



Preparation of dahi from buffalo milk and blends with soy milk

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Abstract

The present study was conducted to measure the feasibility of using soy milk as a supplement for the preparation of dahi from buffalo milk. In this experiment, four different types of dahi were prepared by partial replacement of buffalo milk with soy milk named A (control-100% Buffalo Milk), B (75% Buffalo Milk + 25% Soy Milk), C (50% Buffalo Milk + 50% Soy Milk) and D (25% Buffalo Milk + 75% Soy Milk). The prepared samples were judged by a panel of expert judges for organoleptic qualities and analyzed for chemical tests. From the results of physical study, it was found that the overall organoleptic (viz. smell and taste, body and texture, color and appearance) score of A, B, C and D types dahi varied significantly ($P < 0.01$). From the results of the chemical test, the moisture and protein content increased significantly ($P < 0.05$), while fat, acidity, total solids and mineral contents significantly decreased due to addition of soy milk. From the findings of this work, it was concluded that 25% replacement of buffalo milk with soy milk could be used successfully which would produce dahi nearly similar to the quality of that made exclusively from buffalo milk.

Key words: Dahi, soy milk, buffalo milk

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Introduction

Dahi is the most popular fermented milk products which results from lactic acid fermentation of milk. Dahi is the prime source of proteins, B vitamins and calcium which are more digestible than when they are present in fresh condition. Dahi is very much popular and people of all ages like it for its typical flavor, characteristic solids consistency and high nutritive and therapeutic value. Dahi contains 85-88% water, 5-8% fat, 3.2-3.4% protein, 4.6-5.2% lactose, 0.5-1.1% lactic acid, 0.7-0.75% ash and 0.12-0.14% calcium (Laximinarayana *et al.* 1952). Though cows are the main source of milk in the world but buffalo are also the second source of milk supply in the world. Buffalo milk fat has less cholesterol and more tocopherol. Buffalo milk is richer in calcium and phosphorus and lower in sodium and potassium compared to cow milk. The peroxidase activity in buffalo milk is much higher than in cow milk. There is an acute shortage of milk and other protein rich food of animal origin in Bangladesh. Now-a-days, different types of milk replacing ingredients are used to make milk and milk products. Kamruzzaman *et al.* (2003) prepared dahi by using 10, 20, and 30% banana juice with

whole milk. Soy milk could be used in the manufacture of yoghurt (Hardi and Novakovie, (1994). Soybean contains 35-40% protein and 18-20% fat (Schroder *et al.*, 1986). Dahi is valued for controlling the growth of bacteria and incurring intestinal disease like constipation, diarrhea and dysentery (Shahani and Chandan, 1979). Dahi is also effective in lowering blood cholesterol (Mann and Spoerry 1974). Arsenic poisoning may be cured by taking dahi. Locally prepared soy milk is comparatively cheaper than whole milk and at the same time nutrient contents is nearly similar to whole milk. The present study was undertaken to study the feasibility of using soymilk to prepare dahi using buffalo milk replaced with soy milk.

Materials and Methods

Site and time of experiment

The experiment was carried out at the Dairy Chemistry and Technology Laboratory of the Department of Dairy Science, Bangladesh Agricultural University, Mymensingh, during the period of July to October, 2008.

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Dahi from buffalo and soy milk

Collection of soybean seeds and buffalo milk

The soybean seed was collected from Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh and the buffalo milk was collected from local buffalo farm, Senbari of Trisal Thana, Mymensingh.

Preparation of soy milk from whole soybean powder

Whole soybean (1000 gm) free from immature field damage and black spot were grinded in a soy flour mill. Grained powder (125g) was dissolved with 1000 ml of water by stirring. The milk was strained through a fine cloth to separate the residue. Soy milk was then boiled at 100°C for 10-15 minutes with constant stirring.

Preparation of different types of dahi

Four types of dahi were prepared in this experiment. Out of four samples, one was prepared only from whole buffalo milk (control) and other three were prepared by replacing whole buffalo milk with soy milk at the rate of 25, 50 and 75%, respectively.

Preparation of dahi from buffalo milk (control)

The collected (1250 ml) buffalo milk was heated to boiling temperature until reduced up to 20% of the original volume of milk. At the time of boiling, sugar was added to the milk at the rate of 12%. During heating, milk was stirred thoroughly with the help of the spoon. After heating milk pan was taken out from the heater and allowed to cool down to 40°C. The mixed bacteria containing starter culture was added to the milk at the rate of 2% and dissolved properly by stirring it and then milk was poured in several pre-boiled water washed plastic cups of about 100 ml size and kept at an incubation temperature of 37°C until complete coagulation of the samples (6-8hrs). After complete coagulation, the dahi samples were taken out from the incubator and were stored 2 hours in a refrigerator at 5°C for evaluation. This type of dahi was identified as 'A' type (control) dahi for experimental purpose.

