

Preparation of Dahi from Skim Milk Incorporating Apple Juice

A Rahman^{1*}, M Asaduzzaman¹, M Akter², M N Hassan³, MM Ali⁴

¹Department of Dairy Science, Sher-e-Bangla Agricultural University, Dhaka-1207

²Department of Animal Nutrition, Genetics and Breeding, Sher-e-Bangla Agricultural University, Dhaka-1207

³Department of Dairy Science, Bangladesh Agricultural University, Mymensingh-2202

⁴Department of Animal Production & Management, Sher-e-Bangla Agricultural University, Dhaka-1207

*Correspondence: ashro24.dasc@sau.edu.bd

ABSTRACT

An experiment was conducted to measure the feasibility of incorporation the apple juice in the manufacture of dahi. Five different types of dahi were manufactured incorporating 0, 5, 10, 15 and 20 per cent apple juice with skim milk. The prepared dahi samples were subjected to physical, chemical and microbiological analysis to evaluate their quality. It was observed that the addition of apple juice with milk improves the physical qualities. Dahi manufactured incorporating 10% apple juice gave superior results for body and consistency. Dahi having 15% of apple juice was better for smell & taste and also for color & texture. Dahi containing 10% apple juice get the highest total score. Addition of apple juice increased the total solids, carbohydrate, ash and acidity content but decreased the protein, fat and pH content. The level of decrease was higher in dahi having 20% apple juice. Dahi containing 5% apple juice showed little better performance with respect to chemical qualities other than control. Total bacterial count was higher in the dahi manufactured incorporating apple juice than control group A. From the studies it was suggested that dahi could be successfully manufactured incorporating different proportions of apple juice and addition of 10% juice showed best performance.

Keywords: Dahi, Skim milk, Apple juice

INTRODUCTION

Dahi is one of the oldest fermented milk products and is the most popular one in Indian sub-continent. Fermented milks originated in the nearest perhaps before the Phoenician era and spread through central and eastern Europe since early times. It is an important food item in the Middle East especially in those countries bordering the eastern Mediterranean coast. In some countries of central Europe, the Mediterranean Basin area, Asia & Africa fermented milks are considered as an article required in Vedic rites and the ancient medical books spells highly of its therapeutic value (Aggarwala and Sharma, 1961).

Traditionally fruits like mango, pine apple, strawberry, apricot and blackcurrant can be used for manufacture of fruit yoghurt. Indian scientists prepared fruit yoghurt by using different types of fruit juice viz. mango, papaya, pineapple and kokun (Desai, *et al.* 1994). An attempt was made making fruit dahi (Yoghurt) by using different types of fruit juice by Mustafa (1997). Yoghurt has a long history of being used as a valuable dietary item and a good number of research works have been done in different parts of the world (Deasi *et al.*, 1994 and Shukla *et al.* 1987 etc). Yoghurt was made by adding jack fruit juice in milk (Rahman, 1998) and also by adding mango juice in milk (Yasmin, 1999). We know mango, pineapple, strawberry, & apple are the most popular and attractive fruit. These fruits are nutritious and available in Bangladesh also.

But utilization of apple juice in the manufacture of dahi from skim milk was not well studied in Bangladesh. So keeping in mind the above discussions, this human health food oriented laboratory based work was under taken with the objectives to prepare acceptable quality fruit

dahi incorporating different levels of apple juice with skim milk, variation among them and to recommend an appropriate technology with level of apple juice to be used for dahi prepared from skim milk.

MATERIALS AND METHODS

Preparation of apple juice

The experiment was conducted in Dairy Science laboratory of Bangladesh Agricultural University. The apple (*Malus sylvestris*) was washed and the skin was separated with a knife using clean hand. The seeds were removed from the apple pulp. Then the fruit pulp was blended. After blending the juice was filtered by clean cloth (hot water washed) and then was kept in plastic cups. The juice was stored at refrigeration until preparation of dahi.

Preparation of different types of dahi

The skim milk was prepared from the whole milk with the help of cream-separator machine. Skim milk was boiled for some time until reduced up to 20-25 percent of original volume. Sugar was added to the skim milk at the rate of 10 percent during boiling. During heating milk was stirred thoroughly with the help of a stirrer. After desired heating milk pan was taken out from the heater and was allowed to cool. Apple juice was taken out from the refrigerator and was kept in the room temperature for melting. When the temperature became about 40°C, then the skim milk was divided into five equal portions and different types of dahi was prepared from each portion by using apple (*Malus sylvestris*) juice designated as A (Skim milk without apple juice), B (Skim milk + 5% apple juice), C (Skim milk + 10% apple juice), D (Skim milk + 15% apple juice) and E (Skim milk + 20% apple juice).

