

Shelf-life of Dahi (Yogurt) with or without potato mash

M. R. Amin, M. N. Islam*, M. A. Habib¹ and F. Islam

Department of Dairy Science, Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

Four different types of Dahi (Yogurt) were prepared and kept at room and refrigeration temperatures with different concentrations of potato mash (0, 5, 10 and 15%). These Dahi samples were analyzed for smell and taste, body and consistency, colour, texture and acidity and pH at pre and post storage period. The quality of Dahi deteriorated quickly at room temperature than at refrigeration temperature. With (5%) or without potato mash keeping quality was preserved for up to three days but at refrigeration temperature they were suitable up to 12 days. Addition of 10% and 15% potato mashes were suitable for keeping Dahi up to two days at room temperature while in refrigeration temperature it was acceptable up to ten and eight days, respectively. Preparation of Dahi in incorporating potato mash may be economically feasible without compromising its qualities. (*Bangl. vet.* 2012. Vol. 29, No. 1, 22 – 30)

Introduction

Although, Dahi and Yogurt are more or less similar dairy products but there are some differences between them. Yogurt is prepared using the starter organisms: *Streptococcus thermophilus* and *Lactobacillus bulgaricus*, in a proportion of 1 : 1 with higher temperature (40 - 50°C) and shorter incubation period (3 - 4h), whereas Dahi is prepared by using mixed culture of *Streptococcus lactis*, *Lactobacillus bulgaricus*, *Streptococcus thermophilus*, *Streptococcus citrophilus*, *Lactobacillus planetonium* with lower temperature (37 - 42°C) and long incubation period (8 - 15h). Comparatively curd of Yogurt is softer than the Dahi curd. A good quality Dahi should have smooth surface, firm body with marked acid flavour, no proteolysis, no gassiness, and no crack in cut surface.

Different types of Dahi, such as sweet Dahi, sour Dahi and flavoured Dahi are available in the market. Sweet Dahi is generally prepared from a mixed culture of *Streptococcus lactis*, *Streptococcus thermophilus* and *Streptococcus citrophilus*, sugar is usually added at the rate of 8 - 10% of volume of milk. Sour Dahi is generally prepared by seeding milk with a combination of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* without sugar. Flavoured Dahi is made by the addition of synthetic flavour or natural fruit juice and sometimes by adding slice of seasonal

¹Department of Animal Breeding and Genetics, Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

*Corresponding author:- E-mail: ahsan.rony@yahoo.com

fruits, flavourings, sugar and colour can be added prior to fermentation. Shakeel *et al.* (1994) successfully used mango juice to enrich the quality of sweet Dahi. Soya milk, sunflower proteins were used in the manufacture of yogurt (Hardi and Novakovic, 1994). Though, milk price and demand is increasing day by day, researchers are now thinking to add some milk replacer in partial amount like fruit juice (Desai *et al.*, 1994; Shukla, 1982), soybean and powder milk to prepare Dahi.

No work has yet been done in Bangladesh to manufacture Yogurt or Dahi by using potato. Potato as a source of energy, may contribute not only energy but also substantial amounts of protein and essential vitamins, minerals and trace element of the human diet (Horton and Houghland, 1987). It is possible to use potato mash during preparation of Dahi to improve its texture and consistency, an important factor for popularization among consumers. But, question may arise for the preservative quality (shelf-life) of potato made Dahi. There are no comprehensive precise reports available and as such this study was undertaken to assess the shelf-life of Dahi using potato mash at different concentrations.

Materials and Methods

Chemical analysis of whole milk

Before preparing Dahi, initial quality of collected milk from the university dairy farm was estimated for specific gravity, total solids (TS; %), solids-not-fat (SNF; %), fat (%), acidity (%), protein (%), ash (%), moisture (%) and pH value. Protein content was measured by micro-Kjeldahl method (AOAC, 1990). Fat was determined by the Gerber method (Bradly *et al.*, 1992). Ash content was determined by dry ashing of the samples for 24 hours at 550°C. Total solids content was determined by gravimetric method by drying the samples in an oven at 105°C for 24 hours (AOAC, 1990). Total titratable acidity was determined by AOAC (1990) method. The pH was measured using an electric digital pH meter (HANNA-pH 210, Germany) according to AOAC (1990).

