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Storage Related Changes in *Lassi* incorporated with Moringa and Curry Leaves Powder

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Abstract

The present investigation entitled 'Process Optimization for Preparation of *Lassi* Blended with Moringa (*Moringa oleifera*) and Curry (*Murraya koenigii*) Leaves Powder' was undertaken during 2023-24 with a view to standardize the process for preparation of *lassi* with improved therapeutic value using moringa and curry leaves powder and sugar. Initially, preliminary trials were conducted to decide the levels of moringa leaves powder, curry leaves powder and sugar to prepare acceptable *lassi*. From the results of sensory evaluation of preliminary trials one per cent moringa leaves powder and one per cent curry leaves powder with 15 per cent sugar were selected for conducting experimental trials. It was observed that, all the sensory attributes *viz.*, colour and appearance, flavour, body and texture and overall acceptability of fresh *lassi* samples under different treatment combinations were significant. The treatment combination T3 (0.50% moringa, 0.50% curry leaves powder and 15% sugar) was found to besensorily superior over the rest of treatment combinations and used to carry out the storage study. The samples were kept at refrigerated temperature (5 ± 1°C) and compared to fresh control samples (T_0). The samples were evaluated for sensory, chemical and microbiological qualities during storage on 1st, 3rd, 6th, 9th and 12th day using 3 days interval period using two types of packaging materials *i.e.,* polypropylene (PP) cups and plastic pouch.

Keywords : *Lassi*, Moringa leaves powder, Curry leaves powder, Storage study

Lassi, a refreshing drink derived from dahi, has been a timeless thirst quencher, offering a diverse range of quality variations. *Lassi* is characterized by its smooth, creamy texture and subtly acidic flavour profile. *Lassi*'s composition includes approximately 79 per cent water, 3 per cent fat, 2.8 per cent protein and 4.5 per cent lactose. *Lassi* has important therapeutic properties and helps treat gastrointestinal issues. *Lassi*, often referred to as chhas or matha, is the by-product of churning curdled whole milk using rudimentary local machines in order to produce desi butter (makkhan). This drink features a rich aroma, a creamy texture and a mildly tangy flavour. (Sharma, 2006).

Moringa is often referred to as the mother's best friend or the power house of minerals. In India, the drumstick pod is called munga, sargawa or saragwe and it's commonly known by the generic name moringa (Pandey, 2013). A wealth of proteins, vitamins and minerals, such as potassium, calcium, phosphorus, iron, folic acid and carotene, are potentially found in almost all parts of the drumstick, including the bark, fruit, leaves, flower, seed and gum (Anjorin *et al.*, 2010). Drumstick pods and green leaves are strong source of protein, which includes a decent quantity of sulphur-containing amino acids and minerals like calcium and iron. They are also good suppliers of vitamins A, B and C (Ram, 1994).

Curry leaves are said to have a number of therapeutic benefits in ayurvedic medicine, including antidiabetic, antioxidant, antibacterial, anti-inflammatory, anticarcinogenic and hepato-protective qualities. The bark is used to relieve snake bite pain and the roots are used to alleviate bodily ailments. Curry leaves are good source of calories, fibre, carbs, phosphorus, calcium, iron, magnesium, copper and other minerals. It also includes antioxidants, plant sterols, amino acids, glycosides, flavonoids and several vitamins, including nicotinic acid and vitamins C, A, B and E (Pathak and Singh, 2022).

Material and Methods

Starter Culture

The standard dahi culture *i.e.,* LF-40 containing *Lactobacillus* spp. and *Lactococcus lactis* was used in this study and was procured from National Collection of Dairy Cultures, National Dairy Research Institute, Karnal as lyophilized ampules.

Moringa and Curry Leaves Powder

Moringa (*Moringa oleifera*) leaves powder and curry (*Murraya koenigii*) leaves powder were procured from the market.

Sugar

Food grade sugar was obtained from the local market.

