Development of Fibre Fortified Butter Milk

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Abstract- *Fiber fortified buttermilk was developed by using fenugreek powder. Pre-experimental trials were conducted using different levels of fenugreek powder in the buttermilk to optimize the levels for experimental trials. On the basis of sensory evaluation, three levels of fenugreek powder i.e. 0.30, 0.50 and 0.70 per cent levels were selected for experimental trials. Experimental results were analyzed using standard statistical method. The sensory attributes viz; colour and appearance, consistency, flavour and overall acceptability of the fresh buttermilk samples showed significant (P<0.05) differences due to the addition of fenugreek powder in the buttermilk. The addition of fenugreek powder in the buttermilk significantly (P< 0.05) influenced the fat, protein, lactose, total solids, titratable acidity (% LA), pH, ash and total fiber content. The fat, protein, lactose, total solids, total fiber and titratable acidity (% LA) ranged from 0.34 (T_3) to 0.76 (T_0), 3.42 (T_3) to 3.54 (T_0), 1.69 (T_3) to 2.10 (T_0), 0.32 (T_0) to 0.37 (T_3), 0 (T_0) to 0.085 (T_3) per cent and 0.54(T_0) to 0.64(T_3) % LA , respectively. The viscosity of fresh buttermilk samples significantly (P< 0.05) influenced due to addition of fenugreek powder. The total viable count of fresh buttermilk samples ranged from 3.2 (T_3) to 4.6 (T_0) cfu/ml x 10^6. The buttermilk samples significantly (P< 0.05) differed in fat, lactose, lactic acidity, and total fiber content during storage. The viable count ranged from 3.0 cfu/ml X 10^6 to 4.6 cfu/ml X 10^6. The better acceptable fiber fortified buttermilk can be prepared by addition of 0.5 % fenugreek powder and 5 % sugar.*

Keywords- butter milk , fenugreek powder,sensory quality, chemical quality, microbiological quality

I. INTRODUCTION

Buttermilk is traditionally known as "*Chhash*" (Gujarat and MP), "*Mattha*" (UP and Delhi), "*Tak*" (Maharastra), "*Ghol*" (Bengal). *Chhash* is a “ready-to-serve” fermented milk product and is used as a refreshing beverage from time immemorial in India, especially in the Western and Northern regions. *Chhash* is also popular, as sour buttermilk, in several other parts of the world i.e. East Asia, Africa, Europe, etc. The popularity of *chhash* is not only because of its refreshing and delicious taste, but also due to its nutritive and therapeutic benefits and thirst quenching qualities.

Buttermilk is the aqueous phase expelled after the formation of large butter grains during churning of cream (Boudreau and St-Amant, 1984). It has a composition similar to that of skim milk, and is predominantly made up of protein, lactose, and minerals (Ramachandra *et al.*, 1995; Walstra *et al.*, 2006). Buttermilk is a unique product due to its concentration of milk fat globule membrane (MFGM) components (proteins, phospholipids, and sphingolipids) that have been associated with very promising health properties ranging from anti-viral to anti-cancer. Moreover, buttermilk contains other constituents with potential food applications such as caseins (75 per cent of the total proteins) and whey proteins (Sodini *et al.*, 2006). Two types of buttermilk are manufactured viz. (i) sweet cream buttermilk obtained by churning of fresh/pasteurized cream and (ii) sour buttermilk obtained by churning cultured/sour cream. The cultured buttermilk has distinctive characteristics due to the presence of butter aroma (mainly diacetyl). Buttermilk should have mild pleasing flavour resulting from a blend of clean acid taste and delicate aromatic flavour and it should be free from off flavours like flat, metallic, yeasty or bitterness. The colour of the cultured buttermilk varies from yellowish creamy white for cow milk to creamy white for buffalo milk and should be free from browning and extraneous matter; smooth and glossy appearance of cultured buttermilk is preferred. It should have uniform thick consistency and should be free from churned particles and smooth texture is more preferred (Chandan, 2006).

