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Suitability of Replacement of Whole Buffalo Milk by Soy Milk for Dahi Making (Flavour Quality)

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Abstract : In this investigation for flavour scores of Dahi, it was revealed that the main effect of factors A, B, C, D and E was found to be highly significant. The first order interactions AC, AD, BD, CD, and second order interactions ACD and BCD were also found to be significant and the rest all first, second and third order interactions were observed to be non significant. The effect of types of milk, starter cultures, incubation periods and packaging materials (ABCDE) on flavour score of Dahi, was observed that maximum score (8.65) was in case of sample prepared from the combination of pure buffalo milk, *Lactococcus lactis* subsp. *lactis* with 1% inoculum, 37^0C incubation temperature with 8 hrs. incubation period and earthen pot packaging ($A_1B_1C_3D_1E_2$) followed by the combination of $A_1B_1C_3D_1E_1$, $A_2B_1C_3D_1E_2$, $A_1B_2C_3D_1E_2$, $A_2B_1C_3D_1E_2$ and $A_1B_2C_3D_1E_1$ which were statistically at par with respect to flavour of Dahi and were graded excellent quality and liked extremely. The lowest score (6.01) was obtained from $A_4B_4C_1D_1E_1$ samples and were graded as fair quality.

Key Word : Dahi , Soy milk, Sensory quality, Flavour

1. Introduction: Fermented milk has been used for human consumptions as refreshing beverage and nutritious food in many part of the world since time immemorial. The varieties of fermented milk products differ according to local traditional practices and known under various

names such as Acidophilus milk, Bulgarian milk, Cultured butter milk, Dahi, Leben, Keffir, Kumiss, Yoghurt etc. (Laxminarayan and Shankar, 1980).

The milk of different species (cows, buffaloes, goats, ewe and mares) has been fermented by the people of the oriental and other countries to produce sour products as a necessity for preserving milk. There has been a phenomenal increase in the production and consumption of fermented milk in the developed countries of the world for use as nutritious and refreshing beverage or as therapeutic agent in the treatment of gastrointestinal diseases (Garg, 1988; Gandhi and Muralidhar Rao, 1989). In the recent year the production and use of fermented milk and acidophilus culture preparation for treatment of intestinal disorders have gained great popularity in America, Europe, Japan and other countries as well. The production of these products has been highly mechanised and wide variety of fermented milk products are manufactured and marketed. Fruit and various flavouring material are also incorporated into the products to enhance their palatability. As a corollary to these developments, the importance of fermented milks in human nutrition and health has been the subject of numerous investigations by microbiologists, medical scientists and public health organizations. As a result of these studies sufficient experimental evidences are now available to establish the nutritive and therapeutic value of fermented milk product as well.

Dahi is the most popular and oldest fermented milk product of our country, prepared and utilized in various forms in almost all homes. It is an indispensable item of our Indian diet and is quite analogous to yoghurt. Dahi is known by quite different names throughout the world as Yoghurt in Turkey, Matzoon in Armenia, Leben or Laben raib Egypt-Arabia. Gioddu in Italy and Naja in Bulgaria. Fermented milk is consumed worldwide since immoral but are believed to have originated in the near East, perhaps before the Phoenician era and spread through the central and Eastern Europe.

Use of Dahi was much prevalent since Vedic times and its quotation and references occurs in our ancient scriptures like Vedas, Upanishads and various hymns. Dahi which came into existence probably as a means of preserving milk was used by Aryans in their daily diet as it checked putrefactive changes and added to an acidic, refreshing taste.

It is however, an encouraging sign to find that some enterprising medical practitioners have started advocating the use of curd and butter milk in children diets, not only for treatment for common intestinal or other diseases but also for general improvement of their health.

India is a huge country abounds with natural resources. It has been estimated that the population of India would touch 1500 millions by the year 2020. To feed the aforesaid

population we would be required to tap our resources to a substantial level. Soybean is one of the solutions of protein hunger being faced by our country.

Soybean is a unique crop that combines unparalleled nutritional quality with the potential to spark economic progress in the rural areas of rich and poor countries a like. Unlike most plant sources of protein, the soybean has a relatively balanced amino acid pattern close to the standards of the World Health Organization. It also contains about 20 per cent unsaturated oil and is rich in vitamins, minerals and calories.

Soymilk can be used as a milk extender. It is recommended for lactose intolerant infants and malnourished children. It is a cheaper source of high quality protein and its usefulness was proved for treatment of protein deficiency among under nourished pre-school children. Therefore soybean can play a significant role as source of supplementary and complimentary protein and as a source of calories in human diet (Bressani, 1975).