Preparation of *Lassi* Incorporated with Moringa and Curry Leaves Powders

The *lassi* samples were prepared by using procedure prescribed by De (2004) with a slight modification. Milk was standardized to 3.5 per cent fat content and pasteurized for 30 minutes at 63°C. After cooling to 36°C, 2 per cent of starter culture (LF-40) was added and the mixture was incubated for 14 hours at 36°C. Once the dahi was formed, it was transferred to vessels, 10 per cent water added and then moringa leaves powder and curry leaves powder were incorporated according to specific treatment combinations, along with a constant 15 per cent sugar. The ingredients were thoroughly mixed and the prepared *lassi* was then stored in a refrigerator at 5±1°C to maintain optimal freshness.

Plate 1 : Moringa leaves powder

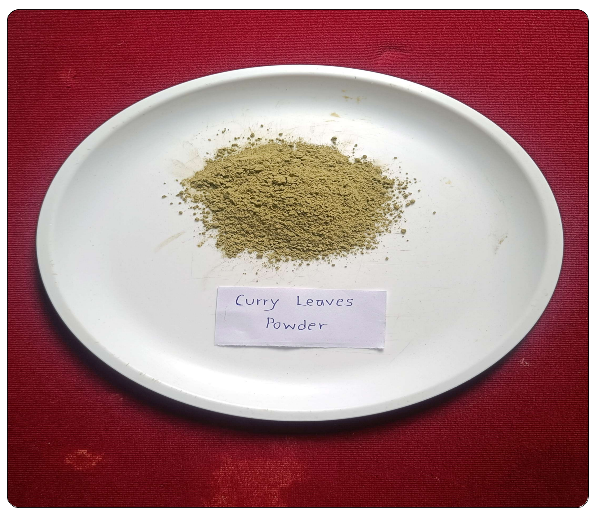

Plate 2 : Curry leaves powder

Chemical Analysis

Fat : As per the method described in IS: 1224, Part II, 1977. Protein : As per the procedure described in IS : 1479 (part-II) (1961). Total solids : As per the method given in ISI : 1479 Part-II (1961). Titratable acidity

(% LA.) As per the method given in IS : 1479, Part-I (1961). pH : As per the method given in IS : 1465 (1967) Part-II (1961). Total soluble solids : The total soluble solids in *lassi* was determined with the help of Erma hand refractometer (Range 0-32^0 Brix) IS : 1479 (Part-II), 1961. Reducing sugar and total sugar: Reducing sugar and total sugar were determined by the method of Ranganna (1986).

Statistical Analysis

The data generated during the course of this investigation was tabulated and analyzed using Completely Randomized Design (CRD) for pre-experimental trials and to compare control with other treatments. However, effect of moringa and curry leaves powders and sugar levels and their interaction effect was analyzed by Factorial Completely Randomized Design (FCRD) with four replications (Snedecor and Corchan, 1967).

TABLE 1
Treatment details

Treatment No.	Treatment combination
T_0	Dahi + 15% sugar
T_1	Dahi + 100% Moringa leaves powder +15% sugar
T_2	Dahi + 75% Moringa leaves powder + 25% Curry leaves powder + 15% sugar
T_3	Dahi + 50% Moringa leaves powder + 50% Curry leaves powder + 15% sugar
T_4	Dahi + 25% Moringa leaves powder + 75% Curry leaves powder + 15% sugar
T_5	Dahi + 100% Curry leaves powder + 15% sugar

Storage Studies

On the basis of results of sensory evaluation, the best treatment combination of *lassi* prepared with 0.50 per cent moringa leaves powder, 0.50 per cent curry leaves powder and 15 per cent sugar was selected for conduct storage study. Both the control and optimized samples were packed in two types of pre-sterilized packaging materials - polypropylene cup and plastic pouch. These samples were analysed at 3-day intervals until the product was deemed acceptable from a sensory perspective.

A_1 : Control sample
A_2 : Optimized sample
B_1 : 1st Day
B_2 : 3rd Day
B_3 : 6th Day
B_4 : 9th Day
B_5 : 12th Day
C_1 : PP cups
C_2 : Plastic pouch

RESULTS AND DISCUSSION

Change in Sensory Qualities of *Lassi* Samples during Storage at 5 ± 1^{0}C

Flavour : The changes in flavour scores of *lassi* samples during storage at 5 ± 1°C, using PP cup and plastic pouch packaging, are shown in Table 2 and graphically in Fig. 1. The flavour score for the control sample decreased from 7.61 to 5.92 in PP cups and from 7.58 to 5.89 in pouch packaging. In comparison, the optimized sample's flavour score declined from 8.25 to 6.94 in PP cups and from 8.23 to 6.83 in pouch packaging. As the storage duration progressed, flavours in all the samples gradually changed to pungent acidic flavour.