Preparation of potato mash

The purchased potato was weighed with the help of balance and boiled, and the skin was separated with the help of clean hand. Black spotted diseased potatoes were removed. Then the potato was mashed by clean hand, kept in different plastic cups and stored at refrigeration temperature (5°C) until used.

Preparation of plain Dahi

Required amount of milk boiled for about 10 minutes to reduce some volume of milk and also to destroy the viable organisms. At the boiling time, sugar was added at the rate of 8%. During heating, milk was stirred thoroughly with the help of a stirrer. After desired heating milk pan was taken out from the heater and allowed to cool down near 42°C and inoculated with 2% starter cultures collected from local market. After inoculation warm milk of 42°C was then poured into several pre washed plastic

cups and kept undisturbed at an incubation temperature of 37°C until complete coagulation. After complete coagulation (5 - 8h), the Dahi samples were taken out from the incubator and were stored in a refrigerator at about 5°C for further analysis. This type of Dahi was designated as type "A" Dahi for the study purpose.

Preparation of Dahi mixed with potato mash

The preparation of Dahi with potato mash is similar with the preparation of plain Dahi. Potato mash @ 5, 10 and 15% was added during boiling and was blended for proper mixing. After proper heating, the milk pan was taken out from the heating source and was kept to cool down to 42°C. At that time starter culture @ 2% was added and was kept in an incubator at 37°C until the complete coagulation (5 - 8h). Then the Dahi samples were stored at about 5°C in the refrigerator until used.

Four different types of Dahi were prepared and designated as: i) Type A Dahi (plain Dahi without adding potato mash), ii) Type B Dahi (added 5% potato mash in milk), iii) Type C Dahi (added 10% potato mash in milk) and iv) Type D Dahi (added 15% potato mash in milk).

Shelf-life assessment

In this case, the prepared Dahi samples were preserved at room temperature (32°C) and refrigeration temperature (5°C) to assess the shelf-life. The qualities of Dahi were assessed as: (a) Physical tests: i) Smell and taste (50 marks), ii) Body and consistency (30 marks) and iii) Colour and texture (20 marks) and (b) Chemical tests: i) Acidity test and ii) pH value.

At room temperature, the said parameters of four samples were measured every day for every sample but at refrigerator temperature the same tests were done every alternate day until spoilage was evident.

Statistical design and data analysis

All study materials were completely homogenous and statistical analysis done as per Steel and Torrie (1960) using Completely Randomized Design. Data collected were analyzed by using (MSTAT) statistical program.

Results and Discussion

Physical parameters

The plain Dahi and potato mashed Dahi were stored at room and refrigeration temperature and their qualities were measured with the help of some physical tests (smell and taste, body and consistency and colour and texture) by organoleptic evaluation and chemical tests (Acidity, pH) and are presented in Table 1-4.

Smell and taste

Smell and taste score of different Dahi samples stored at different duration of

room and refrigeration temperatures are presented in Table 1. Prior to storage, the smell and taste score of A, B, C and D Dahi samples were 48 ± 1.5 , 49.0 ± 1.0 , 49.0 ± 1.2 and 45.3 ± 0.6 . After storage smell and taste score of the samples decreased rapidly at room temperature. Nahar *et al.* (2009) observed rapid decrease of smell and taste of Dahi added with 5% potato mash at room temperature. At room temperature smell and taste scores of A and B samples were acceptable up to three days (32.7 ± 0.6 and 32.0 ± 2.0), but for C and D samples, smell and taste scores were acceptable for two days only (36.3 ± 1.5 and 32.0 ± 1.7). At 4th days of storage smell and taste scores of A and B become unacceptable and their scores were not recorded. Nahar *et al.* (2009) reported potato mash (5%) Dahi to be acceptable stored at room temperature up to 24 hours. Sultana (2005) reported quick deterioration of Dahi at room temperature and acceptable for consumption up to three days.

