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Studies on effect of addition of Bajra flour on chemical properties of *Dahi*

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Abstract
In the present study *dahi* was prepared by replacing milk solids with biofortified bajra flour. Bajra flour of biofortified hybrid AHB-1200 was used which is rich in iron and zinc than local varieties/hybrids. *Dahi* was prepared from buffalo milk by blending with bajra flour at 2 per cent, 4 per cent, 6 per cent and 8 per cent. The requisite samples of *dahi* with different treatments were subjected for proximate analysis *viz.* Acidity, pH, fat, protein, total sugar, moisture, total solid and ash. It was observed that as the blending of bajra flour decreased there was increase in protein, carbohydrate, total solids, ash, iron and zinc whereas, decrease in moisture content of *dahi.*

Keywords: *Dahi*, chemical, buffalo milk, Bajra

Introduction
Fermented dairy foods have been an important part of human diet in many regions of the world since times immemorial. Evidences showing the use of fermented milks have been found in archeological research associated with the Sumerians and Babylonians of Mesopotamia, the Pharoes of Northeast Africa, and Indo-Aryans of the Indian subcontinent Chandan, 2002 [5]; Fermented milk also plays an important part in the issue of lactose intolerance. Such people who are intolerant to lactose may ingest fermented dairy foods, because they would have little or no lactose. With regard to the therapeutic value of fermented milk, lactic acid bacteria produce acids such as lactic acids and acetic acid that inhibit the growth of many bacteria, especially gram negative and bacteria's which are pathogenic (Sharma, 1981) [11].

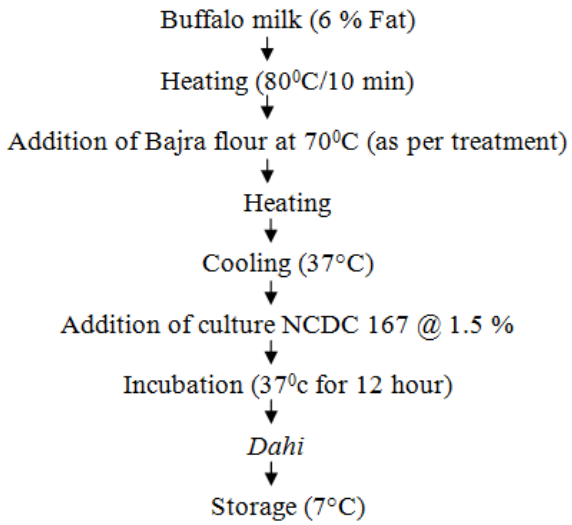
Dahi is one of the oldest fermented milk products and is the most popular one in the Indian subcontinent. This product is known by different names in different countries of the world. According to PFA (1976), *dahi* or curd is the product obtained from pasteurized or boiled milk by souring, natural or otherwise, by lactic acid or other bacterial culture. It is an important fermented dairy product which is used as a base to make other dairy products like *lassi* and *shrikhand*. *Dahi* is a rich source of protein, calcium, riboflavin, vitamin B6 and vitamin B12 and others. It is reported to have better nutritive value than milk. Lactose-intolerant persons can digest *dahi*, since the lactose present in milk had got converted to lactic acid by bacterial fermentation. (Wikipedia, 2012) [16]. As reported by Surra (2012) [13], *dahi* contains good bacteria which help in digestion process. This beneficial bacterium helps to prevent probable cancer and other forms of stomach disorder. It reduces cholesterol level and prevents heart attacks. Curd is a probiotic food whose daily intake brings about the health benefits. The protein in curd is easily digestible in comparison to that found in milk. It is found that a majority of curd is digested for the same time that a quarter of the same quantity of milk is digested. According to the research conducted, eating curd regularly can improve and strengthen one's deficiency of phosphorus as it is good for people suffering from or at risk of osteoporosis.(Verma *et al*., 2011) [15]. Pearl millet (*Pennisetum glaucum*), also known as Bajra, is one of the four most important cereals (rice, maize, sorghum and millets) mostly grown in marginal agricultural zones with inconstant, unpredictable, receives very low annual precipitation (200-500 mm) and a day temperature is above 30°C. (FAO, 2012).