Though India is a higher milk producer, due to the huge population it is difficult to fulfil the requirements. Hence to meet the demand and supply, extensive studies are being undertaken to find out a suitable substitute of milk. A successful outcome of these strenuous efforts is soymilk which is an excellent source of good quality protein. Such vegetable protein products incorporated into Dahi may help not only in considerably reducing the cost but also diversity a major quantity of milk for consumption in fluid form.

Availability of such a cheap source of high quality nutrition is such an abundance, needs attention in the direction of its maximum utilization as human food. In this perspective, the use of soymilk as a substitute of milk for Dahi making being very suitable.

2. Materials and Methods : The present investigation was carried out in the Dairy Technology Laboratory of the Department of Animal Husbandry and Dairying, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Buffalo milk was obtained from University Dairy situated at University campus for entire experimentation. Soy milk was prepared in Dairy Technology Laboratory, Dahi manufacturing technique was standardized on the basis of various parameters under study and final product was subjected for the evaluation of sensory, physico-chemical and microbiological qualities.

The details of technical programme, procedures, techniques and methods are as follows :

1. Types of milk : 2

(a) Buffalo milk

(b) Soy milk

Combinations : 4

(i) 100% pure buffalo milk (control)

(ii) 75% buffalo milk + 25% soy milk

(iii) 50% buffalo milk + 50% soy milk

(iv) 25% buffalo milk + 75% soy milk

2. Starter culture with inoculum: 4

(i) *Lactococcus lactis* subsp. *lactis* with 1% inoculum

(ii) *Lactococcus lactis* subsp. *lactis* with 2% inoculum

(iii) *Lactococcus lactis* biovar. *diacetylactis* with 1% inoculum

(iv) *Lactococcus lactis* biovar. *diacetylactis* with 2% inoculum

3. Incubation temperature: 3

(i) 25^0C

(ii) 30^0C

(iii) 37^0C

4. Incubation period: 3

(i) 8h.

(ii) 10h.

(iii) 12h.

5. Packaging materials: 2

(i) Plastic cup

(ii) Earthen pot

3. Results and Discussion (Flavour):

The flavour of Dahi is the most important quality attributes. A pleasant sweetish aroma and a mild clean acid taste are desirable characteristics of Dahi. It should be free from any off flavour. A good pleasant diacetyl flavour is desired in Dahi.

It should not show any signs of bitterness, saltiness as any other off flavour. The flavour of Dahi as affected by different factors have been revealed the following facts.

The effect of different levels of all the factors, the following facts were observed. The highest (7.65) flavour score was found in milk sample of A_1 (100 BM:00SM) followed by A_2 (75BM:25SM) score (7.56). The flavour score showed a decreasing trend as a content of soy milk increased in Dahi. The mean difference in scores between A_1 and A_2, A_2 and A_3, A_3 and A_4 when compared with CD at 5% level (0.010), the flavour scores varied significantly from one another's. The results of this investigation regarding flavour score agreed with the findings of (Changade and Tambat, 1992). Who also reported a decreasing trend in flavour with increased proportions of soy milk in Dahi.

On comparing average scores of flavour and aroma of Dahi in case of different cultures and their inoculum levels. It was observed that the best flavour score (7.45) was noted in pure culture *Lactococcus lactis* subsp. *lactis* with 1% inoculum (B_1) and lowest score (7.04) in case of *Lactococcus lactis* subsp. *diacetylactis* with 2% inoculum (B_4).

Effect of incubation temperatures (C) on flavour and aroma of Dahi. It was observed that the highest average score (7.44) was in C_3 (37^0C) samples followed by C_2 (30^0C).

Effect of incubation periods (D) on flavour score of Dahi, it was observed that the highest score (7.49) obtained from 8 hrs. incubation period (D_1) followed by 10 hrs. incubation period (D_2). The lowest flavour score (7.12) observed from 12 hrs. incubation period (D_3).

As regard the packaging materials, the maximum flavour score (7.29) of Dahi was noted when the samples were packaged in earthen pot (E_2) followed by plastic cup packaging (E_1).

The mean interactions between type of milk (A) and starter cultures with inoculation levels (B), it was observed that Dahi prepared from pure buffalo milk with *Lactococcus lactis* subsp. *lactis* with 1% inoculum (A_1B_1) showed maximum score (7.86), followed by (75BM:25SM) with *Lactococcus lactis* subsp. *lactis* with 1% inoculum (A_2B_1) flavours score (7.77), while minimum flavour score (6.44) observed from (A_4B_4) samples.