Table 1. Sensory scores of smell and taste (score = 50) of different Dahi samples kept under room and refrigeration temperature

Storage days	Room temperature				Refrigeration temperature			
	A	B	C	D	A	B	C	D
0	48.0 ± 1.5	49.0 ± 1.0	49.0 ± 1.2	45.3 ± 0.6	48.0 ± 1.5	49.0 ± 1.0	49.0 ± 1.2	45.3 ± 0.6
1	44.3 ± 0.6	43.3 ± 1.5	42.0 ± 0.0	40.0 ± 0.0	-	-	-	-
2	38.0 ± 1.0	37.0 ± 1.0	36.3 ± 1.5	32.0 ± 1.7	-	-	-	-
3	32.7 ± 0.6	32.0 ± 2.0	29.7 ± 2.0	27.0 ± 0.0	-	-	-	-
4	-	-	-	-	47.4 ± 0.6	46.3 ± 1.5	46.0 ± 1.0	42.0 ± 0.0
6	-	-	-	-	44.0 ± 1.0	43.3 ± 1.5	42.3 ± 0.0	35.3 ± 0.6
8	-	-	-	-	42.3 ± 2.0	41.3 ± 1.5	38.0 ± 1.5	31.0 ± 1.0
10	-	-	-	-	38.0 ± 2.0	38.0 ± 1.7	32.3 ± 0.6	27.3 ± 0.6
12	-	-	-	-	32.3 ± 1.8	31.3 ± 1.6	27.8 ± 1.0	20.7 ± 0.6
14	-	-	-	-	28.3 ± 1.5	26.0 ± 1.0	22.0 ± 1.2	19.7 ± 1.5
16	-	-	-	-	25.7 ± 1.2	23.3 ± 1.5	21.0 ± 1.7	16.0 ± 0.0

On the other hand, smell and taste score of Dahi samples preserved at refrigeration temperature decreased slowly, which agrees well by Nahar *et al.* (2009). Smell and taste score of A and B samples in this situation was acceptable up to 12 days (32.3 ± 1.8 and 31.3 ± 1.6), whereas for C and D samples could be acceptable up to ten and eight days, respectively (32.3 ± 0.6 vs 31.0 ± 1.0). The result of this study agrees with the findings of Shukla (1982) who reported 10% fruit yogurt could be stored just for a day at ambient temperature, whereas at refrigeration temperature could do well for about ten days without deterioration. Nahar *et al.* (2009) reported keeping quality of Dahi containing 5% potato mash to be acceptable up to 13 days stored at refrigerated temperature, which is in agreement with this study. In the present study, although, the Dahi sample that contained 5% potato mash was good for three days at room temperature, but Dahi samples that contained 10% and 15%

potato mash were good for two days at room temperature. The result indicates that addition of potato mash enhanced quick fermentation and for this reason the keeping quality of different levels of potato mash added Dahi was lower than plain Dahi.

Body and consistency

Before storage, body and consistency score of A, B, C and D Dahi samples were 27.0 ± 1.0 , 29.0 ± 1.0 , 28.7 ± 1.2 and 27.0 ± 0.0 , respectively, (Table 2).

Table 2. Sensory scores of body and consistency (score = 30) of different Dahi samples kept under room and refrigeration temperature

Storage days	Room temperature				Refrigeration temperature			
	A	B	C	D	A	B	C	D
0	27.0 ± 1.0	29.0 ± 1.0	28.7 ± 1.2	27.0 ± 0.0	27.0 ± 1.0	29.0 ± 1.0	28.7 ± 1.2	27.0 ± 0.0
1	25.3 ± 2.0	27.3 ± 1.2	27.3 ± 1.2	24.0 ± 1.7	-	-	-	-
2	22.3 ± 2.5	26.0 ± 1.7	25.7 ± 0.8	22.0 ± 2.1	-	-	-	-
3	18.3 ± 2.0	20.0 ± 1.7	18.3 ± 2.4	17.3 ± 0.6	-	-	-	-
4	-	18.0 ± 1.1	-	-	25.3 ± 1.7	26.6 ± 1.2	27.0 ± 1.0	25.3 ± 1.5
6	-	-	-	-	23.7 ± 1.8	26.7 ± 1.5	26.7 ± 1.2	22.3 ± 2.0
8	-	-	-	-	22.3 ± 1.2	25.7 ± 2.0	24.3 ± 0.6	20.0 ± 2.0
10	-	-	-	-	19.3 ± 1.2	23.7 ± 2.0	23.0 ± 2.2	18.3 ± 1.5
12	-	-	-	-	19.0 ± 1.7	20.7 ± 1.1	20.3 ± 0.6	17.0 ± 0.0
14	-	-	-	-	16.7 ± 1.2	18.0 ± 1.0	18.0 ± 1.2	16.0 ± 1.0
16	-	-	-	-	14.7 ± 1.2	17.3 ± 1.2	16.0 ± 2.0	15.3 ± 0.6

