



Preparation of dahi from skim milk with different level of carrot juice

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Abstract

An experiment was conducted to measure the feasibility of incorporating carrot (*Daucus carota*) juice in the manufacture of dahi. Four different types of dahi were manufactured by adding 0, 5, 10, and 15 per cent carrot juice to skim milk. The prepared dahi samples were subjected to physical, chemical and microbiological analysis to evaluate their qualities. Data on physical, chemical and microbiological parameters were recorded and analyzed. It was observed that the addition of carrot juice with skim milk improved the physical qualities. Dahi with 5% carrot juice was superior to other dahi samples in respect of smell and taste, body and consistency and also for colour and texture. Chemical analysis showed that addition of carrot juice increased the total solids and acidity content but decreased the protein, fat, ash and pH content. Total bacterial count was higher in the dahi samples manufactured by incorporating carrot juice than the control. From this study, it was suggested that dahi could be successfully manufactured from skim milk by incorporating carrot juice and 5% was found better for this purpose.

Key words: Dahi, Skim milk, Carrot juice

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Introduction

Dahi (Yoghurt) is one of the oldest fermented milk-products and is the most popular one in Indian sub continent. It is also popular in Bangladesh. Dahi is generally considered as a safer product and its unique flavour appeals to so many that consideration is being given by nutritionists to incorporate inexpensive sources of nutrients to make it an almost complete food in these areas. Manufacturing technology of sweet and sour dahi is nearly similar but the main difference is that former contains sugar and the latter has no sugar. Flavored dahi may be made by the addition of synthetic flavour or natural fruit juice and sometimes by adding slice of seasonal fruits, flavoring materials, sugar and colour can be added prior to fermentation (Shakeel *et al.*, 1994).

In our country, it is mostly prepared from cow and buffalo milk and/or with their combination. The fermented products have therapeutic properties and high nutritive value (Karagul-Yuceer *et al.*, 2001). It reduces cholesterol in the body and helps to assimilate nutrients in the body (Schieber *et al.*, 2002; Marona and Pedrigo, 2004; Patel *et al.*, 2009). Yoghurt is functioning as anti-oxidants, anti-scorbutic, anti-cancer and reduce digestive problem. It is

good for the patient who facing bone problem, especially in case of osteoporosis and digested properly in all human being (Beom *et al.*, 1998; Sun *et al.*, 2001; Seo and Yu, 2003).

Different types of fruits and flavored dahi have been prepared successfully in the past by different researchers (Datta, 2009, Chakraborty, 2010) in the Department of Dairy Science of BAU, Mymensingh. No work has yet been done in our country to prepare dahi by using carrot juice. Carrot juice will not only increase the nutritive value of dahi, it will also help to increase the taste of skim milk dahi. In our country carrot is available and is popular vegetable. It's nutritional value is very high. Carrot (*Daucus carota*) is a good source of carbohydrate, calcium, phosphorus, iron, potassium, magnesium, copper, manganese and sulphur. It is an excellent source of vitamins A, B₁, B₂, C, E, thiamin, folic acid and riboflavin. Blending of yoghurt with carrot juice would produce a nutritionally rich food (Ikken *et al.*, 1998).

From the above discussion it is clear that nutritive value and taste of different types of dahi could be improved by adding different flavoring materials. Information are very limited to produce dahi by using carrot. For this

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reason attempts were made to prepare dahi from skim milk with addition of different levels of carrot juice.

Materials and Methods

The present experiment was conducted at the Department of Dairy Science of Bangladesh Agricultural University. Chemical analysis was done in the Dairy Technology and Dairy Microbiology Laboratory and in Animal Science Laboratory of Bangladesh Agricultural University, Mymensingh. Whole milk was collected from 'Sutiakhali' market near the Bangladesh Agricultural University, Mymensingh. Whole milk was skimmed by an electric cream separator. Before preparation of various types of dahi from skim milk using different level of carrot juice, milks used in this study were analyzed in the laboratory to monitor the quality.

Preparation of carrot juice

The carrot was purchased from Kamal-Rangit market in Bangladesh Agricultural University Mymensingh and was brought to the laboratory for collecting juice. Firstly, it was washed with distilled water and the skin was separated with a knife using clean hand. Then the carrot was blended by adding 30% of water. After blending the juice was filtered by clean cloth (hot water washed) and then was kept in plastic cups.