Among the blend treatment combinations of type of milk (A) and incubation temperature (C), the maximum flavour score (7.87) observed from pure buffalo milk with 37^0C incubation temperature (A_1C_3) followed by (75BM:25SM) with 37^0C incubation temperature (A_2C_3) score of (7.77), while minimum flavour score (6.58) observed from (25BM:75SM) with 25^0C incubation temperature (A_4C_1).

From the interaction A.D, it was observed that highest flavour score (7.76) was in the samples of pure buffalo milk with 8 hrs. incubation period (A_1D_1). The next maximum flavour

score (7.63) was in case of (75BM:25SM) with 8 hrs. incubation period (A_2D_1). The mean differences between the two treatments were higher than CD at 5% which reflected that the treatment was significantly different not only to each other but also to remaining all treatment combination.

Among the treatment combination of types of milk and packaging materials (A.E), it was observed that maximum flavour score (7.70) was in the samples of pure buffalo milk packaged in earthen pot (A_1E_2) followed by buffalo milk packaged in plastic cup (A_1E_1) score (7.61), while lowest score (6.59) obtained from (A_4E_1) samples.

From interactions B.C, it was observed that maximum flavour score (7.66) in case of *Lactococcus lactis* subsp. *lactis* with 1% inoculum and 37^0C incubation temperature (B_1C_3) followed by (B_2C_3) and minimum score (6.93) obtained from *Lactococcus lactis* subsp. *diacitylactis* with 2% inoculum and 30^0C incubation temperature (B_4C_2).

From the mean interactions of B.D, it was observed that the highest flavour score (7.68) was in the samples of *Lactococcus lactis* subsp. *lactis* with 1% inoculum and 8 hrs. incubation period (B_1D_1) followed by B_1D_2, while minimum flavour score (6.89) obtained from *Lactococcus lactis* subsp. *diacetylactis* with 2% inoculum and 12 hrs. incubation period (B_4D_3).

Among the treatment combinations of starter culture with inoculum level and packaging materials (B.E), it was observed that maximum flavour score (7.50) obtained from B_1E_2 and minimum (7.00) from B_4E_1 samples.

From interactions C.D, it was observed that maximum flavour score (7.96) of Dahi were in case of 37^0C incubation temperature with 8 hrs. incubation period (C_3D_1) followed by C_1D_3 score of (7.54) and minimum score (6.86) obtained from C_1D_1 i.e. 25^0C incubation temperature and 8 hrs. incubation period.

From interaction between incubation temperatures and packaging materials (C.E), it was investigated that maximum flavour score (7.48) obtained from 37^0C incubation temperatures and earthen pot packaging (C_3E_2), while minimum score (7.08) observed from C_2E_1 samples.

In the treatment combinations of incubation periods and packaging materials (D.E), it was noted that highest flavour score (7.73) in samples of D_1E_2 followed by (D_2E_2) score of (7.37), while minimum score (7.07) of Dahi was observed from (D_3E_1) samples.

The effect of types of milk, starter cultures, incubation periods and packaging materials (ABCDE) on flavour score of Dahi (Table 2). It was observed that maximum score (8.65) was in case of sample prepared from the combination of pure buffalo milk, *Lactococcus lactis* subsp. *lactis* with 1% inoculum, 37^0C incubation temperature with 8 hrs. incubation period and earthen

pot packaging ($A_1B_1C_3D_1E_2$) followed by the combination of $A_1B_1C_3D_1E_1$, $A_2B_1C_3D_1E_2$, $A_1B_2C_3D_1E_2$, $A_2B_1C_3D_1E_2$ and $A_1B_2C_3D_1E_1$ which were statistically at par with respect to flavour of Dahi and were graded excellent quality and liked extremely. The lowest score (6.01) was obtained from $A_4B_4C_1D_1E_1$ samples and were graded as fair quality.

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Table No.-1: Effect of Types of milk (A), starter cultures with inoculation levels (B), incubation temperatures(C), incubation periods(D) and packaging materials(E) on flavour score of Dahi.