Body and consistency score of the Dahi samples decreased gradually depending on the days of storage life. Decreased in score was very rapid for the room temperature preserved samples. This is in agreement with Nahar *et al.* (2009). Body and consistency score was acceptable up to three days for A, C and D Samples (18.3 ± 2.0 , 18.3 ± 2.0 and 17.3 ± 0.6). On the other hand, body and consistency score was acceptable up to four days for B sample (18.0 ± 1.1), whereas Nahar *et al.* (2009) found it up to 24 hours for the same sample.

Body and consistency score decreased slowly in refrigerated samples. At refrigeration temperature (5°C) body and consistency was acceptable up to 14th days for B and C samples (18.0 ± 1.0 and 18.0 ± 1.2), up to 12th days for A sample (19.0 ± 1.7) and up to 10th days for D sample (18.3 ± 1.5). Nahar *et al.* (2009) got keeping quality of body and consistency of 5% potato mash added Dahi to be acceptable at refrigerated temperature up to nine days of storage, which is five days lower than our study. From the result, it is evident that smell and taste score become unacceptable little earlier than body and consistency score.

Colour and texture

Colour and texture score of all Dahi samples are given in Table 3. Initial colour

and texture score of A, B, C and D samples were 18 ± 2.0 , 16.3 ± 1.5 and 16.3 ± 1.5 , respectively. Like other physical tests mentioned earlier, colour and texture scores were decreased with progressing storage period. Deterioration was rapid at room temperature (32°C) than that of samples kept at refrigeration temperature (5°C). This is in agreement with Nahar *et al.* (2009). In every case colour and texture of plain Dahi decreased little slowly than that of samples contained potato mash. Storage at room temperature, Dahi samples were acceptable for their colour and texture up to three days for A, B and C (15.3 ± 1.2 , 15.0 ± 1.2 and 14.7 ± 1.2), while for D (15.7 ± 1.2) it was acceptable for two days. Nahar *et al.* (2009) reported acceptability of colour and texture of 5% potato mashed Dahi up to 24 hours storage at room temperature.

Table 3. Sensory scores of color and texture (scores = 20) of different Dahi samples kept under room and refrigeration temperature

Storage days	Room temperature				Refrigeration temperature			
	A	B	C	D	A	B	C	D
0	19.3 ± 1.2	18.0 ± 2.0	16.3 ± 1.5	16.3 ± 1.5	19.3 ± 1.2	18.0 ± 2.0	16.3 ± 1.5	16.3 ± 1.5
1	18.3 ± 1.5	17.3 ± 2.2	15.7 ± 1.2	16.0 ± 1.0	-	-	-	-
2	16.3 ± 1.2	17.0 ± 2.5	14.7 ± 1.2	15.7 ± 1.2	-	-	-	-
3	15.3 ± 1.2	15.0 ± 1.2	14.7 ± 1.2	13.0 ± 1.0	-	-	-	-
4	-	-	-	-	18.7 ± 1.2	17.7 ± 1.7	16.0 ± 2.0	16.0 ± 2.0
6	-	-	-	-	18.7 ± 1.1	16.3 ± 1.5	15.3 ± 1.2	15.7 ± 2.1
8	-	-	-	-	16.7 ± 1.2	14.7 ± 2.0	14.7 ± 0.6	14.6 ± 1.2
10	-	-	-	-	16.0 ± 1.7	14.7 ± 2.3	12.0 ± 0.0	13.7 ± 2.1
12	-	-	-	-	14.0 ± 1.7	13.3 ± 1.1	10.7 ± 1.2	13.0 ± 1.7
14	-	-	-	-	13.0 ± 1.0	12.7 ± 1.2	10.0 ± 0.0	11.6 ± 2.0
16	-	-	-	-	12.7 ± 1.2	11.3 ± 1.2	10.0 ± 0.0	10.7 ± 1.2

On the other hand, at refrigeration temperature, colour and texture was acceptable up to 12 days for A (14.0 ± 1.7), 10 days for B (14.7 ± 2.3) and eight days for C and D samples (14.7 ± 0.6 , 14.6 ± 1.2). Nahar *et al.* (2009) reported acceptability up to 11 days at refrigerated temperature for colour and texture of 5% potato mash containing Dahi. This result is in agreement with them.

