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Chemical Quality of Misti Dahi Prepared from Blending of Soy Milk with Buffalo Milk

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Abstract

A study was carried out during the year of 2012 and 2014 at Department of Animal Husbandry and Dairying, C.S. Azad university of Agriculture and technology, Kanpur -208002. The chemical evaluation of Misti Dahi prepared from various composition of different milk was the objective of present study. The treatments i.e., 100% buffalo milk (A_1), 50% buffalo milk + 25% soy milk (A_2), 50% buffalo milk + 50% soy milk (A_3) and 25% buffalo milk + 25% soy milk (A_4) were tested. In each batch, four levels of sugar was added i.e., B_1 (10%), B_2 (12%), B_3 (14%) and B_4 (16%). After adding of sugar, the each batch was inoculated with starter culture *Lactococcus lactis* subsp. *lactis* with 2% inoculum (C_1), *Lactococcus lactis* subsp. *cremoris* with 2% inoculums (C_2) and *Bifidobacterium bafidum* 2% inoculums (C_3). These were further divided in two batches and each batch was allowed to incubate at 30^0C (D_1) and 37^0C (D_2) temperature. After that the storage studied were carried out on fresh product (E_1- 0 days storage), after 7 days storage (E_2) and after 14 days storage (E_3). Pure buffalo milk was found most suitable, while 75% buffalo milk + 25% soy milk also at par in respect of chemical qualities of Misti Dahi. The overall maximum fat, lactose, ash and total solids content were noted in samples prepared from 100% buffalo milk with 10% sugar by the use of *Lactococcus lactis* subsp. *lactus* culture at 37^0C incubation temperature at freshly prepared (0 day storage period).

Keywords: *Bifidobacterium bifidum*, Chemical Qualities, *Lactococcus lactis,* Misti Dahi

1. Introduction

Converting samples milk available in Indian villages into traditional milk products is being practiced from time immemorial. About half of India's total milk production is utilized for the preparation of different traditional dairy products. Traditional dry products have played a significant role in economic, social, religious and nutritional well being of people and are gradually becoming popular all over the world[2].

Amongst several varieties of fermented milks and milk products, Dahi is the most popular milk product with different names in the world. Dahi has attained a significant importance in the Indian diet since centuries; an ancient recognized its advantages over milk in view of its better keeping quality, nutritive value, therapeutic value and taste. In fact, since long back Ayurveda had prepared Dahi which was vitalizing proved curative in dysentery and other metabolic disorders.

Dahi is generally consumed in its original form as an accompaniment to the meal or it may be converted into raita. Dahi may be consumed as such or a sweet or savoury drink as desert containing sugar, spices, fruits nut etc. An extensive al India survey project on Dahi revealed that there are broadly speaking, two types of Dahi prevalent in the country for direct consumption viz., a sweet/ milky acidic variety with a pleasant flavour, and a sour variety with a sharp, acidic flavour.

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Although India is a highest milk producer in the world, due to huge population it is different to fullfil the requirements. Hence to meet the demand and supply, extensive studies are being under take to find out a suitable substitute of milk. A successful effort is soymilk which is an excellent source of good quality protein. Availability of such a cheap abundance needs attention in the direction of its maximum utilization as human food. They provide complete protein, high quality fibre, low glycemic index, therefore, it can be higher concentration of omega 3 fatty acids which has the ability to lower the risk of heart diseases and even cancer.

Therefore, the use of soymilk for making Misti Dahi becomes requirement of the day as it will not only increase the availability of fluid milk for consumption but will also increase the nutritive value of Misti Dahi. Hence the present investigation was under taken in the control part of Uttar Pradesh in order to explore the possibility of use of soymilk in buffalo milk to produce a novel fermented milk product, to standardize the optimum level of soymilk in the preparation of Misti Dahi and to study its chemical quality.