	B_1	B_2	B_3	B_4	C_1	C_2	C_3	D_1	D_2	D_3	E_1	E_2	Mean
A_1	7.86	7.70	7.60	7.45	7.57	7.52	7.87	7.76	7.70	7.52	7.61	7.70	7.65
A_2	7.77	7.61	7.52	7.34	7.48	7.43	7.77	7.63	7.52	7.42	7.52	7.62	7.56
A_3	7.34	7.18	7.08	6.93	7.07	7.02	7.31	7.26	7.23	7.02	7.09	7.28	7.13
A_4	6.84	6.69	6.59	6.44	6.58	6.53	6.81	6.87	6.74	6.52	6.59	6.78	6.64
B_1					7.37	7.34	7.66	7.68	7.54	7.34	7.41	7.50	7.45
B_2					7.22	7.18	7.49	7.45	7.38	7.17	7.25	7.34	7.30
B_3					7.13	7.07	7.38	7.34	7.27	7.07	7.15	7.24	7.19
B_4					6.97	6.93	7.22	7.19	7.14	6.89	7.00	7.08	7.04
C_1								6.86	7.13	7.54	7.13	7.22	7.13
C_2								7.05	7.43	6.90	7.08	7.17	7.17
C_3								7.96	7.44	6.91	7.39	7.48	7.44
D_1											7.25	7.73	7.49
D_2											7.29	7.37	7.33
D_3											7.07	7.16	7.12
Mean	7.45	7.30	7.19	7.04	7.17	7.13	7.44	7.29	7.33	7.12	7.20	7.29	

	A	B	C	D	E	AB	AC	AD	AE	BC	BD	BE	CD	CE	DE
SE(diff.)	0.006	0.006	0.006	0.006	0.005	0.013	0.011	0.011	0.09	0.011	0.011	0.009	0.010	0.008	0.008
CD at (5%)	0.010	0.010	0.009	0.009	0.007	NS	0.018	0.018	NS	NS	0.018	NS	0.016	NS	NS

Table No. - 2: Means of flavour score of Dahi as affected by different treatment combinations of ABCDE.

		C_1						C_2						C_3					
		D_1		D_2		D_3		D_1		D_2		D_3		D_1		D_2		D_3	
		E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2	E_1	E_2
A_1	B_1	7.40	7.50	7.70	7.75	8.10	8.17	7.60	7.70	8.00	8.08	7.45	7.55	8.60	8.65	8.00	8.10	7.55	7.62
	B_2	7.25	7.32	7.55	7.62	7.95	8.05	7.45	7.55	7.85	7.90	7.30	7.42	8.45	8.50	7.85	7.95	7.30	7.40
	B_3	7.15	7.26	7.43	7.53	7.84	7.90	7.36	7.42	7.72	7.80	7.19	7.30	8.35	8.42	7.75	7.84	7.21	7.32
	B_4	7.01	7.10	7.29	7.38	7.69	7.76	7.22	7.29	7.58	7.68	7.05	7.12	8.20	8.28	7.60	7.70	7.06	7.12
A_2	B_1	7.36	7.40	7.60	7.65	8.00	8.07	7.50	7.61	7.90	8.00	7.38	7.48	8.50	8.60	7.90	8.00	7.44	7.50
	B_2	7.15	7.26	7.44	7.52	7.85	7.90	7.35	7.44	7.74	7.80	7.24	7.32	8.34	8.43	7.74	7.85	7.22	7.30
	B_3	7.14	7.25	7.30	7.41	7.75	7.85	7.26	7.33	7.62	7.71	7.10	7.20	8.30	8.38	7.65	7.74	7.10	7.20
	B_4	6.69	7.00	7.18	7.27	7.58	7.65	7.12	7.18	7.47	7.54	6.94	7.04	8.10	8.20	7.48	7.60	6.92	7.00
A_3	B_1	6.90	7.00	7.21	7.25	7.60	7.67	7.10	7.20	7.50	7.60	6.95	7.05	7.90	8.00	7.80	7.54	7.04	7.15
	B_2	6.75	6.80	7.04	7.12	7.45	7.52	6.85	7.05	7.34	7.40	6.80	6.90	7.84	7.90	7.35	7.40	6.81	6.90
	B_3	6.65	6.72	6.90	7.01	7.35	7.45	686	6.93	7.22	7.30	6.70	6.80	7.65	7.76	7.25	7.34	6.70	6.80
	B_4	6.51	6.60	6.79	6.89	7.20	7.28	6.72	6.80	7.08	7.20	6.54	6.60	7.55	7.65	7.08	7.16	6.52	6.60
A_4	B_1	6.40	6.46	6.72	6.75	7.10	7.17	6.60	6.70	7.00	7.12	6.45	6.55	6.40	7.50	7.00	7.05	6.54	6.62
	B_2	6.24	6.35	6.54	6.62	6.95	7.04	6.45	6.55	6.84	6.90	6.30	6.40	7.34	7.45	6.85	6.95	6.31	6.40
	B_3	6.25	6.35	6.40	6.51	6.85	6.95	6.36	6.43	6.72	6.80	6.20	6.31	7.10	7.15	6.75	6.84	6.20	6.31
	B_4	6.01	6.10	6.29	6.38	6.70	6.79	6.22	6.30	6.69	6.74	6.10	6.12	7.05	7.15	6.59	6.66	6.02	6.10