Recently, the production of buttermilk on commercial scale has been taken up largely by some reputed dairy plants. In India, the major product portfolios are Amul Masti Spiced Buttermilk, Amul Buttermilk, Nestle Masala Buttermilk, Danone Buttermilk, Go buttermilk, Mother Dairy Tadka Chhach, etc. The dairy industry manufactures a wide range of products ranging from liquid milk products to specialized dairy products aimed at a particular segment of consumers. Consumers are rather conservative and cautious in accepting entirely new ingredients and new food products and prefer to look for new benefits in more or less familiar products (Jongen and Meulenbery, 2005). The demands of consumers change from time to time. This can be due to demands for improving food safety, improved shelf life, demands for foods

having special characteristics in terms of nutritional value, convenience and improved taste. Improving human health and wellness through food nutrition and innovative products is one of the priorities identified in the world. A range of innovative applications are known to enhance nutritional quality of food including novel materials and nutrient delivery mechanisms (Salem *et al.,* 2013). Currently health is a major concern of consumers. In modern society, people desire both good health and longevity and hence demand nutritious and functional food that promotes their wellbeing, enjoyment and active lifestyle (Hsieh and Ofori, 2007). Therefore, manufacturers are finding new ways to incorporate natural and innovative ingredients into dairy products for health benefits. Food manufacturers are adding value to their products to meet the current demand for healthier food products. Few of the trends which top the list of healthy eating are incorporation of fruits and vegetables, low-calorie products, natural products and products with functional ingredients (Chatterjee *et al.,* 2016). Vegetables not only form an essential part of a well-balanced diet, but the flavour, aroma, also make them important in human diet and appetite (Tsao and Akhtar 2005). Vegetables when added to foods act as prebiotics (fibers) (Alegria *et al.,* 2010), as flavouring and colouring agents (Salem and Mowafy, 2001; Smith and Hui, 2008) and as a source of natural antioxidants (photochemical antioxidants).

Fenugreek (*Trigonella foenum-graecum)* is an annual herb found in different parts of world. The seeds of fenugreek are good source of insoluble fibre (30%) and soluble fraction (20 %) mostly galactomannan (Srinivasan, 2006). Studies have shown that various physiological health benefits such as anticancer, antifertility, antidiabetic, antiparasitic, lactation stimulant and hypo-cholesterolaemic effects (Al-Habori *et al.,* 1998; Karim *et al.,* 2011). Fenugreek has been used to develop bakery (Hooda and Jood, 2005) and extruded products (Wani *et al.,* 2015). Extruded snack product enriched with fenugreek possessing higher antioxidant activity has been developed (Wani and Kumar, 2015a). Keeping these facts in view, the present investigation was planned to develop fiber fortified buttermilk with fenugreek .

II. MATERIALS AND METHODS

Milk

The composite samples of fresh crossbred cow milk were procured from the herd maintained at the Research-Cum-Development project (RCDP) on cattle, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra).

Starter culture

The *LF-40* starter culture containing *Streptococcus lactis, Str. cremoris* and *Str. diacetilactis* strains was obtained from the National Collection of Dairy Cultures, National Dairy Research Institute, Karnal.The starer culture was maintained in autoclaved skimmed milk by sub- culturing once in fortnight for attaining high activity.

Fenugreek powder

Fenugreek powder (Brand name- Nutrova Functional Fiber) manufactured by Vital Neutraceuticals Pvt. Ltd. Ambernath (MH) was used for experiments. The average fenugreek powder had 0% fat, 0% protein, 83.4% dietary fibre, 64.5% soluble fibre and 18.9% insoluble fibre, respectively(As per composition given by Nutrova).

Sugar

Clean crystalline cane sugar was obtained from local market and used as sweetening agent.

B.O.D. Incubator

Digital temperature controlled B.O.D. incubator manufactured by M/S, Neutronic, Mumbai (India) was used for incubation purpose.