Pearl millet is recognized as an important crop in developing countries to overcome with food shortages and meeting the nutritional demands of a rising population. It is an essential source of dietary calories and protein for a wide segment of the poor population in their daily diet (Simwemba *et al.* 1984) [12]. Bajra grains are also a rich depository of the fat-soluble retinol (vitamin A) and tocopherol (23 mg/100 g). Pearl millet grains contain 0.38mg of thiamine, 0.21 mg riboflavin, and 2.8 mg of niacin (Hulse *et al.*1980) [6]. Bajra grains contain minerals like iron, phosphorus, magnesium, and calcium in containing appreciable amounts (Burton *et al.* 1992) [4].

Micronutrient malnutrition, particularly vitamin A, iron and zinc-related malnutrition, has recently reported to be a most prevalent food-related health problem globally, particularly with people in those parts of the developing countries which have little access to vegetables, fruits and animal products in their meal intakes (Mason and Garcia 1993) [10]. Since the biofortification approach provides a sustainable and cost-effective solution to this problem (Bouis, 2000) [3]. The fortification of milk and dairy products with iron and zinc is considered a possible solution to avoid iron and zinc deficiency diseases. Hybrid variety AHB 1200 variety of bajra contains 88 ppm iron while others contain average 40 ppm of iron it also contains 43 ppm zinc. As milk is deficient in Iron, it was decided to add flour of AHB 1200 biofortified bajra during *dahi* preparation. Use of bajra flour in preparation of cereal based traditional dairy products like *dahi* would not only improve the product quality but also provide essential mineral like iron and zinc.

Experimental Methodology

Preparation of *dahi* –



Flow chart for preparation of *dahi lassi*

During this study flour of iron rich variety of bajra (AHB 1200) and buffalo milk from buffalo unit Dept of AHDS will be utilized for preparation of *dahi* independently. Milk was Standardize to 6 per cent fat by using Pearson's square formula. The treatment details will be as below

Treatment combinations

T_1 - 100 Parts of milk
T_2- 98.00 Parts of milk + 2 Parts of Bajra flour
T_3 - 96.00 Parts of milk + 4 Parts of Bajra flour
T_4 - 94.00 Parts of milk + 6 Parts of Bajra flour
T_5 - 92.00 Parts of milk + 8 Parts of Bajra flour

Preparation of *Dahi*

First the composite buffalo milk was filtered and standardized to 6 per cent fat. It was pasteurized at 80 ^{0}C for 10 minutes. Bajra flour was added slowly during heating at 70^0 C. Milk was cooled down to room temperature. Active *dahi* starter culture (ncdc-167) was inoculated under aseptic conditions at the rate of 1.5 per cent and mixed thoroughly. The inoculated milk was incubated at 37 ^{0}C temperature for 12 hrs and *dahi* was obtained.

Physico-chemical analysis of *Dahi*

A) Determination of fat

Determined as per method described in AOAC (1990) [2]

B) Determination of protein

Determined by Kjheldhal method given in A.O.A.C (1965)

C) Determination of moisture, total solids, ash

Determined by method as described in IS: SP (part XI) 1981.

D) Determination of carbohydrate

Determined by substraction method.

E) Determination of Iron and zinc

Iron and zinc was determined by using atomic absorption spectroscopy (AAS) as given by Harjit Kaur and Karan Singh (2009).

F) Statistical analysis

The data were analyzed statistically by using Completely Randomized Design (CRD) as per Panse and Sukhatme (1985).

Result and Discussion

Chemical composition of *dahi*

The perusal of table 4.11 shows that the average fat, protein, carbohydrate, ash, total solids, moisture, iron and zinc contents of *dahi*.

Table 1: Gross chemical composition of *dahi*

Treatment	Fat (%)	Protein (%)	Carbohytdate (%)	Ash (%)	Total Solid (%)	Moisture (%)	Iron (ppm)	Zinc (ppm)
T_1	6.00^a	3.89^e	5.16^a	0.80^e	15.85^a	84.15^a	2.00^a	3.99^a
T_2	5.81^b	4.03^d	6.35^b	0.82^d	17.02^b	82.98^b	3.72^b	4.78^b
T_3	5.75^c	4.11^c	7.48^c	0.84^c	18.18^c	81.82^c	5.44^c	5.56^c
T_4	5.64^d	4.34^b	8.82^d	0.87^b	19.67^d	80.33^d	7.16^d	6.34^d
T_5	5.50^e	4.42^a	10.01^e	0.91^a	20.84^e	79.16^e	8.87^e	7.12^e
SE ±	0.008	0.011	0.017	0.007	0.01	0.010	0.009	0.011
C.D at5%	0.025	0.033	0.052	0.022	0.03	0.033	0.02	0.036

The values with different superscript row wise differ significantly at 5per cent level of significance.