2. Materials and Method

An experiment was conducted during the year of 2012 and 2014 at Department of Animal Husbandry and Dairying, C.S. Azad University of Agriculture and Technology, Kanpur-208002. The main objective of this study was evaluation of chemical quality of prepared Misti Dahi. The fresh clean buffalo milk was obtained from the university Dairy of C.S. Azad University of Agriculture and Technology, Kanpur. It was strained through two fold clean muslin cloth to remove extraneous matter. Raw milk was preheated to 40-50^{0}C and separated in centrifugal separator model no. 104 manufactured by De level separator company Ponglkepsic. The separated milk, thus obtained was used for standardization of milk. The soybean kernels were obtained from Vegetable Research Farm, Kalaynpur-208024. The kernels were soaked in tap water (1:3 w/v) for 14-16 hours at room temperature (22-30^{0}C). The hydrated were rubbed between the palms to dehull manually followed by rinsing with water to separate hulls. Remove off flavour and to inactivated lapoxygenase enzyme, the dehulled kernels were dipped in hot water (95^{0}C) with 0.1% sodium chloride for 30 minutes. After that the kernels were grinded in a mixture for 3 minutes using hot water (25^{0}C) to extract maximum solids. The kernels to water ratio was kept 1:9 (w/v) for grinding. The slurry thus obtained was filtered through a double layered muslin cloth. The soymilk thus obtained was boiled for 5 minutes and was further used for blending with buffalo milk.

For preparation of Misti Dahi, 8 litres of pure buffalo milk and 4 liter 800 ml soymilk was boiled for 3 to 5 minutes and cooled to 40^{0}C. buffalo milk was taken and four combination of buffalo milk with soymilk were made i.e. 100% buffalo milk (Control – A_1), 75% buffalo milk, 50% buffalo milk and 25% buffalo milk with 25% soymilk (A_2), 50% soymilk (A_3) and 75% soy milk respectively. In each batch four level of sugar was added i.e., 10% (B_1), 12% (B_2), 14% (B_3) and 16% (B_4). The each batch was inoculated with starter culture *Lactococcus lactis* subsp. *lactis* (C_1), *Lactococcus lactis* subsp. *cremoris* (C_2) and *Bifidobacterium bifidum* (C_3) with 2% inoculums. They were distributed in 100 ml capacity of plastic cups. These plastic cups were further divided in two batches at 30^{0}C (D_1) and 37^{0}C (D_2) temperature. The prepared Misti Dahi was stored refrigeration temperature. Storage standers were carried out on fresh product (E_1) and after 7 days (E_2) and 14 days (E_3) interval period.

The total solids content, fat content, protein content, lactose content, sucrose content, ash content and acidity content were evaluated by chemically in prepared Misti Dahi. The total solids content and titrable acidity were determined by the method in BIS Hand Book of Food Analysis (Part – XI), 1981. Fat content was determined as per procedure adopted by Chaudhary[5], protein content, ash content and lactose content were estimated by the procedure as described in IS: 1479 (Part-II), 1961. Sucrose content of Misti Dahi was estimated by procedure as suggested by Upadhyay et al[9]. Statistical analysis (ANOVA) was done according to the procedure described by Snedecor and Cochron[8].

3. Results and Discussion

3.1 Total Solids Content of Misti Dahi

The mean values of total solids content of Misti Dahi affected by four combination of milk revealed highly significant differences. The highest value was found in A_1 (29.23) and lowest noted in A_4 (23.16). The mean values of sugar combination was observed as 24.00, 25.46, 26.93 and 28.28 in B_1, B_2, B_3 and B_4 treatment respectively. The

highest value of total solids was found B_4 treatment of sugar combination while lowest was occurred in B_1. The highly significant differences were noticed among the different types of starter cultures with 2% inoculants. The highest value was analyzed in C_1 (26.45) and lowest was found in C_3 (25.93). The highly significant differences were noticed among the different incubation temperatures. The highest value of total solids was analyzed under the treatment of D_2 (26.26), which was significantly differs from D_1 (26.13). The different storage period also indicated the significant difference. The highest value was noted under tested treatment of E_1 (26.31) and least was noted in E_3 (26.07) Table 1.

The interaction effect of all 288 treatment combinations exhibited that the Misti Dahi prepared from the combination of 100% pure buffalo milk, 16% sugar level, pure culture *Lactococcus lactis* subsp. *lactis* with 2% inoculums, 37^{0}C incubation temperatures and 0 day. Storage period ($A_1B_4C_1D_2E_1$) scored the maximum (31.82), while Misti Dahi prepared from the combination of 25% buffalo milk with 75% soybean, 10% sugar level, *Bifidobacterium bifidum* culture, 37^{0}C incubation temperature and 14 days storage period ($A_4B_1C_3D_2E_3$) scored minimum (20.57) point.