Preparation of dahi

The skim milk was obtained from the whole milk by screaming with the help of cream-separator machine. Skim milk was boiled for some time until volume reduced up to 20-25 per cent of original volume. Sugar was added to the skim milk at the rate of 10 per cent during boiling. During heating milk was stirred thoroughly with the help of a stirrer. After desired heating at boiling temperature milk pan was taken out from the heater and was allowed to cool. Carrot 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 four equal portions and different types of dahi was prepared from each portion by using the different proportions of carrot juice.

The carrot juice was incorporated into dahi at 5, 10 and 15% level in different cups except control. Finally four different types of dahi were designated as A (Skim milk without carrot juice), B (Skim milk + 5% carrot juice), C (Skim milk + 10% carrot juice), and D (Skim milk + 15% carrot juice). Juice was added before incubation with culture as suggested by Gandhi et al. (1977), Singh (1979). Heated milk was cooled to 40°C and inoculated with desirable proportion of culture (2%). The plastic cups were pre-washed with boiled water. The samples were incubated at 37°C until the complete coagulation of dahi samples. After complete coagulation (5-6 hrs.) the dahi was prepared and then dahi samples were stored at about 5 °C at refrigerator until used.

Parameters studied

Physical, chemical and microbiological tests were done for the evaluation of different types of dahi samples.

Physical tests

Physical quality was evaluated with the help an expert panel of judges of the Teachers' of Dairy Science using a score card which consisted of smell and taste (50), body and consistency (30), colour and texture (20).

Chemical tests

After the organoleptic evaluations all dahi samples were chemically analyzed to know acidity percentage, pH values, total solids (g/kg), moisture (g/kg), protein (g/kg), fat (g/kg), carbohydrate (g/kg) and ash (g/kg). Total solids and ash content of the dahi samples were determined by oven drying and incineration method according to AOAC (2003). 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 Kjeldahl procedure as per (AOAC) and pH was measured with the help of a pH meter -2 15 (Ciba Corning Diagnostics Ltd, Sudhury, Suffolk, England Co. 106×D).

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Microbiological tests

Microbiological tests were done for the determination of total viable count and Coliform count as per standard methods for the examination of dairy products followed by American Public Health Association (2004).

Data Analysis

Data collected from different parameters were subjected to statistical analysis. Analysis of variance (ANOVA) test was done to find out the statistical difference between the treatments. In this experiment all experimental materials were completely homogenous and for this reason data were analyzed by one-way analysis of variance test (CRD) using MSTAT statistical program.

Results and Discussion

Initial quality of skim milk

Skim milk was analyzed before preparation of dahi for getting idea about the initial quality of skim milk used in this experiment. The result of analysis of skim milk is given in Table 1. Specific gravity of skim milk samples was 1.035 ± 0.0006 (Table 1). Generally the specific gravity of skim milk are within the range of 1.034 to 1.039 having an average value of 1.036 (Eckles et al., 1951). This specific gravity was within normal range of specific gravity of skim milk.. TS content of skim milk sample before starting experiment was 80.7 ± 1.1 g/kg (Table 1). The value of TS content agreed with the reports of Munzur (2004), who found that 82.9 ± 0.00 g/kg of TS in cows' skim milk. The lower percentage of TS content of skim milk is due to low level of fat content in skim milk. Fat content of skim milk sample before starting experiment was 2.67 ± 0.88 g/kg (Table 1). Generally fat content of present study indicates that the skimming was done properly. Protein content of skim milk is shown in Table 1. It was found that protein content of experiment skim milk samples was 31.70 ± 0.84 g/kg. The protein content of skim milk obtain in this study was within the normal range. This result agrees with the findings of Rahman (1998), who found 3.4 ± 0.42 percent protein in cows' skim milk. The lactose content of skim milk samples was 41.42 ± 2.74 g/kg (Table-I). This results of the