Heated milk was cooled to 40°C and inoculated with desirable proportion of culture (2%) which was collected from local market. The plastic cups were pre-washed with boiled water. The apple juice was incorporated into dahi at 5, 10, 15 and 20% level in different cups except control. Juice was added before incubation with culture as suggested by Gandhi *et al.* (1977), Singh (1979) and De (1985). The samples were incubated at 37°C until the complete coagulation of dahi samples. After complete coagulation (8-12hrs) the dahi samples were stored at about 5°C at refrigerator until used.

Evaluation of different types of dahi samples

Out of different physical tests organoleptic tests (smell and texture, body and consistency & color and texture) were done with the help of expert panel of judges. Total solids and ash content of the different types of dahi samples were determined by oven drying method according to AOAC (1982). Fat percent was estimated by Babcock method using the procedure described by Aggarwala and Sharma (1961). Acidity was determined by titrating with N/10 sodium hydroxide solution using the procedure of Aggarwala and Sharma (1961). Crude protein was determined by Kjeldahal procedure and pH was measured with the help of a pH meter-215 (Ciba Corning Diagnostics Ltd, Sudhury, Suffolk, England Co. 106xD).

Design of Experiment

In this experiment all experimental materials were completely homogenous and for this reason data were analyzed by using one-way analysis of variance test (CRD) as per Stell and Torrie (1960).

RESULTS AND DISCUSSION

Physical parameters

Smell and taste score of dahi samples containing 0%, 5%, 10%, 15% and 20% apple juice were 40.97 ± 0.27 , 42.43 ± 1.13 , 45.23 ± 0.35 , 45.77 ± 0.31 and 38.63 ± 0.27 respectively (Table 1) Statistical analysis showed that there was significant difference within the smell and taste score of different types of dahi. Higher smell and taste score was recorded in case of dahi having 15% apple juice, on the other hand, lowest score was seen in case of control dahi. The result of this experiment indicates that smell and taste of dahi is increased due to the addition of apple juice and addition of 15% apple juice gave best result. The result of this experiment agrees with the work of Mustafa (1997) who found that addition of fruit juice improved the smell and taste score of dahi. Similar results were also reported by White (1991).

Body and consistency score of dahi sample containing 0%, 5%, 10%, 15% and 20% apple juice were 22.61 ± 0.92 , 24.66 ± 0.47 , 25.22 ± 0.15 , 22.11 ± 0.95 and 20.55 ± 0.56 , respectively. The values were presented in Table 1. Statistical analysis showed that there was significant difference within the body and consistency score of different types of dahi samples. Highest body and consistency score was recorded in case of dahi containing 10% apple juice; on the other hand, lowest score was seen in case of control dahi. The result of this experiment agrees with the findings of Desai *et al.* (1994) and Mustafa (1997).

The colour and texture of different types of dahi sample are presented in Table 1. It was found that colour and texture score of dahi samples having 0%, 5%, 10%, 15% and 20% apple juice were 14.77 ± 0.31 , 15.11 ± 0.68 , 16.00 ± 0.70 , 16.33 ± 0.54 and 12.77 ± 0.31 respectively. Statistical analysis showed that there was significant difference within colour and texture score of different types of dahi samples. Highest colour and texture score was recorded in case of dahi having 15% apple juice and lowest score was recorded in case of control dahi. The result of this experiment supports the findings of Desai *et al.* (1994) who observed that addition of fruit juice improved the colour and texture score of dahi. Regarding dahi texture Shukla *et al.* (1987), advocated the use of stabilizers and additives to improve the textural characteristics of yogurt. Similar results were also reported by Rahman (1998) who found that addition of fruit juice improved the colour and texture score of dahi.

Table 1: Summary of the results of physical evaluation of different dahi samples

Parameters	Types of dahi					LSD Value	Level of significance	% CV
	A	B	C	D	E			
Smell and Taste	40.97 ± 0.27^c	42.43 ± 1.13^b	45.23 ± 0.35^a	45.77 ± 0.31^a	38.63 ± 0.27^d	1.247	***	1.67
Body and consistency	22.61 ± 0.92^c	24.66 ± 0.47^{bc}	25.22 ± 0.15^{ab}	22.11 ± 0.95^a	20.55 ± 0.56^d	1.462	***	3.63
Color and Texture	14.77 ± 0.31^b	15.11 ± 0.68^a	16.00 ± 0.70^a	16.33 ± 0.54^b	12.77 ± 0.31^c	1.186	***	4.52
Total score	78.38 ± 0.31^c	82.22 ± 0.68^b	86.47 ± 0.70^a	84.21 ± 0.54^{ab}	71.99 ± 0.31^c	2.250	***	2.71