3.2 Fat Content of Misti Dahi

Perusal of data make it clear that the highest value of fat was found under A_1 (6.57), while lowest was averaged in A_4 (3.60) treatment. All the treatment differs significantly from each other. The mean values of fat content of four sugar levels were found significant. The maximum count was noted in B_1 (5.53), while lowest was found in B_4 (4.65). The other two treatments showed the value sugar in between these two limits. the average values of three different types of starter culture with 2% inoculums was observed as 5.20 in C_1, 5.07 in C_2 and 5.01 in C_3, which were significantly differ from each other, the highly significant differences were noticed among the different incubation temperature. The highest score noted in D_2 (5.13) and lowest recorded in D_1 (5.05) treatment. The average values of fat content in Misti Dahi were affected by different storage periods. The highest value of fat content was noted at E_4 (5.14) and lowest was count under E_3 (5.04) Table 1. The incubation effect of 288 treatments combination was analyzed statistically and found that 100% pure buffalo milk, 10% sugar level, *Lactococcus lactis* subsp. *Lactis* culture, 37^{0}C incubation temperature and 0 day storage period ($A_1B_1C_1D_2E_1$) showed the maximum linking score (7.20), while the minimum linking score (3.00) of Misti Dahi was observed from combination of 25% buffalo milk with 75% soymilk, 16% sugar level, *Bifidobacterium bifidum* culture, 30^{0}C incubation temperature and 14 days storage period ($A_4B_4C_3D_1E_3$).

3.3 Protein Content of Misti Dahi

The mean values of four different types of milk were observed as 4.08, 4.18, 4.27 and 4.38 under A_1, A_2, A_3 and A_4, respectively. This indicated that significantly highest value of protein was found in A_4 and lowest was recorded in A_4. The different level of sugar displayed that the highest score was recorded in B_1 (4.26) and lowest was in B_4 (4.19). The other two treatments showed the values of sugar level between these two limits. The highly significant differences were noticed among the different types of starter cultures with 2% inoculums. The highest value in C_1 (4.24) followed by C_2 (4.28) and C_3 (4.21). The mean values of two different incubation temperature were noticed as D_1 (4.23) and D_2 (4.28), which were statistically at par with each other. The results displayed the significant differences among the different storage periods. The significantly highest value was averaged in E_1 (4.24), while lowest was noted in E_3 (4.21) Table 1.

The interaction effects of 288 treatment combination exhibited that the combination of 25% buffalo milk with 75% soy milk, 10% sugar level *Lactocuccus lactis* subsp. *Lactis* culture, 37^{0}C incubation temperature and 0 day storage period ($A_4B_1C_1D_2E_1$) showed the maximum linking score (4.97), while minimum linking score (4.04) of Misti Dahi was found in combination of 100% pure buffalo milk, 16% sugar level, *Bifidobacterium bifidum* culture, 30^{0}C & 37^{0}C both incubation temperatures and 0/4 days storage period.

3.4 Lactose Content of Misti Dahi

The highly significant differences were noticed in lactose content of Misti Dahi due to four combination of milk. The highest lactose was scored in A_1 (3.81), while lowest was noted in A_4 (0.86). The highest value of lactose content was noted under B_1 (2.63) while lowest was recorded in B_4 (2.05). The average values of lactose content of Misti Dahi affected by different starter cultures with 2% inoculums. It was noted highest under treatment C_1 (2.41) and lowest was reported in C_3 (2.28). The average value of lactose content in Misti Dahi less than two different incubation

Table 1. Average values of total solid, fat, protein, lactose, sucrose, ash and acidity contents of Misti Dahi under main effect of different treatments

Treatment		total solid content	Fat content	Protein content	Lactose content	Sucrose content	Ash content	Acidity content
Pure buffalo milk	(A_1)	29.22	6.57	4.08	3.81	13.01	0.86	0.87
75% buffalo milk + 25% soymilk	(A_2)	27.20	5.58	4.18	2.84	13.01	0.74	0.83
50% buffalo milk + 50% soymilk	(A_3)	25.20	4.62	4.27	1.84	13.01	0.65	0.79
25% buffalo milk + 75% soymilk	(A_4)	23.16	3.60	4.38	0.86	13.01	0.54	0.75
10% Sugar level	(B_1)	24.00	5.53	4.26	2.63	10.01	0.763	0.82
12% Sugar level	(B_2)	25.46	524	4.23	2.43	12.01	0.71	0.8
14% Sugar level	(B_3)	216.93	4.95	4.21	2.24	14.01	0.69	0.80
16% Sugar level	(B_4)	28.38	4.65	4.19	2.05	16.00	0.67	0.79
Lactococcus lactis subsp. *lactis* 2% inoculums	(C_1)	26.45	5.20	4.24	2.41	13.01	0.71	0.85
Lactococcus lactis subsp. *cremoris* 2% inoculums	(C_2)	26.20	5.07	4.23	2.32	13.01	0.70	0.85
Bifidobacterium bifidum 2% inoculum	(C_3)	25.93	5.01	4.21	2.28	13.01	0.68	0.72
30^0C incubation temperature	(D_1)	26.13	5.05	423	2.31	13.0	0.78	0.81
37^0C incubation temperature	(D_2)	26.26	5.13	4.23	2.36	13.01	0.70	0.81
0 day storage period	(E_1)	26.31	5.14	4.04	2.38	13.02	0.71	0.80
7 day storage period	(E_2)	26.20	5.10	4.22	2.34	13.01	0.70	0.81
14 day storage period	(E_3)	26.07	5.04	4.01	2.30	13.00	0.69	0.82
CD 5%	A	0.03	0.01	0.01	0.01	NS	0.01	0.01
	B	0.03	0.01	0.01	0.01	0.01	0.01	0.01
	C	0.02	0.01	0.01	0.01	NS	0.01	0.01
	D	0.02	0.01	NS	0.01	NS	NS	NS
	E	0.02	0.01	0.01	0.00	0.01	0.01	0.01