present study agrees with the findings of Rahman (1998), who found 42.31 ± 0.24 g/kg of lactose in cow's skim milk. Average ash content of skim milk is shown in (Table 1). It was found that ash content of experimental skim milk samples was 6.23 ± 0.09 g/kg. This ash content of cow's skim milk was within the normal range of ash content of skim milk. SNF content of skim milk sample before starting experiment was 78.63 ± 1.85 g/kg (Table 1). The value of SNF content agrees with the reports of Munzur (2004), who found that 80.4 ± 0.1 g/kg of SNF in cow's skim milk. The acidity percentage of skim milk was 0.14 ± 0.01 (Table-1). This acidity percentage was within the normal range. Generally acidity percentage of cow's skim milk range from 0.14 to 0.17. The result of the study agrees with the results of Rahman (1998). The mean pH value of the experimental cow's skim milk was 6.76 ± 0.02 (Table-I). This pH value was in the normal range. Generally pH of cow's skim milk range from 6.6 to 6.7. The result of the study agrees with Rahman (1998).

Table 1: Chemical quality of skim milk sample obtained from BAU Dairy Farm

Parameter	Value
Specific gravity	1.038 ± 0.01
Total solids (g/kg)	80.7 ± 1.1
Fat (g/kg)	2.67 ± 0.88
Protein (g/kg)	31.7 ± 0.84
Lactose (g/kg)	41.42 ± 2.74
Ash (g/kg)	6.23 ± 0.09
Solids-not-fat (g/kg)	78.63 ± 1.85
Acidity %	0.14 ± 0.01
pH	6.76 ± 0.02

Quality of prepared dahi

Prepared dahi samples were analyzed physically chemically and microbiologically. Results obtained are presented in Table 2.

Physical parameters

Smell and taste

Smell and taste score of dahi samples containing 0% (A), 5% (B), 10% (C) and 15% (D) carrot juice were 46.90 ± 1.01 , 48.78 ± 0.69 , 47.70 ± 1.47 , 46.33 ± 2.08 , respectively. Statistical analysis showed that there was significant difference within the smell and taste scores of different types of dahi (Table 2).

Higher smell and taste score was recorded in case of dahi having 5% carrot juice, on the other hand, lowest score was seen in case of 15% dahi. The result of this experiment agreed with the work of Mustafa (1997) who found that addition of fruit juice improved the smell and taste score of dahi. Desai *et al.*, (1994) also found that smell and taste of dahi or yogurt improved due to the addition of fruit juice.

Body and consistency

Body and consistency score of prepared dahi sample of A, B, C and D were 27.60 ± 1.51 , 29.22 ± 1.50 , 28.33 ± 1.15 and 26.89 ± 1.17 , respectively (Table 2). Statistical analysis showed that there was no 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 5% carrot juice, on the other hand, lowest score was seen in case of 15% dahi. The result of this experiment agrees with the findings of Desai *et al.* (1994) and Mustafa (1997). Both the workers found that body and consistency of dahi or yogurt improved due to the addition of fruit juice.

Colour and texture

The colour and texture score of A, B, C and D dahi samples were 16.89 ± 1.54 , 19.00 ± 0.67 , 18.22 ± 0.38 and 16.89 ± 0.84 , respectively (Table -2). Statistical analysis showed that there was significant difference within colour and texture score of B and C samples, but there was no significant difference between sample A and D. Highest colour and texture score was recorded in case of dahi having 5% carrot 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.

Chemical and microbiological parameters

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 in Table 3.

Total solids

The total solids content of A, B, C, D and E types of dahi was 192.4 ± 0.17 , 193.2 ± 0.17 , 204.5 ± 0.18 and 216.9 ± 0.18 g/kg respectively (Table-2). The total solids content was highest in case of 15% carrot juice, lowest score was recorded in case of control dahi. Statistical analysis showed that there were significant differences within the total solids content of different dahi samples but there was no significant difference between sample A and B. It is distinct from the study that incorporation of carrot juice to the dahi might have increased 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. Total solids content of carrot juice is higher than skim milk. This might be the cause of higher total solid 15% carrot juice added dahi samples.