Electronic balance

An Electronic Anamade precision balance (BT 2245, Sartorius ISO 9001) was used for weighments.

Autoclave

An instrument manufactured by M/S. Modern Industrial Corporation (MIC) Bombay (India), was used for autoclaving purpose.

Colony counter

A colony counters with magnifying lens was used for counting the colonies formed by microorganisms.

Laminar Air Flow

An instrument manufactured by Kirloskar Electronic Ltd.(India) was used for microbiological work.

pH meter

A digital pH meter manufactured by Lab Techno, Mumbai (India) was used for determination of pH.

Viscometer

The viscosity of cultured buttermilk samples was determined by using 'Brook field' viscometer (DV II + Pro Viscometer, Model-LVDV-II + P, USA).

Packaging and storage

Butter milk samples prepared under experimental trials were filled in sterilised 200ml capacity bottles. After filling the bottles were sealed aseptically to prevent post processing contamination and stored in refrigerator at 5 ± 2^0C .

The sampls were withdrawn and monitored at predetermined intervals as fresh, 24 hrs, 48 hrs and 72 hrs and analysed for their sensory, physical, chemical and microbiological qualities. The analysis of stored samples was discontinued when the product was declared spoiled by the sensory panel or got contaminated with visible microbial growth.

Methods

The butter milk samples were prepared as per the procedure described by Henderson (1971) with slight modification.

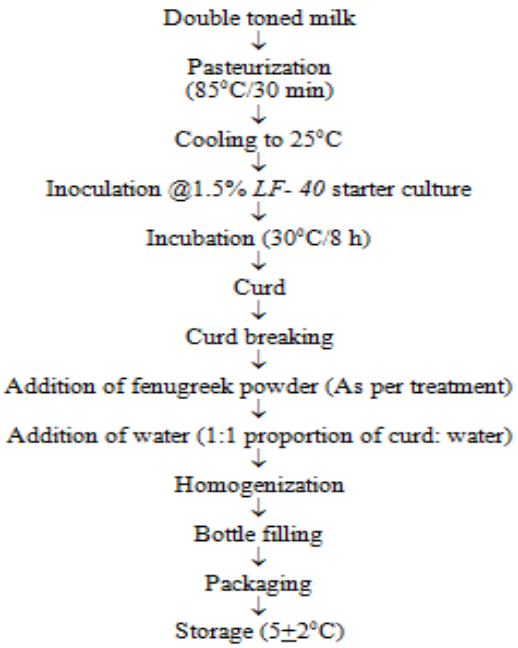

Fig-1 Flow chart for preparation of buttermilk

Chemical analysis of double toned milk

Fat ,protein,lactose, total solids, ash , titratable acidity and pH of double toned milk was determined by using BIS (1981).

Chemical analysis of buttermilk

Fat ,protein,lactose, total solids, titratable acidity, and total fibre contents of butter milk samples was determined by using BIS (1981).

Physical quality

Viscosity

The viscosity of buttermilk samples was determined by using 'Brook field' viscometer (DV II + Pro Viscometer, Model-LVDV-II + P, USA).

Sensory evaluation

The sensory evaluation of *Buttermilk* samples prepared under different preliminary and experimental treatments was done by using the method described in the IS:6273, Part –I and Part–II (1971) adopting 9 point Hedonic scale.

Microbiological quality

Viable Count

Samples were collected from each lot of Buttermilk. The sample was taken with a sterile pipette and remaining product was mixed thoroughly to make the contents homogenous. Then representative samples (11 ml) of Buttermilk ware mixed thoroughly with citrate phosphate buffer (99 ml) to get first dilution of the sample. This dilution was serially diluted by transferring 1ml dilution to 9ml of dilution blank.

Then 0.1ml from each dilution was plated on MRS agar using pour plate technique. All the plates were then incubated at 37^0C for 24-48 hours. Isolated colonies were selected and inoculated into MRS broth and incubated for 24 hours.