Figures within the same column with different superscripts differ significantly whereas without letter do not differ significantly (as per DMRT)

** = Significant at $p < 0.01$

*** = Significant at $p < 0.001$

NS = Not significant $p > 0.05$

Total score of dahi sample were given by judge on the basis of smell and taste, body and consistency & colour and texture were 78.38 ± 0.31 , 82.22 ± 0.68 , 86.47 ± 0.70 , 84.21 ± 0.54 and 71.99 ± 0.31 for A, B, C, D and E dahi samples respectively (Table 1). Statistical analysis showed that significant ($p < 0.01$) difference existed among the total score of dahi samples. The highest score was obtained in sample C (10% apple juice). On the other hand, lowest score was obtained in case of sample E (20% apple juice). Sample B, C and D falls under the grade “Good” and sample A and E falls in “Fair” category. The result of this experiment indicates that if we use apple juice, total score of dahi is increased up to certain level that is 10% apple juice. But if we add more than this level total score of dahi decreased.

Chemical parameters

The chemical tests were conducted in Dairy Technology and Microbiology laboratory, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh to know the content of total solids (TS), moisture, fat, protein, carbohydrate, ash, acidity and pH value. The results obtained regarding chemical parameters are presented below:

The total solids content of A, B, C, D and E types of dahi was 180.09 ± 0.06 , 190.87 ± 0.28 , 205.53 ± 0.27 , 209.83 ± 0.12 and 223.60 ± 0.20 , gm/kg respectively (Table 2). As the total solids content of dahi increased, consistency and texture were also increased. The total solids content was highest (223.60 ± 0.20) in dahi having 20% apple juice, followed by dahi containing 15% apple juice (209.83 ± 0.12). The plain dahi had lowest per cent of total solids (180.90 ± 0.06). Statistical analysis showed that there were significant differences within the total solids content of different dahi samples. It is distinct from the study that incorporation of fruit juice to the dahi might increase quality of dahi by increasing total solids content. The result of this experiment agrees with the work of Desai *et al.* (1994) who found that total solids content increased significantly due to addition of fruits in yogurt. Mustafa (1997) also conducted an experiment with different types of fruit juice and found that addition of fruit juice significantly increased the total solids content of dahi.

Table 2: Summary of the results of chemical evaluation of different dahi samples

Parameters	Types of dahi					LSD Value	Level of significance	% CV
	A	B	C	D	E			
Total solids (g/Kg)	180.09 ± 0.06^c	190.87 ± 0.28^d	205.33 ± 0.27^c	209.83 ± 0.12^b	223.60 ± 0.20^a	0.47	***	0.27
Moisture (g/Kg)	819.10 ± 0.06^a	809.13 ± 0.28^b	799.46 ± 0.27^c	790.16 ± 0.12^d	776.40 ± 0.20^d	1.21	***	1.14
Fat (g/Kg)	3.66 ± 0.20^a	3.46 ± 0.30^b	3.20 ± 0.17^c	2.73 ± 0.20^d	2.56 ± 0.15^d	0.37	***	6.91
Protein (g/Kg)	29.26 ± 1.95	29.20 ± 0.81	28.16 ± 0.41	27.70 ± 1.05	27.6 ± 0.17	1.88	NS	3.79
Carbohydrate (g/Kg)	141.83 ± 1.52^d	151.96 ± 2.08	162.76 ± 2.51^c	172.86 ± 1.95^b	186.23 ± 2.00^a	3.61	***	1.27
Ash (g/Kg)	6.13 ± 0.23^d	6.23 ± 0.10^d	6.41 ± 0.24^c	6.55 ± 0.32^b	7.20 ± 0.26^a	0.42	**	3.77
Acidity %	0.70 ± 0.02^d	0.76 ± 0.02^d	0.84 ± 0.01^c	0.87 ± 0.01^b	0.88 ± 0.03^a	0.05	***	2.77
pH value	4.36 ± 0.01^a	4.10 ± 0.10^b	3.96 ± 0.11^c	3.70 ± 0.20^d	3.85 ± 0.03^c	0.22	**	3.16

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NS = Not significant $p > 0.05$

The average moisture content of A, B, C, D and E types of dahi were 819.10 ± 0.06 , 809.13 ± 0.28 , 799.46 ± 0.27 , 790.16 ± 0.12 and 776.40 ± 0.20 respectively (Table 2). Statistical analysis showed that there was significant difference within the moisture content of different dahi samples. Similar type of result for skim milk dahi samples was reported Nahar (2000).