temperature were found significantly differ. It was higher under D_2 (2.36) and lowest in D_1 (2.34).

The average values of lactose content of Misti Dahi affected by different storage periods. The highest value was noted in E_1 (2.38), while lowest recorded in E_3 (2.80) treatment (Table 1).

It was observed from analysis of interaction factor that out of all 288 treatments combination of A, B, C, D and E, the combination of 100% pure buffalo milk, 10% sugar level, *Lactococcus lactis* subsp. *Lactis* culture, 37^{0}C incubation temperature and 0 day storage period (A_1,B_1,C_1,D_2,E_1) and 100% pure buffalo milk, 10% sugar level, *Lactociccus lactis* subsp. *cremoris*, 37^{0}C incubation temperature and 14 days storage period ($A_1B_1C_2D_2E_3$) were both showed the maximum linking score (4.20) while the minimum linking score (0.46) of Misti Dahi was observed from the combination of 25% buffalo milk with 75% soy-milk, 16% sugar level, *Lactococcus lactis* subsp. *cremoris* culture, 30^{0}C incubation temperature and (4 days storage period ($A_4B_4C_2D_1E_3$) and 25% buffalo milk with 75% soy-milk, 16% sugar level, *Bifidobacterium bifidum* culture, 37^{0}C incubation temperature and 14 days storage period ($A_4B_4C_3D_2E_3$).

3.5 Sucrose Content of Misti Dahi

The non significant values of four different type of milk were observed as 13.01, 13.01, 13.01 and 13.01 under A_1, A_2, A_3 and A_4, respectively. Perusals of data make it clear that the different level of sugar highly significantly differed from each other. The highest values was found in B_4 (16.00) and lowest recorded in B_1 (10.01). The average values of sucrose content of Misti Dahi under three different types of starter culture with 2% inoculums were found at par (13.01). The effect of incubation temperature in D_1 (13.00) and D_2 (13.01) treatment was found non-significant. The highly significant difference was found among the different storage periods on sucrose content of Misti Dahi. The highest value recorded in E_1 (13.02) and lowest was found in E_3 (13.00) treatment (Table 1).

It is clear from the statistical analysis of interaction effect that out of all 288 treatment combination of A, B, C, D and E, the maximum percentage of sucrose (16.03) was noticed in the combination which prepared by adding 16% sugar in its composition. The lowest percentage of sucrose (10.00) was noted in combination which prepared by adding 10% sugar in its composition.

3.6 Ash Content of Misti Dahi

The highest ash content of Misti Dahi was recorded in treatment A_1 (0.86), which was significantly higher over the other tested treatment. Lowest ash content of Misti Dahi was found in A_4 (0.54) treatment. The results revealed that the different levels of sugar were highly significantly differed. The highest value of ash content was found in B_1 (0.73) and lowest recorded in B_4 (0.67). The average values of ash content of Misti Dahi affected by different starter cultures with 2% inoculums.

The highest values of ash content of Misti Dahi was found in C_1 (0.71) and lowest recorded in C_3 (0.68). The mean value of two different incubation temperatures were observed as 0.70 and 0.70 at D_1 and D_2, respectively, which were at par. The highly significant difference was observed in ash content of Misti Dahi due to different storage periods. The highest value was found in E_1 (0.71) and lowest noted in E_3 (0.69) treatments.