Statistical analysis

Experiment was laid out in completely Randomized Design (CRD) with three replications for pre-experimental trials and five replications for experimental trials. The experimental data was analyzed using the statistical method of Snedecor and Cochran (1994).

III. RESULTS AND DISCUSSION

Chemical Composition of Milk

The milk used for preparation of butter milk contained on an average 1.5% milk fat, 3.60% protein, 4.59% lactose, 10.04% total solids, lactic acidity 0.14%LA and 6.63 pH.

Preliminary trials

In the earlier phase of study , preliminary trials were conducted to choose the better appropriate fenugreek powder and to optimize there maximum and minimum levels that could be incorporated in the preparation of value added butter milk. The maximum and minimum range for fenugreek powder were taken as 0, 0.15, 0.30, 0.50, 0.70, 0.90, 1.0 and 1.5 per cent respectively wheras 5 per cent constant sugar level was used to all treatment samples. The prepared samples of buttermilk were subjected to sensory evaluation by the panel of 5 trained judges.

Experimental trials

Following levels of fenugreek powder were selected for experimental trials.

Treatment details:

T_0 : Without fenugreek powder
T_1 : 0.3% fenugreek powder
T_2 : 0.5% fenugreek powder
T_3 : 0.7 % fenugreek powder

Effect of addition of different levels of fenugreek powder on sensory quality of buttermilk

Colour and appearance

Table 1. Colour and appearance of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	8.04^a	8.00^a	7.50	6.90^c
T_1	7.80^a	7.80^a	7.12	7.08^b
T_2	7.82^a	7.82^a	7.42	7.28^b
T_3	7.56^c	7.48^c	7.00	6.58^d
SE (±)	0.037	0.021	0.143	0.028
CD @ 5%	0.112	0.064	NS	0.085

The colour and appearance of buttermilk samples significantly (P< 0.05) influenced due to addition of fenugreek powder at 0, 24 and 72 hours of storage(Table 1). It may be due to colour of fenugreek powder reflected in the treatment samples of butter milk . The mean sensory scores ranged from 7.56 (T_3) to 8.04 (T_0), 7.48 (T_3) to 8.00 (T_0), 7.00 (T_3) to 7.50 (T_0) and 6.58 (T_3) to 7.28(T_2) at 0, 24, 48 and 72 hours of storage, respectively.The average colour and appearance score of fresh butter milk samples was in the range of 7.56 (T_3) to 8.04 (T_0) but during storage the colour and appearance score declined to 6.58 (T_3) to 7.28(T_2) at 72 hrs of storage. During storage the samples became slight darker with advancement of storage period. **T**he results of this study are in close agreements with Matkar (2010) who reported that decrease in sensory score for colour and appearance of plain lassi and lassi samples blended with 14% papaya pulp were ranged from 7.77 to 6.97 and 7.87 to 6.97 from day 0 to 5 storage period.

Consistency

Changes in the consistency scores of butter milk samples during storage have been presented in the Table 2. it is revealed that, the consistency scores of butter milk samples significantly (P<0.05) influenced due to incorporation of fenugreek powder in the butter milk. The mean sensory score of the samples under different experimental treatments were ranged from 7.62 (T_3) to 7.15 (T_0) at 24 hours of storage. The corresponding scores at 48 and 72 hrs varied from 7.00 (T_3) to 7.60 (T_2) and 6.70 (T_3) to 7.02 (T_2), respectively.