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

Properties	Types of dahi				LSD value	Level of significance
	A	B	C	D		
Smell & taste	$46.90^b \pm 1.01$	$48.78^a \pm 0.69$	$47.70^b \pm 1.47$	$46.33^c \pm 2.08$	1.54	*
Body & consistency	$27.60^a \pm 1.51$	$29.22^a \pm 1.50$	$28.33^a \pm 1.15$	$26.89^a \pm 1.17$	1.37	NS
Colour & texture	$16.89^c \pm 1.54$	$19.00^a \pm 0.67$	$18.22^b \pm 0.38$	$16.89^c \pm 0.84$	1.04	*
Total	$91.39^b \pm 1.51$	$97^a \pm 0.67$	$94.25^b \pm 0.38$	$90.11^c \pm 2.08$	1.86	*

A: Skim milk +0% carrot juice, B: Skim milk +5% carrot juice, C: Skim milk +10% carrot juice, D: Skim milk +15% carrot juice. Figures within the same row with different superscripts differ significantly. ** = Significant at $p < 0.01$, * = Significant at $p < 0.05$, NS= Not significant at $p < 0.01$.

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Table 3: Chemical and microbiological evaluation of different dahi samples prepared by using carrot juice

Parameter	Types of dahi				LSD value	Level of significance
	A	B	C	D		
Total solids (g/kg)	192.4 ^c ±0.17	193.2 ^c ±0.17	204.5 ^b ±0.18	216.9 ^a ±0.18	0.19	**
Moisture (g/kg)	80.76 ^a ±0.17	80.72 ^a ±0.15	79.93 ^b ±0.58	78.83 ^c ±0.82	0.56	**
Fat (g/kg)	2.6 ^a ±0.12	1.9 ^a ±0.09	2.1 ^a ±0.10	2.2 ^a ±0.10	0.11	NS
Protein (g/kg)	34.2 ^a ±0.11	34.0 ^a ±0.10	32.9 ^b ±0.10	31.4 ^c ±0.10	0.11	**
Carbohydrate (g/kg)	148.4 ^d ±0.17	153.3 ^c ±0.10	162.3 ^b ±0.10	172.1 ^a ±0.11	0.13	**
Ash (g/kg)	7.2 ^b ±0.02	6.7 ^c ±0.01	7.3 ^b ±0.00	7.8 ^a ±0.01	0.01	**
pH value	4.60 ^a ±0.10	4.37 ^b ±0.15	4.17 ^c ±0.15	4.05 ^d ±0.13	0.15	**
Acidity (%)	0.73 ^d ±0.02	0.79 ^c ±0.04	0.84 ^b ±0.03	0.92 ^a ±0.02	0.03	**
Total viable count cfu/g (×10 ⁴)	70.90 ^c ±9.38	69.53 ^c ±11.86	86.82 ^b ±14.03	92.7 ^a ±16.07	14.21	*
Coliform cfu/g	10.00 ^a ±.00	13.33 ^a ±5.77	13.33 ^a ±5.77	13.33 ^a ±5.77	5.44	NS

A: Skim milk +0% carrot juice, B: Skim milk +5% carrot juice, C: Skim milk +10% carrot juice, D: Skim milk +15% carrot juice. Figures within the same row with different superscripts differ significantly. ** = Significant at p<0.01, * = Significant at p<0.05, NS= Not significant at p<0.01.

Moisture content

The average moisture content of A, B, C, D and E types of dahi were 80.76±0.17, 80.72±0.15, 79.93±0.58 and 78.83±0.82 g/kg, respectively (Table 2). Statistical analysis showed that there was significant difference within the moisture content of A, C, D dahi samples but there was no significant difference between sample A and B. This result also agrees with Nahar (2000).

Fat

The average fat percent of A, B, C and D types of dahi was 2.6±0.12, 1.9±0.09, 2.1±0.10 and 2.2±0.10 g/kg respectively (Table 2). Fat content of control sample was slightly higher than carrot juice. Statistical analysis showed that there was no significant difference within the fat content of different dahi samples. Addition of carrot juice has no or little effect on fat content. The result agrees with the work of Desai *et al.* (1994), Mustafa (1997), Ghosh and Rajorhia (1987, Sarker *et al.* (2000) who found that addition of fruit juice does not increase fat content of dahi.

Protein

The average values of protein content of A, B, C and D types of dahi were 34.2±0.11, 34.7±0.10, 32.9±0.10 and 31.4±0.10 g/kg respectively (Table 2). The protein content was higher in A sample and lower in dahi containing 0% carrot juice. This might be due to the fact that carrot juice contain lower amount of protein than milk. So addition of carrot juice decreased the protein content of dahi. Statistical analysis showed that there was significant difference within the protein content of A, C, D dahi samples but there was no significant difference between sample A and B. 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).