The Misti Dahi prepared from the combination of 100% pure buffalo milk, 10% sugar level, *Lactococcus lactis* subsp. *lactis* culture 2% inoculums, 30^{0}C and 37^{0}C, incubation temperature and 0-14 days storage period scored the maximum (0.90) point on ash content. The Misti Dahi prepared from the combination of 25% buffalo milk with 75% soy milk, 16% sugar level, *Bifidibacterium bifidum* culture, 37^{0}C incubation temperature and 14 days storage period ($A_4B_4C_3D_2E_3$) scored minimum (0.47) point on ash content.

3.7 Acidity Content of Misti Dahi

Perusal of the data make it clear that the highly significant differences in acidity content of Misti Dahi prepared from four types of milk were noticed. The highest value was recorded in A_1 (0.87) and lowest noted in A_4 (0.75) treatment. It is observed that the different levels of sugar highly significantly differed to the acidity content of Misti Dahi. The highest value of acidity content was noted in B_1 (0.82), while lowest noted in B_4 (0.79). The highly significant differences in acidity content of Misti Dahi due to different types of starter cultures with 2% inoculums. The at par values were recorded in C_1 (0.85) and C_2 (0.85). The significantly lowest value of acidity content was recorded under C_3 (0.72) treatment. The mean score of two incubation temperature sowed non-significant difference. The highly significant differences were noticed among the different storage period. The highest value was found in E_3

(0.82), while lowest recorded in E_1 (0.80).

The interaction factors showed that the Misti Dahi prepared from the combination of 100% pure buffalo milk, 10% sugar level, *Lactococcus lactis* subsp. *lactis* with 2% inoculums and *Lactococcus lactis* subsp. *cremoris* with 2% inoculums, 30^{0}C and 37^{0}C incubation period ($A_1B_1C_1D_1E_3$), ($A_1B_1C_1D_2E_3$), ($A_1B_1C_2D_1E_3$) & ($A_1B_1C_2D_2E_3$) scored the maximum (0.94), while Misti Dahi prepared from the combination of 25% buffalo milk with 75% soy milk, 16% sugar level, *Bifidobacterium bifidum* culture, 37^{0}C incubation temperature ad 0 day storage period ($A_4B_4C_3D_2E_1$) scored minimum (0.62) point.

The fat content in Misti Dahi was higher prepared with 100% buffalo milk and 75% buffalo milk + 25% soy milk due to presence of high fat content by which the products made. Similar observation was reported by Changade and Tambat[4]. Fat content were decrease during storage due to lypolytic activity of micro flora as suggested by Ahmed[1].

The higher levels of protein in Misti Dahi may be due to the addition of soy milk, which has high protein content in kernels. It was observed that lactose content in 75% buffalo milk with 25% soy milk was at par with Dahi made from 100% buffalo milk and superior over other blends die to higher lactose content ion buffalo milk. These results confirm the finding of Changade and Tambat[4]. The sucrose content in Misti Dahi was highest at 16% sugar level. This was due higher level of sugar used in the preparation of Misti Dahi. This finding was in accordance to findings of Ray[6].

The increase soymilk ratios with buffalo milk for preparation Misti Dahi were decreased ash content. This was due to deficit ash content in soymilk over buffalo milk.

The Misti Dahi prepared from 100% buffalo milk and 75% buffalo milk + 25% soymilk with 10% sugar level, *Lactococcus lactis* subsp. *Lactis* & *cremosis* at 30^{0}C & 37^{0}C incubation temperature and 14 days storage period due to conversion of lactose into lactic acid. These findings support to the results of Bilal[3].

The total solids content of Misti Dahi was recorded maximum in case of 100% buffalo milk and 75% buffalo milk + 25% soy milk at 16% sugar level, *Lactococcus lactis* subsp. *lactis*, 37^{0}C incubation temperature and 0 day storage period. The higher amount of fat, protein and lactose contents in after mentioned formulation. The addition of higher amount of sugar in the preparation of Misti Dahi from a fermented material for mentioned material was also responsible for higher amount of total solids. The findings of this attribute found similar to the results of Sarkar et al[7].

4. Conclusion

Overall findings of this study revealed that the preparation of good quality Misti Dahi, the combination of pure buffalo milk, 12% sugar level, inoculated with *Lactocoocus lactis* subsp. *lactis* culture, 37^{0}C incubation temperature and 0 day storage period may be prepared 25% buffalo milk can easily the replaced by soymilk to produce the best quality Misti Dahi from mixture of 75% buffalo milk + 25% soymilk.

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