Fat percent of control dahi was somewhat higher than the dahi with 5%, 10%, 15% and 20% apple juice. The differences in fat percent between plain dahi and dahi containing apple juice at different levels were significant. The average fat percent of A, B, C, D and E types of dahi was 3.66 ± 0.20 , 3.46 ± 0.30 , 3.20 ± 0.17 , 2.73 ± 0.20 and 2.56 ± 0.15 , g/kg respectively (Table 2). Maximum fat percent was seen in plain dahi and lowest fat percent was found in case of dahi containing 20% apple juice. Generally fruit contains low level of fat. So the addition of fruit juice might have decreased the fat percent of dahi. The result agrees with the work of Desai *et al.* (1994) who found that fruit yogurt contained lower amounts of fat than the plain yogurt. Similar type of results was also obtained by Mustafa (1997).

The average values of protein content of A, B, C, D and E types of dahi were 29.26 ± 1.95 , 29.20 ± 0.81 , 28.16 ± 0.41 , 27.7 ± 1.05 , and 27.6 ± 0.17 g/kg respectively (Table 2) The protein content was higher in plain dahi (29.26 ± 1.95) and medium in dahi with 10% apple juice and lower in dahi containing 20% apple juice (27.60 ± 0.17). This type of finding was also reported by Mustafa (1997), who found that plain dahi contain higher amount of protein than fruit dahi. Similar type of result was also obtained by Desai *et al.* (1994).

The average carbohydrate content of A, B, C, D and E types of dahi were 141.83 ± 1.52 , 151.96 ± 2.08 , 162.76 ± 2.51 , 172.86 ± 1.95 and 186.23 ± 2.00 g/kg respectively (Table 2). Statistical analysis showed that there was significant difference within the carbohydrate content of different dahi samples. The carbohydrate content was higher in sample E (20% apple juice) and lowest in sample A (control dahi). This result agrees with Munzur *et al.* (2004) who found that carbohydrate content of dahi was remarkably increased with addition of banana.

Overall ash content of dahi with different levels of apple juice was somewhat lower than that of plain dahi but differences in ash content between and among the treatments was significant. The average ash content of A, B, C, D and E types of dahi was 6.13 ± 0.23 , 6.23 ± 0.10 , 6.41 ± 0.24 , 6.55 ± 0.32 , 7.20 ± 0.26 , g/kg respectively (Table 2). The highest and the lowest percent of ash were seen in plain dahi and dahi having 20% apple juice respectively. The finding of this study agrees with the work of Mustafa (1997) and Desai *et al.* (1994). Both researchers found that addition of fruit juice decreased the ash percent in dahi sample.

The acidity percentage of different types of dahi samples is shown in (Table 2). The average values of acidity per cent were 0.70 ± 0.02 , 0.76 ± 0.02 , 0.84 ± 0.01 , 0.87 ± 0.01 and 0.88 ± 0.03 for A, B, C, D and E type dahi respectively. Statistical analysis showed that the differences of acidity percentage among different treatments were significant. Acidity increased a little due to the addition of juice. The results of acidity of dahi samples agrees with the findings of Desai *et al.* (1994) who found that the titratable acidity of fruit dahi was significantly increased due to the addition of fruit juice/pulp. Mustafa (1997) prepared dahi by using different types of seasonal juice and observed that acidity content of dahi increased due to the addition of fruit juice in dahi. Sarkar *et al.* (1996) studied the acidity content of plain sweet dahi from different districts of West Bengal and found that acidity percent was within the range of 0.36 to 1.17% with an average value of 0.92 percent. Addition of fruit juice might

have initiated quick fermentation of milk. This was the main reason for increased acidity in fruit dahi samples.

The average pH values of different dahi samples are presented in (Table 2). The pH of different dahi samples was almost similar. The differences of pH values among the samples were statistically significant. The average pH values of A, B, C, D and E types dahi were 4.36 ± 0.11 , 4.10 ± 0.1 , 3.96 ± 0.11 , 3.86 ± 0.20 and 3.85 ± 0.03 respectively. Addition of fruit slightly decreased the pH value of dahi. In this experiment, acidity of apple juice increased slightly that might be the cause of slightly lowered the pH value. The result of present findings agreed with the work of Mustafa *et al.* (1991), who found that pH of plain dahi were 4.25. Kosikowski (1966) also reported that the pH of normal dahi samples should be approximately 4.4.