Carbohydrate content

The carbohydrate content of A, B, C, and D types of dahi were 148.4±0.17, 153.3±0.10, 162.3±0.10 and 172.1±0.11 g/kg respectively (Table 2). This might be due to the fact that carrot juice contain higher amount of carbohydrate than milk. So addition of carrot juice increased the carbohydrate content of dahi.

Statistical analysis showed that there was significant difference within the carbohydrate content of different dahi samples. The carbohydrate content was higher in sample d (15% carrot juice) and lowest in sample A (control dahi).

Ash

The average ash content of A, B, C and D types of dahi was 7.2 ± 0.02 , 6.7 ± 0.01 , 7.3 ± 0.00 and 7.8 ± 0.01 g/kg respectively (Table 2). The highest and the lowest percent of ash were seen in sample D and dahi having 5% carrot juice respectively. Statistical analysis showed that there was significant difference within the ash content of A, B, D dahi samples but there was no significant difference between sample A and C. The finding of this study agrees with the work of Mustafa (1997) and Desai et al. (1994). The result of this experiment also indicates that incorporating of carrot juice decreases the ash content of dahi.

Acidity

The acidity percentage of different types of dahi samples is shown in (Table 2). The average values of acidity percent were 0.73 ± 0.02 , 0.79 ± 0.04 , 0.84 ± 0.03 and 0.92 ± 0.02 for A, B, C, and D types 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. Addition of fruit juice might have initiated quick fermentation of milk. This was the main reason for increased acidity in fruit dahi samples.

pH

The average pH values of A, B, C, and D types dahi were 4.60 ± 0.10 , 4.37 ± 0.15 , 4.17 ± 0.15 and 4.05 ± 0.13 respectively. The differences of pH values among the samples were statistically significant. Addition of fruit slightly decreased the pH value of dahi. It is well known that when pH value decreases when acidity increases. In

this experiment, acidity of carrot 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 (1997), who found that pH of plain dahi was 4.25. Kosikowski (1966) also reported that the pH of normal dahi samples should be approximately 4.4.

Microbiological parameters

Total Viable count

The total viable count of A, B C, and D types of dahi were $70.90 \pm 9.38 \times 10^4$, $69.53 \pm 11.86 \times 10^4$, $86.82 \pm 14.03 \times 10^4$ and $92.7 \pm 16.07 \times 10^4$ cfu/g, respectively (Table 2). Statistical analysis showed that there was significant difference among the different samples. This finding indicates that total viable count increased with addition of carrot juice. The present investigation agrees with the results of Rahman (1998) who found the average total viable count was $120.22 (\pm 2.51) \times 10^4$ cfu/g of flavoured yoghurt drinks.

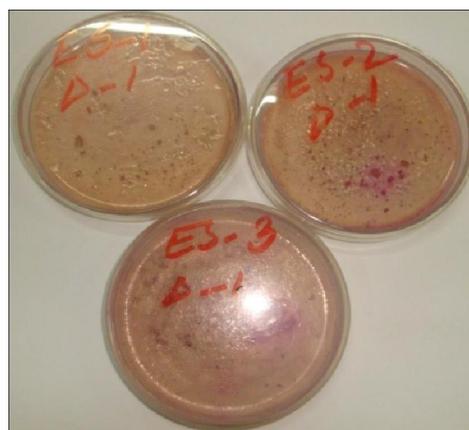


Figure 1. Average total viable count of Bacteria in dahi sample

Coliform count

The total coliform count of A, B C, and D types of dahi were $10. \pm 0.00$, 13.33 ± 5.77 , 13.33 ± 5.77 and 13.33 ± 5.77 cfu/g respectively (Table 2). Statistical analysis showed that there was no significant difference among the different samples. This finding indicates that total coliform count almost similar of different sample. There was no available reference in this regards.

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Conclusion

From the finding of this experiment, it is clearly indicated that dahi prepared by incorporating 5% carrot juice was best quality based on higher values of smell and taste, body and consistency, colour and

texture score. Similarly total viable bacterial count was lower in 5% carrot juice added dahi than 10 and 15% carrot juice added dahi. So, it is recommended to use 5% carrot juice with skim milk for preparation of acceptable quality dahi

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