Preparation of dahi from buffalo milk with the addition of different levels of soy milk

For the preparation of these types of dahi from buffalo milk, milks were divided into three portions (937.5, 625 and 312.5 ml) and taken in three different beakers. Previously collected soy milk was added with the buffalo milk (312.5, 625 and 937.5 ml) in different levels like 25, 50 and 75% in different beakers. The buffalo and soy milk samples were mixed properly with the help of the spoon. After mixing the different mixtures were boiled in different suspans and then dahi was prepared by using the same procedure used for making buffalo milk dahi. These different types of dahi were identified as 'B', 'C' and 'D' types of dahi for the experimental purpose, respectively.

Evaluation of different types of Dahi

Organoleptic parameters measured by a panel of expert judges included smell and taste score (50); body and consistency score (30); color and texture score (20); overall score (100).

Chemical tests and analysis of Dahi

For certifying the nutritional status the samples were evaluated in various ways. After organoleptic evaluation; all dahi samples were chemically analyzed in the laboratory in terms of acidity percentage, moisture content (g/kg), total solids (TS) content (g/kg), fat content (g/kg), protein content (g/kg), carbohydrate content (g/kg), ash content (g/kg).

Statistical analysis

Analysis of variance test (ANOVA) was done to find out the statistical differences between different treatments. As all experimental materials were completely homogenous and for this reason data were analyzed by using one way analysis of variance test (Completely Randomized Design, CRD) as per MSTAT statistical program. The differences among sample means were compared by calculating LSD value with the help of a Least Significant Difference (LSD) test (Gomez and Gomez, 1984).

Results and Discussion

Initial quality of buffalo milk and soy milk

The flavor, appearance and colour of the buffalo milk sample was normal. Average

specific gravity; acidity (%); moisture content (g/kg); total solids (TS) content (g/kg); fat content (g/kg); protein content (g/kg); carbohydrate (lactose) content (g/kg); ash content (g/kg) are given in the Table 1. The initial specific gravity and chemical analysis of buffalo milk in this study were in accordance with the normal range found in different literatures (Sultana 2005), El-Salam and El-Shibini (1966), Islam et al. (1999), Hossain (2000), Alam (1999), Rahman (2000), Sharma et al. (1996). In the present study four categories of dahi (from buffalo milk in corporation with soy milk were prepared and their physical and chemical qualities were measured to monitor the quality. The results agree with the findings of Tuli (2007) and Katara and Bhargava (1994), Swarninathan and Bhagavan (1966).

Organoleptic quality of Dahi

The score of smell and taste, body and consistency, color and appearance as well as the total score of different types Dahi were compiled in Table 2. It was observed that the individual and total score of physical parameters of Dahi

were significantly decreased ($p < 0.01$) when different levels of soy milk added with buffalo milk. The findings of the experiments agree with Alam (1998) and Sultana (2005) who showed that addition of soy milk decrease individual as well as over all score of reported dahi. The results of this study supports the findings of Munzur (1999), Nahar (2000) and Begum et al. (2011) who found that overall score for whole milk dahi was higher than other samples. It was also observed that overall score of dahi `B' (25% SM) of this experiment was little lower than dahi `A' (control) but the score was within acceptable range. The result also indicates that overall score of dahi `B' (25% SM) was higher than that of dahi `C' (50% SM) and dahi `D' (75% SM) samples. The findings of the present study agrees with the work of Alam (1998) who reported that 25% soy milk with whole milk was highly acceptable. From this experiment it was observed that 75% buffalo milk and 25% soy milk was highly acceptable for organoleptic characteristics. Soy milk has beany flavor and for this reason, increased level of soy milk is related with lower organoleptic scores.

Table 1. Chemical quality of buffalo milk and soy milk sample

Types of milk	Specific gravity	Acidity (%)	Moisture	Total solids	g/kg			
					Fat	Protein	Ash	CHO
Buffalo Milk	1.03±	0.17±	830.67±	169.33±	75.67±	39.00±	8.03±	46.63±
	0.001	0.010	4.93	4.93	2.08	2.00	0.21	3.63
Soy milk	1.02±	0.13±	902.50±	97.50±	25.00±	43.17±	6.87±	22.47±
	0.001	0.010	1.95	1.95	1.00	0.76	0.35	1.69

Table 2. Organoleptic evaluation of dahi samples prepared from buffalo milk and its partial replacement with soy milk

	Sample				LSD
	A	B	C	D	
Smell & Test (50)	45.74 ^a ±0.07	43.21 ^{ab} ±2.61	41.76 ^{bc} ±2.18	38.50 ^c ±2.18	6.28
Body & Consistency (30)	26.93 ^a ±0.52	26.26 ^a ±2.11	24.65 ^{ab} ±1.22	22.86 ^b ±1.28	3.01
Colour & Texture (20)	17.81 ^a ±0.17	16.92 ^a ±0.83	15.39 ^b ±0.68	14.36 ^b ±0.43	0.52
Overall Score (100)	90.47 ^a ±0.71	86.39 ^{ab} ±5.31	81.80 ^c ±3.76b	75.72 ^c ±3.88	22.28

A: 100% buffalo milk dahi (control); B: 75% buffalo milk +25% soy milk dahi; C: 50% buffalo milk + 50% soy milk dahi; D: 25% buffalo milk + 75% soy milk dahi ^{abc}Superscripts not similar within the mean of same row differ significantly; * $p < 0.001$