Microbiological parameters

The total viable count per g of A, B, C, D and E types of dahi were $42.33(\pm 2.51) \times 10^4$, $56.17(\pm 0.76) \times 10^4$, $61.83(\pm 1.25) \times 10^4$, $67.17(\pm 1.25) \times 10^4$ and $97.67(\pm 1.15) \times 10^4$ per g respectively (Table 3). Statistical analysis showed that there was significant difference among the different samples. This finding indicates that total viable count increase with addition of apple juice. The present investigation agrees with the results of Rahman (1998) who found the average total viable count $120.22(\pm 2.51) \times 10^4$ /g of flavoured yoghurt drinks. The results of present study also agree with the findings of Nahar *et al.* (2007) who found that the average total viable count per g of yoghurt sample was 75×10^4 .

There was no existence of coliform bacteria in any of the dahi samples. The presence of coliform bacteria indicates unhygienic conditions of dahi preparation. In the present study there was no coliform count, which may be due to strict sanitary condition followed during collection and processing of milk, as well as good bacterial starter culture was used.

Table 3: Average Microbial Count

Parameters	Types of dahi					LSD Value	Level of significance	% CV
	A	B	C	D	E			
Total viable count/g ($\times 10^4$)	42.33 ± 2.51^c	56.17 ± 0.76^d	61.83 ± 1.25^c	67.17 ± 1.25^b	97.67 ± 1.15^a	26.4	***	2.32
Coliform/g	0	0	0	0	0	-	-	-
Yeast/g ($\times 10$)	81.67 ± 1.52^c	142.66 ± 2.51^d	151.33 ± 2.08^c	193.66 ± 2.30^b	217.33 ± 2.08^a	3.72	***	1.35
Mould/g($\times 10$)	4.03 ± 0.11^c	6.36 ± 0.15^d	7.43 ± 0.11^c	8.66 ± 0.32^b	9.33 ± 0.20^a	0.34	***	2.77

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Data in Table 3 showed the yeast percent of different dahi samples. Presence of yeast was 81.66 ± 1.52 , 142.66 ± 2.51 , 151.33 ± 2.08 , 193.66 ± 2.30 and 217.33 ± 2.08 per g dahi with 0, 5, 10, 15 and 20 percent apple juice. Results reveal that there were significant differences among the treatments. The highest percent of yeast was found in case of dahi with 20% apple juice and lowest per cent of yeast was found in plain dahi. Yeast content of plain and fruit

dahi was studied by Mustafa (1997) and found that addition of fruit juice increased the yeast content. Similarly in the present study yeast content of fruit dahi was higher than plain dahi. This result agrees with the findings of Mustafa (1997). Regarding yeast, Dastum (1965) reported that yogurt should not contain yeast cells. Yeast cells found in the dahi sample might be due to contamination. Ghosh and Rajorhia (1987) observed that yeast were the major contaminants in the market samples of plain dahi and suggested for immediate attention of the manufacturers during production, packaging and storage of sweet dahi. To reduce the incidence of yeast in market plain sweet dahi adoption of hygienic practices during production and handling, incubation of product in close containers, disinfection of hands of manufacturers and earthen pots with chlorinated water was suggested by Sarkar *et al.* (1996).

The average mould count per g of A, B, C, D and E types of dahi were 4.03(\pm 0.11), 6.36(\pm 0.15), 7.43(\pm 0.11), 8.66(\pm 0.32) and 9.33(\pm 0.20) respectively (Table 3). Statistical analysis showed that there was significant difference among the different samples. Mould content of plain and fruit dahi was studied by Mustafa (1997) and found that, addition of fruit juice increased the mould content.

CONCLUSION

Considering the organoleptic and /or physical qualities of dahi we found that incorporation of apple juice to the dahi during preparation might increase the qualities. The experiment shows that dahi can be prepared from skim milk incorporating the apple juice which have a different taste and flavor and make more options to consumer. It is also found that the incorporation up to a certain level (10%) is quite good. Addition of more apple juice increases the microbial load. General customers usually choose fruit dahi having improved physical and chemical qualities without considering microbial status. The incorporation of apple juice to the dahi may increase microbial load. Control on microbial status of dahi prepared from incorporation of apple juice might help in minimization of microbial count from the public health point of views. In commercial point of views, using skim milk will reduce the production cost of dahi preparation and productions of maximum volume of dahi from minimum volume of skim milk incorporating apple juice (10%) might profitably and popularize the milk product business. So, both the manufacturers and the consumers might welcome to incorporation of apple juice in the manufacture of dahi from skim milk.

CONFLICT OF INTEREST STATEMENT

The author declares that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

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