Fat content of *dahi*

It is noticed from table 1 that mean fat content of *dahi* decreased slightly from 6.0 to 5.50 per cent. Fat content of *dahi* for treatment T_1, T_2, T_3, T_4 and T_5 was 6.00, 5.81, 5.75, 5.64 and 5.50 per cent, respectively. Highest fat content was observed for control sample (6.0 per cent) and lowest in treatment T_5 (5.50 per cent) which is incorporated with 8 parts of bajra flour. It might be due to lower fat content of bajra flour than buffalo milk used for preparation of *dahi*. Similar decreasing trend was observed by Ghule *et al*. (2015).

Protein content of *dahi*

Protein content of *dahi* increased from 3.89 to 4.42 per cent. The mean protein content in *dahi* was 3.89, 4.03, 4.11, 4.34 and 4.42 per cent for treatment T_1, T_2, T_3, T_4 and T_5 respectively. The highest protein (4.42 per cent) was observed in T_5 (8 parts of bajra flour) while lowest (3.89 per cent) was observed in T_1 (control sample). It might be due to higher protein content of bajra flour. Results obtained were comparable with findings of Syama, (2014)

Carbohydrate content of *dahi*

Carbohydrate content of *dahi* ranged from 5.16 to 10.01 per cent. The mean carbohydrate content in *dahi* was 5.16, 6.35, 7.48, 8.82 and 10.01 per cent for treatment T_1, T_2, T_3, T_4 and T_5 respectively. The lowest carbohydrate (5.16) was observed in T_0 while, highest (10.01per cent) was observed in T_5. Similar increasing trend was observed by Kumar and Das (2015) [9].

Ash content of *dahi*

Ash content of *dahi* increased to some extent from 0.80 to 0.91 per cent. The mean ash content in *dahi* was 0.80, 0.82, 0.84, 0.87 and 0.91 per cent for treatment T_1, T_2, T_3 T_4 and T_5 respectively. The lowest ash content was observed in T_1 while highest ash content was observed in T_5 results obtained were with findings of Kiruthika *et al.* (2018).

Total solid content of *dahi*

The total solid content of *dahi* ranged in between 15.85 to 20.84 per cent. The mean total solid content in *dahi* was 15.85, 17.02, 18.18, 19.67 and 20.84 per cent for treatment T_1, T_2, T_3, T_4 and T_5 respectively. Lowest total solid content (15.85 per cent) was observed in T_0 while the highest total solid content (20.84) was found for T_5. Similar increasing trend in total solids due addition of cereal flour was similar results were obtained by Jain (2009).

Moisture content of *dahi*

Moisture content of *dahi* decreased from 84.15 to 79.16 per cent. The mean moisture content in *dahi* was 84.15, 82.98, 81.82, 80.33 and 79.16 per cent for treatment T_1, T_2, T_3, T_4 and T_5 respectively. Highest moisture content (84.15per cent) was observed in T_1 (100 parts of milk), while the lowest moisture content of (79.16per cent) was found for T_5 (8 parts of bajra flour).

Iron content of *dahi*

Iron content of *dahi* increased from 2.00 to 8.87 ppm. The mean iron content in *dahi* was 2.00, 3.72, 5.44, 7.16 and 8.87 ppm for treatment T_1, T_2, T_3, T_4 and T_5 respectively. The highest iron content was observed in T_5 while lowest was observed in T_1, results were comparable with findings of Vilhekar (2014). It might be due to use of iron and zinc biofortified flour for blending.

Zinc content in *dahi*

Mean zinc content in *dahi* was 3.99, 4.78, 5.56, 6.34 and 7.12 ppm for treatment T_1, T_2, T_3, T_4 and T_5 respectively. Zinc content of *dahi* increased from 3.99 to 7.12 ppm. The lowest zinc content (3.99) was observed in T_1 (control sample) while highest (7.12 ppm) was observed in T_5. It might be due to higher zinc content of bajra flour used for blending. Similar results were observed by Basu and Tomar (2016).

Conclusion

It is concluded from present investigation it is concluded that due to addition of bajra flour there was increase in total solids, protein, carbohydrate, titratable acidity and ash content but decrease in fat and moisture content. Results also showed that with an increase in the bajra flour level, there was significant increase iron and zinc content of developed *dahi*.

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