Acidity

Acidity of different Dahi samples is presented in Table 4. Immediately after preparation, the average acidity of A, B, C and D Dahi samples were 0.6 ± 0.0 , 0.7 ± 0.0 , 0.7 ± 0.0 and 0.7 ± 0.0 . Acidity of all Dahi samples increased gradually depending on the storage time. Acidity of Dahi increased rapidly at room temperature but at refrigeration temperature acidity increased slowly. In both cases acidity was high in D sample and low in A sample.

From organoleptic evaluation, it has been mentioned earlier that at room temperature A and B Dahi samples were acceptable for consumption up to three days

and for C and D it was two days. At two days of storage, acidity of A and B samples were 1.0 ± 0.0 and $1.1 \pm 0.0\%$. On the other hand, acidity of C and D samples at one day of storage were 1.0 ± 0.0 and $1.0 \pm 0.0\%$. Nahar *et al.* (2009) showed the shelf-life of 5% potato mashed Dahi at room temperature with spoilage after 24 hours of storage.

Chemical test

Table 4. Changes of chemical parameters (acidity and pH) of different Dahi samples under room and refrigeration temperature

Storage days	Acidity (%)				pH			
	Treatment group				Treatment group			
	A	B	C	D	A	B	C	D
Room temperature								
0	0.6 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	4.2 ± 0.0	4.2 ± 0.0	4.2 ± 0.0	4.2 ± 0.0
1	0.9 ± 0.1	0.9 ± 0.0	1.0 ± 0.2	1.0 ± 0.0	4.1 ± 0.1	4.1 ± 0.1	4.0 ± 0.1	3.9 ± 0.1
2	1.0 ± 0.0	1.07 ± 0.04	1.3 ± 0.0	1.3 ± 0.0	3.9 ± 0.1	3.8 ± 0.0	3.7 ± 0.1	3.5 ± 0.1
3	1.4 ± 0.0	1.5 ± 0.0	1.5 ± 0.0	1.5 ± 0.0	3.1 ± 0.2	2.6 ± 0.9	2.9 ± 0.2	2.9 ± 0.1
4	ND	ND	ND	ND	ND	ND	ND	ND
Refrigeration temperature								
0	0.6 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	0.7 ± 0.0	4.2 ± 0.0	4.2 ± 0.0	4.2 ± 0.0	4.2 ± 0.0
4	0.7 ± 0.0	0.7 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	4.2 ± 0.0	4.17 ± 0.0	4.2 ± 0.0	4.2 ± 0.0
6	0.8 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	4.2 ± 0.0	4.2 ± 0.0	4.1 ± 0.0	4.1 ± 0.0
8	0.8 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	0.8 ± 0.0	4.2 ± 0.0	4.2 ± 0.0	4.1 ± 0.0	4.1 ± 0.0
10	0.8 ± 0.0	0.8 ± 0.0	0.9 ± 0.0	0.9 ± 0.0	4.2 ± 0.0	4.1 ± 0.0	4.1 ± 0.0	4.0 ± 0.1
12	0.9 ± 0.0	1.0 ± 0.0	1.2 ± 0.0	1.2 ± 0.0	4.0 ± 0.0	4.0 ± 0.0	3.9 ± 0.1	3.7 ± 0.2
14	1.1 ± 0.1	1.2 ± 0.0	1.2 ± 0.0	1.3 ± 0.1	3.8 ± 0.1	3.7 ± 0.1	3.6 ± 0.0	3.4 ± 0.1
16	1.2 ± 0.1	1.3 ± 0.1	1.3 ± 0.0	1.4 ± 0.1	3.6 ± 0.1	3.5 ± 0.1	3.7 ± 0.6	3.1 ± 0.1

At refrigeration temperature A sample was acceptable up to 14 days and at that time acidity was $1.1 \pm 0.1\%$, whereas, sample B was acceptable up to 12 days and at that time acidity was $1.0 \pm 0.0\%$. It was observed that C and D samples were acceptable for consumption up to ten days and at that time their acidity for both the samples were 0.9 ± 0.0 .

