results obtained on different parameters are summarized below:

Organoleptic evaluation

The scores for smell and taste, body and consistency, color and texture and overall physical score are given in the Table 1.

Smell and taste: The mean value of smell and taste scores for dahi prepared with sugar (A), sac-sweet (B) and sucrol (C) were 47.33 ± 0.37, 45.22 ± 0.96 and 44.44 ± 1.50, respectively (Table 1). Statistically significant differences (P<0.05) were found among the dahi samples in respect of smell and taste scores.

Body and consistency: The average body and consistency scores for A, B and C type dahi samples were 27.33 ± 0.58, 25.22 ± 1.39 and 25.88 ± 3.10, respectively (Table 1). Statistical analysis showed that there was no significant difference within the body and consistency score of different dahi samples.

Color and texture: The average color and texture score were 17.78 ± 1.07, 17.00 ± 2.02 and 16.67 ± 2.40, respectively for A, B and C type dahi samples (Table 1). Statistically no significant difference was found within the color and texture score of different dahi samples.

Overall score: Overall score of A, B and C types dahi samples given by judges were 92.44 ± 1.83, 86.99 ± 4.70 and 86.44 ± 7.65, respectively (Table 1). Statistical analysis showed that there was no significant difference within the overall score of different dahi samples.

Table 1. Average score card of various organoleptic characteristics of dahi containing different types of sweeteners

Parameters studied	Types of dahi			LSD value	Level of Sig.
	A	**B**	**C**		
Smell & taste (50)	47.33[a] ± 0.37	45.22[b] ± 0.96	44.44[b] ± 1.50	2.088	*
Body & consistency (30)	27.33 ± 0.58	25.22 ± 1.39	25.88 ± 3.10	3.971	NS
Colour and texture (20)	17.78 ± 1.07	17.00 ± 2.02	16.67 ± 2.40	3.827	NS
Overall score (100)	92.44 ± 1.83	86.99 ± 4.70	86.44 ± 7.65	8.496	NS

A = Dahi with sugar, B = Dahi with sac-sweet and C = Dahi with sucrol
NS = Non Significant; * = Significant at 5% level of probability
[a,b] Means with different superscript in the same row differ significantly

Chemical parameters

The chemical parameters of A, B and C type dahi samples are presented in Table 2.

pH value: The average pH value of A, B and C types dahi samples were 4.83 ± 0.06, 4.98 ± 0.06 and 4.93 ± 0.06, respectively (P>0.05) (Table 2). From an experiment Fellows (1991) reported that pH of good quality dahi is about 4.5 which was the close agreement nearly agrees with the present findings. Kamruzzaman *et al*. (2002), who reported that pH value of dahi samples at room temperature varied from 4.01 to 4.16.

Acidity: The average acidity percentage of A, B and C dahi samples were 0.71 ± 0.01, 0.69 ± 0.01 and 0.69 ± 0.01, respectively (Table 2). Statistical analysis showed that there was no significant difference among the different types of dahi samples. Sarkar *et al.* (1996) reported that misti dahi had a titrable acidity of 0.36 to 1.17 %.

Total solids (TS): The average total solids content were 243.43 ± 2.7, 149.73 ± 2.6 and 149.83 ± 2.5 g/kg for A, B and C type dahi samples, respectively (Table 2). Statistical analysis showed that there was significant difference within the total solids content of different types of dahi. Variation in total solids content of dahi could be attributed due to addition of sugar (Ghosh and Rajorhia, 1987).

Solids-not-fat (SNF): It was found that mean SNF content of dahi prepared with sugar, sac-sweet and sucrol (Sample A, B and C) were 199.10 ± 3.7, 100.83 ± 2.7 and 100.83 ± 2.7 g/kg, respectively (P<0.01) (Table 2). Normally the SNF content of misti dahi ranges from 183.0 to 230.6 g/kg (Gone and Okter, 1973).

Fat content: The average fat content of A, B and C type dahi samples were 44.33 ± 2.1, 49.0 ± 2.6 and 49.0 ± 2.6 g/kg, respectively (p>0.05) (Table 2). Ghosh and Rajorhia (1984) found that fat per cent of plain misti dahi varied from 4.3 to 8.8 with an average of 3.78 per cent. Chowdhury *et al*. (2011) reported that fat content of different types of dahi samples varied from 40.23 to 51.02%. In this experiment, fat content of B and C type dahi was slightly higher than A type dahi which might be due to addition of 10% sugar in A type dahi which might have increased its volume and weight than B and C type dahi. For this reason, during analysis, fat per cent of B and C type dahi showed slightly higher value than A type dahi.

Protein content: The average protein content of different types of dahi samples (A, B and C) were 36.17 ± 1.3, 40.06 ± 1.1 and 40.06 ± 1.1g/kg, respectively (P<0.05) (Table 2). Protein content of dahi samples were studied by several workers. Rangappa and Achaya (1974) reported that good quality dahi contains around 3.2 to 3.4 per cent protein. In this experiment, protein content of A, B and C type dahi samples were slightly higher than the values reported by Rangappa and Achaya (1974) which might be due to high level of protein in raw milk and reduction of 20% volume of milk.

Ash content: The average ash content of of A, B and C types of dahi samples were 7.67 ± 0.2, 8.43 ± 0.2 and 8.43 ± 0.2, g/kg respectively (Table 1 & 2). Statistical analysis showed that there was significant difference (P<0.01) within the ash content of different types of dahi samples.

Microbial parameters

Total viable bacterial count: It was found that the average total viable bacterial count of different types of dahi samples prepared with sugar, sac-sweet and sucrol (Sample A, B and C) were 6.80 ± 0.75, 5.77 ± 0.35 and 7.63 ± 0.47 cfu/g (log value), respectively (Table 2). Statistical analysis showed that significant difference (P<0.05) existed among the different types of dahi samples.

Table 2. Average score card of chemical composition of dahi prepared with different types of sweeteners

Parameters studied	Types of dahi			LSD value	Level of Sig.
	A	**B**	**C**		
pH	4.83 ± 0.06	4.98 ±0.06	4.93 ± 0.06	0.104	NS
Acidity (%)	0.71 ± 0.01	0.69 ± 0.01	0.69 ± 0.01	0.01998	NS
Total solids (g/kg)	243.43[a] ± 2.7	149.73[b] ± 2.6	149.83[b] ± 2.5	5.210	**
SNF	199.10[a] ± 3.7	100.83[b] ± 2.7	100.83[b] ± 2.7	6.158	**
Fat (g/kg)	44.33 ± 2.1	49.0 ± 2.6	49.0 ± 2.6	4.934	NS
Protein (g/kg)	36.17[b] ± 1.3	40.06[a] ± 1.1	40.06[a] ± 1.1	2.278	*
Ash (g/kg)	7.67[b] ± 0.2	8.43[a] ± 0.2	8.43[a] ± 0.2	0.1998	**
Total viable bacterial count (cfu/g)	6.80[b] ± 0.75	5.77[c] ± 0.35	7.63[a] ± 0.47	1.1040	*

A = Dahi with sugar, B = Dahi with sac-sweet and C = Dahi with sucrol
[a,b] Means with different superscript in the same row differ significantly
NS = Non-significant; * = Significant at 5% level of probability; ** = Significant at 1% level of probability

Conclusion

Quality of dahi prepared by artificial sweeteners were nearly similar to the dahi prepared by using sugar. As per organoleptic evaluation, there was no appreciable difference between the dahi prepared by using sac-sweet (B) and sucrol (C) as artificial sweeteners. Therefore, it can be concluded that dahi could be prepared by using artificial sweeteners for consumption of diabetic patient.

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