Chemical parameters

The Acidity (%); moisture content (g/kg), total solids (TS) content(g/kg), fat content(g/kg), protein content(g/kg), carbohydrate content (g/kg), ash content (g/kg) of the prepared dahi are presented in Table 3. It was observed that the acidity, total solids (TS), fat, carbohydrate and ash content of dahi were significantly decreased ($p < 0.01$) and moisture and protein content were significantly increased ($p < 0.01$) due to the addition of soy milk. Generally soy milk contains less amount of acidity, total solids (TS), fat, carbohydrate and ash but high amount of moisture and protein than whole buffalo milk. The results of acidity and fat content of prepared dahi agrees with the findings of Alam (1998) who found that the percentage of acidity and fat content decreases due to addition of increased level of soy milk for manufacturing dahi. The results of moisture, total solids, fat, protein, carbohydrates and ash content of the

study also agree with the findings of Sultana (2005) who found that moisture and protein content of dahi increased and total solids (TS), fat, carbohydrates and ash content were decreased due to addition of different level of soy milk. Ghosh and Rojorhia (1984) reported that total solids content of plain market dahi varied from 26.92 to 43.04% with an average value of 34.64% and fat percent varied from 4.3 to 8.8% with an average of 3.78 percent which also agree with our findings.

Cost Benefits Analysis

Four types of dahi were prepared in the laboratory. The minimum production cost of (per kg dahi) A (control), B, C and D types of dahi were Tk. 66.2, 56.2, 46.2 and 36.5 respectively (Table 4). So cost benefit for per kg B type (25% SM) dahi was 10 Tk., C type (50% SM) dahi was 20 Tk. And D type (75% SM) dahi was 30 Tk.

Table 3. Chemical evaluation of dahi samples prepared from buffalo milk and its partial replacement with soy milk

Parameters	Types of dahi				LSD
	A	B	C	D	
Acidity (%)	0.73 ^a ±0.02	0.72 ^{ab} ±0.01	0.70 ^b ±0.01	0.67 ^c ±0.01	0.0002
Moisture (g/kg)	701.87 ^d ±4.05	715.00 ^c ±9.44	734.50 ^b ±5.24	752.20 ^a ±4.11	57.60
Total solids (g/kg)	298.13 ^a ±4.05	285.00 ^b ±9.44	265.47 ^c ±5.28	247.83 ^d ±4.11	57.77
Fat (g/kg)	87.00 ^a ±2.00	72.33 ^b ±1.53	57.67 ^c ±1.53	46.33 ^d ±1.53	4.23
Protein (g/kg)	43.97 ^d ±1.31	54.60 ^c ±2.01	60.54 ^b ±1.54	71.57 ^a ±2.25	5.06
Ash (g/kg)	9.97 ^a ±0.47	9.47 ^b ±0.06	9.20 ^{bc} ±0.10	8.90 ^c ±0.10	0.10
Carbohydrate (g/kg)	157.20 ^a ±3.90	148.77 ^a ±.17	138.10 ^b ±3.25	121.00 ^c ±4.84	44.57

A: 100% buffalo milk dahi (control); B: 75% buffalo milk +25% soy milk dahi; C: 50% buffalo milk + 50% soy milk dahi; D: 25% buffalo milk + 75% soy milk dahi ^{abc}Superscripts not similar within the mean of same row differ significantly; **, $p < 0.001$

Conclusion

From the findings of this study, it might be concluded that 25% buffalo milk could be replaced with soymilk i.e. dahi made by a mixture of 25% soy milk and 75% buffalo milk produced better results. It was also observed that addition of soy milk made dahi was cheaper. So people with lower income level may afford this new type of dahi.

Dahi from buffalo and soy milk

Table 4. Cost of different types of Dahi prepared in the laboratory

Items	Amount	Cost for A dahi (Tk.)	Cost for B dahi (Tk.)	Cost for C dahi (Tk.)	Cost for D (Tk)
	1250ml	50.00	-	-	-
Buffalo milk	937.5ml	-	37.50	-	-
	625 ml	-	-	25.00	-
	312.5 ml	-	-	-	12.50
	-	-	-	-	-
Soy milk	312.5 ml	-	2.50	-	-
	625 ml	-	-	5.00	-
	937.5 ml	-	-	-	7.50
Sugar	150g	4.80	4.80	4.80	4.80
Starter culture	25g	2.40	2.40	2.40	2.40
Container	1no.	3.00	3.00	3.00	3.00
Cost for fuel	1kg	2.00	2.00	2.00	2.00
Labour cost	1kg	2.00	2.00	2.00	2.00
Transport cost	1kg	2.00	2.00	2.00	2.00
Total cost of production	1kg	66.20	56.20	46.20	36.50

A: 100% buffalo milk dahi (control); B: 75% buffalo milk +25% soy milk dahi; C: 50% buffalo milk + 50% soy milk dahi; D: 25% buffalo milk + 75% soy milk dahi

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