The result of this study agrees with the findings of Osborne and Pritchard (1974) who reported yogurt containing 12.5% fruit had a shelf-life up to 14 days at 5°C , six days at $8-10^{\circ}\text{C}$ and one day at ambient temperature. In another study, Nahar *et al.* (2009) reported shelf-life of Dahi having had acidity with 5% potato mash that spoiled after 11 days storage at refrigerated temperature. Similarly, Shukla (1982) found that fruit yogurt could be stored just for a day at ambient temperature, whereas at refrigeration temperature (5°C) it can be preserved for ten day. In our study, acidity development was rapid at room temperature. This could be due to the fact that room

temperature during the study period was 30 to 32°C, which is suitable for rapid multiplication of acid producing bacteria. As the population of microorganism increased rapidly, fermentation of lactose took place quickly and as a result more lactic acid produced at room temperature. On the other, at 5°C refrigeration the growth of acid producing bacteria hampered. As a result acid production was slow in refrigerated samples. Acid production of C and D samples were higher than that of A and B samples and lowest acidity always seen in A sample. This was probably due to the fact that during incorporation of potato mash in milk, microorganisms might have entered in milk, which might have encouraged milk fermentation, thus helped to increase the acid percent in C and D samples.

pH value

Average pH values of A, B, C and D Dahi samples immediately after preparation were 4.2 ± 0.0 , 4.2 ± 0.0 , 4.2 ± 0.0 and 4.2 ± 0.0 , respectively (Table 4). pH values of all samples decreased with progressing storage period. The changes of pH values of samples are given in Table 4. It is mentioned earlier that acidity of all Dahi samples were increased with elapse of storage time. Logically, it is usual for decreasing pH values with increasing storage time. The decrease of pH was rapid at room temperature and slow in refrigeration temperature. This result agrees well with the finding of Nahar *et al.* (2009). The result of pH value agrees with the earlier work of Kondratenko *et al.* (1978), who reported decreased pH value of Dahi samples with storage time.

Conclusions

Considering the shelf-life assessment of Dahi samples, it is suggested that potato mash (5%) may be added for improving the quality of Dahi that can be consumed up to three days at room temperature and 12 days at refrigeration temperature.

References

- AOAC 1990: *Official methods of analysis of the association of official analytical chemists*, 15th edition, Virginia 22201, Arlington, USA.
- Bradly Jr. RL, Arnold Jr. E, Barbano DM, Semerad RG, Smith DE, Vines BK 1992: *Chemical and physical methods*. In: Marshall TR, Standard methods for the microbiological examination of dairy products, 16th edition, American Public Health Association, Washington DC, USA.
- Desai SR, Tono VA, Joshi SV 1994: Utilization of different fruits in the manufacture of yogurt. *Indian Journal of Dairy science* **47** 870-874.
- Hardi J, Novakovic P 1994: The feasibility of yogurt manufacture using cow milk and Soya milk blends. *Dairy Science Abstract* **56** 725.
- Horton AE, Houghland ME 1987: Commercial potato production. US Department of Agriculture Service, *Agriculture Hand Book* pp. 267.

- Kondratenko MS, Goranova L, Simenova R 1978: *International Dairy Science Congress E* 10 3-14.
- Nahar A, Al-Amin M, Akter N, Nahar N 2009: Evaluation of the Shelf-life of Dahi (Yoghurt) at different temperature depending on its consistency quality. *Bangladesh Research Publications Journal* 3 897-908.
- Osborne RJ, Pritchard, EW 1974: *XIX International Dairy Congress IE*, pp. 809.
- Shakeel A, Thompkinson DK, Aagar S 1994: Manufacture of fruit flavored filled bio-yogurt. *Indian Journal of Dairy Science* 47 695-701.
- Shukla FC 1982: *The effect of packaging material on the quality of fruit yogurt*. PhD Thesis, Punjab Agricultural University, Ludhian, India, pp. 315.
- Steel RGD, Torrie JH 1960: *Principles and Procedures of Statistics*. McGraw-Hill Book Company. Inc. New York, USA.
- Sultana N 2005: *Preparation of Dahi from buffalo milk with the addition of different levels of soya milk*. MS Thesis, Department of Dairy Science, Faculty of Animal Husbandry, Bangladesh Agricultural University, Mymensingh, Bangladesh.