Table 2. Consistency of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	8.12^a	7.95^a	7.51^a	6.76^c
T_1	7.98^a	7.80^a	7.58^a	7.00^b
T_2	7.98^a	7.82^a	7.60^a	7.02^b
T_3	7.62^c	7.62^c	7.00^b	6.70^c
SE (±)	0.03	0.016	0.056	0.047
CD @ 5%	0.090	0.049	0.168	0.142

All the treatments showed significant differences at all the stages of storage (Table 2). The treatmentsT_1 and T_2 were on par at fresh state of samples. Wheras T_0, T_1 and T_2 were on par at 48 hrs of storage. The treatments T_1 and T_2 were at par at 72 hrs of storage. It reveals that the addition of fenugreek powder in the butter milk significantly (P<0.05) influenced the consistency of the product. The consistency of the product was decreased as the level of fuugreek powder increased. It is due to increase in total solids content. It was also observed that as storage period advances there was decrease in the consistency of the product..

Flavour

From the Table 3, it is revealed that the flavour of the butter milk significantly (P<0.05) influenced due to addition of fenugreek powder. The mean flavour score of the samples under different experimental treatments were ranged from

7.00 (T_3) to 7.92 (T_2) at 24 hrs. The corresponding scores to 48 and 72 hrs varied from 6.92 (T_3) to 7.60 (T_2) and 6.72 (T_3) to 6.98 (T_1 and T_2), respectively.

Table 3. Flavour of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	8.18^a	7.79^a	7.35^a	6.76^a
T_1	8.00^a	7.66^a	7.50^a	6.98^a
T_2	8.22^a	7.92^a	7.60^a	6.98^a
T_3	7.36^a	7.00^a	6.92^a	6.72^a
SE (±)	0.037	0.019	0.010	0.052
CD @ 5%	0.110	0.057	0.031	0.156

The flavour score treatments T_1 and T_2 and T_0 and T_4 were on par at 72 hrs of storage. The flavour score of fresh butter milk samples ranged from7.36 (T_3) to 8.18 (T_0). The decreasing treand of flavour was observed due course of time . Significant changes in flavour scores were observed during storage interval. The decrease in flavour may be attributed to loss of freshness, which is inherent with any food product.The another reason for decrease in flavour score might be biochemical changes taken place i.e. increase in the lactic acidity of the product samples.

Overall acceptability

The overall acceptability of of stored samples depends up on several factors like degree of proteolysis, lipolisis, flavour changes and microbial activity.From the Table 4, it is revealed that the addition of fenugreek powder in the buttermilk samples significantly ($P<0.05$) influenced the overall acceptability of the product during storage. The mean sensory scores of the buttermilk samples under different treatments ranged from 7.46 (T_3) to 8.0 (T_0) fresh, 7.02 (T_3) to 7.84 (T_1 and T_2) on 24 hrs, 6.86 (T_3) and 7.56 (T_2) on 48 hrs and 6.50 (T_3) to 6.96 (T_1) on 72 hrs of storage. The treatment T_1 and T_2 were on par on 24 and 48 hrs during storage, while T_0, T_1 and T_2 were on par at 72 hrs of storage.

The overall acceptability score declined at 72 hrs storage of all the treatements of butter milk.The decrease in overall acceptability of the buttermilk samples might be due to biochemical changes taken place in the product which adversely affected flavour and consistency of the product

Table 4. Overall acceptability of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	8.00^a	7.46^{ab}	7.24^a	6.76^a
T_1	7.80^a	7.84^a	7.44^a	6.96^a
T_2	8.00^a	7.84^a	7.56^a	6.92^a
T_3	7.46^a	7.02^a	6.86^a	6.50^a
SE (±)	0.012	0.185	0.020	0.035
CD @ 5%	0.037	0.555	0.060	0.107

Effect of addition of different levels of fenugreek powder on chemical composition of buttermilk during storage

Fat

The addition of different levels of different levels of fenugreek powder in the buttermilk significantly influenced the fat content in the product at fresh, 24, 48 and 72 hrs of storage (Table 5). The fat content varied from 0.20 to 0.76 per cent. The treatments T_1 and T_2 were at par on 24, 48 and 72 hrs of storage.

It is observed that there was slight decrease in the fat content of all the sample treatments.

Table 5. Influence of addition of fenugreek powder on fat content in buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	0.76^a	0.66^a	0.54^a	0.46^a
T_1	0.58^a	0.50^a	0.44^a	0.34^a
T_2	0.50^a	0.46^a	0.42^a	0.34^a
T_3	0.34^a	0.26^a	0.22^a	0.20^a
SE (±)	0.020	0.026	0.022	0.021
CD @ 5%	0.060	0.079	0.067	0.064

Protein

The influence of experimental treatment on protein content in the buttermilk samples was significant at fresh, 24 and 72 hrs of storage (Table 6). The total protein content under different experimental samples ranged from 3.42(T_3) to 3.54(T_0) , 3.40 (T_3) to 3.52 (T_0), 3.28 (T_3) to 3.31 (T_2) and 3.02 (T_0) to 3.64 (T_2) at fresh, 24, 48 and 72 hrs of storage, respectively. The results obtained in this study are in agreement with those reported by Gawai (2006), who reported that protein content of the Moringa buttermilk was slightly decreased during storage.

Table 6. Influence of addition of fenugreek powder on protein content in buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	3.54^a	3.52^a	3.28	3.02^a
T_1	3.44^a	3.44^a	3.28	3.00^a
T_2	3.44^a	3.44^a	3.31	3.28^a
T_3	3.42^a	3.40^a	3.28	3.23^a
SE (±)	0.024	0.019	0.040	0.122
CD @ 5%	0.070	0.056	NS	0.366

Lactose

The influence of addition of fenugreek powder on lactose content of buttermilk sample during storage was significant (P<0.05) (Table 7). The mean lactose content in the samples ranged from 1.69(T_3) to 2.10 (T_0), 1.65 (T_3) to 2.02 (T_0), 1.60 (T_3) to 2.00 (T_0) and 1.52 (T_3) to 1.97 (T_0) per cent at fresh, 24, 48 and 72 hrs of storage. All the treatments were differed significantly among themselves during storage.

Table 7. Influence of addition of fenugreek powder on lactose content in buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	2.10^a	2.02^a	2.00^a	1.97^a
T_1	2.09^a	1.97^{ab}	1.91^a	1.90^a
T_2	1.88^a	1.71^a	1.65^a	1.60^a
T_3	1.69^a	1.65^a	1.60^a	1.52^a
SE (±)	0.008	0.018	0.007	0.009
CD @ 5%	0.024	0.054	0.020	0.028

Total solids (TS)

The influence of addition of fenugreek powder on total solids content of buttermilk sample during storage was significant (P<0.05) during storage (Table 8). The total solids content in the samples ranged from 6.64 to 7.32, 6.61 (T_0) to 7.28 (T_3), 6.55 (T_0) to 7.24 (T_3) and 6.35 (T_0) to 7.10 (T_3) per cent at fresh , 24, 48 and 72 hrs of storage.

Table 8. Influence of addition of fenugreek powder on total solids content of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	6.64^a	6.61^a	6.55	6.35^a
T_1	7.01^a	6.98^a	6.94	6.63^a
T_2	7.25^a	7.24^a	7.20	7.00^a
T_3	7.32^a	7.28^a	7.24	7.10^a
SE (±)	0.087	0.009	0.007	0.006
CD @ 5%	0.260	0.026	0.021	0.018

Titratable Acidity (%LA)

The influence of addition of fenugreek powder on titratable acidity of buttermilk sample during storage was significant (P<0.05) during storage (Table 9). The titratable acidity of the samples ranged from 0.54 (T_0) to .64 (T_3), 0.69 (T_0) to 0.75 (T_3), 0.70 (T_0) to 0.77 (T_3) and 0.72 (T_0) to 0.85 (T_3) per cent at fresh, 24, 48 and 72 hrs of storage. Increase in the acidity during storage was might be due to increase in the microbial load in the butter milk samples.

Table 9. Influence of addition of fenugreek powder on titratable acidity of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	0.54^a	0.69^a	0.70^a	0.72^a
T_1	0.56^a	0.72^a	0.73^a	0.78^a
T_2	0.61^a	0.73^a	0.76^a	0.81^a
T_3	0.64^a	0.75^a	0.77^a	0.85^a
SE (±)	0.005	0.003	0.001	0.002
CD @ 5%	0.015	0.009	0.002	0.005

Total Fibre

The influence of addition of fenugreek powder on total fiber content of buttermilk sample during storage was significant (P<0.05) on 24, 48 and 72 hrs of storage (Table 10).

Table 10. Influence of addition of fenugreek powder on total fibre content of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	0	0	0	0
T_1	0.027^a	0.027^a	0.028^a	0.027^a
T_2	0.053^a	0.053^a	0.054^a	0.053^a
T_3	0.085^a	0.085^a	0.084^a	0.080^a
SE (±)	0.001	0.001	0.001	0.001
CD @ 5%	0.002	0.001	0.002	0.002

The total fibre content of the samples ranged from 0 (T_0) to 0.085 (T_3)during storage .

Viscosity

The influence of addition of fenugreek powder on viscosity of buttermilk sample during storage was significant (P<0.05) on 24, 48 and 72 hrs of storage (Table 11).

The viscosity of the buttermilk samples ranged from 2.97 (T_0) to 34.07 (T_3), 3.49 (T_0) to 35.34 (T_3), 3.64 (T_0) to 43.77 (T_3) and 3.85 (T_0) to 46.35 (T_0) centipoise at fresh, 24, 48 and 72 hrs of storage.

Table 11. Influence of addition of fenugreek powder on viscosity of buttermilk during storage

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	2.97^a	3.49^a	3.64^a	3.85^a
T_1	16.54^c	17.06^c	18.59^c	19.58^c
T_2	26.87^e	27.68^e	28.04^e	28.42^e
T_3	34.07^g	35.34^g	43.77^g	46.35^g
SE (±)	0.012	0.015	0.020	0.021
CD @ 5%	0.036	0.045	0.059	0.063

Viable Count

Table 12. Viable count of buttermilk during storage (cfu/ml X 10^6)

Treatment	0 hrs (fresh)	24 hrs	48 hrs	72 hrs
T_0	4.6^a	4.6^a	4.2^a	3.7^a
T_1	4.4^a	4.2^a	3.7^{ab}	3.3^{ab}
T_2	4.0^a	3.4^a	3.2^{ab}	3.0^{ab}
T_3	3.2^a	3.2^a	3.0^a	2.9^a
SE (±)	0.255	0.224	0.173	0.140
CD @ 5%	0.764	0.670	0.519	0.419

The difference in viable counts was found significant ($P<0.05$) at all the stages of storage i.e. at fresh, 24, 48 and 72 hrs of storage (Table 12). The viable counts ranged from 3.2 x 10^6 cfu/ml (T_3) to 4.6 x 10^6 cfu/ml (T_0), 3 x 10^6 cfu/ml (T_0) to 4.2 x 10^6 (T_3), and 2.9 x 10^6 cfu/ml (T_0) to 3.7 x 10^6 cfu/ml (T_3) at fresh, 24 hrs, 48 hrs and 72 hrs of storage, respectively.

Matkar (2010) reported that the decrease in viable count as storage period advances. They further reported the viable count of plain lassi in the range of 11.00 x 10^6cfu/ml to 6.00 x10^6cfu/ml and lassi blended with 14% papaya pulp 14.67 x 10^6 cfu/ml to 7.33 x 10^6 cfu/ml from day 0 to day 7 storage.

IV. CONCLUSION

The better quality fibre fortified buttermilk can be prepared by incorporation of 0.5 per cent fenugreek powder and 5 % sugar. The prepared fibre fortified buttermilk remained acceptable up to 48 hrs at refrigerated temperature (7 ± 2^0C).

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