During refrigerated storage, a significant (P < 0.05) decrease in flavour score was observed in both the samples of *lassi*, which may be due to microbial and enzymatic changes over time. This finding aligns with results of Patel *et al.* (2020). Who reported adecrease in flavour score of *lassi* supplemented with Amaranthus flour during storage due to bacterial decomposition.

Colour and Appearance : The changes in sensory score of colour and appearance of *lassi* samples during storage are shown in Table 2 and graphically in Fig. 1. For the control sample, the colour and appearance score decreased from 7.86 to 5.95 in PP cups and from 7.84 to 5.91 in pouch packaging. In comparison, the optimized samples colour and appearance score decreased from 8.42 to 6.99 in PP cups and from 8.40 to 6.92 in pouch packaging. Overall, during the specified storage period, both the treatment and its interaction were significant, showing a notable effect (P < 0.05) on colour and appearance scores.

TABLE 2

Changes in sensory score of *lassi* samples during storage at 5±1^{0}C (Sensory score out of 9)

Treatment	Flavour	Colour and appearance	Consistency	Overall acceptability
$A_1B_1C_1$	7.61	7.86	7.90	7.79
$A_1B_1C_2$	7.58	7.84	7.87	7.76
$A_1B_2C_1$	7.10	7.12	7.14	7.12
$A_1B_2C_2$	7.07	7.10	7.11	7.03
$A_1B_3C_1$	6.65	6.68	6.70	6.67
$A_1B_3C_2$	6.62	6.65	6.67	6.64
$A_1B_4C_1$	6.11	6.15	6.18	6.14
$A_1B_4C_2$	6.08	6.12	6.16	6.12
$A_1B_5C_1$	5.92	5.95	5.98	5.95
$A_1B_5C_2$	5.89	5.91	5.95	5.91
$A_2B_1C_1$	8.25	8.42	8.26	8.31
$A_2B_1C_2$	8.23	8.40	8.25	8.29
$A_2B_2C_1$	8.02	8.15	7.88	8.01
$A_2B_2C_2$	7.96	8.07	7.83	7.95
$A_2B_3C_1$	7.72	7.85	7.48	7.68
$A_2B_3C_2$	7.67	7.73	7.36	7.58
$A_2B_4C_1$	7.39	7.42	7.12	7.30
$A_2B_4C_2$	7.26	7.37	7.08	7.23
$A_2B_5C_1$	6.94	6.99	6.78	6.90
$A_2B_5C_2$	6.83	6.92	6.54	6.76

Mean of four replications

This trend is consistent with the findings of Patel *et al.* (2020), who reported that the score of colour and appearance decreased with increase in storage period of Amaranthus flour *lassi*.

Consistency : The changes in sensory score of consistency of *lassi* samples during storage is illustrated in Table 2 and graphically in Fig. 1. For the control sample, the consistency score decreased from 7.90 to 5.98 in PP cups and from 7.87 to 5.95 in pouch packaging. In comparison, the optimized sample's consistency score decreased from 8.26 to 6.78 in PP cups and from 8.25 to 6.54 in pouch packaging. Overall, during the given storage period, treatment was significant and their interaction showed a significant ($P<0.05$) effect on consistency scores.

Patel *et al.* (2020) reported that *lassi* samples prepared with Amaranthus flour showed significant ($P < 0.05$) decline in the body & texture score as the storage time progressed, especially from 7th day onwards.

Overall Acceptability : The indicator criterion for the overall sensory quality of the items was overall acceptance. The overall acceptability score for the control sample decreased from 7.79 to 5.95 in PP cups and from 7.76 to 5.91 in pouch packaging. For the optimized samples, the overall acceptability score declined from 8.31 to 6.90 in PP cups and from 8.29 to 6.76 in pouch packaging. The specified storage period and treatment were significant and their interaction had a notable ($P < 0.05$) impact on the overall acceptability scores.

Maji *et al.* (2020) formulated a turmeric-enriched *lassi* and conducted sensory evaluations on samples stored at 7±2°C. Results showed that *lassi* stored in glass

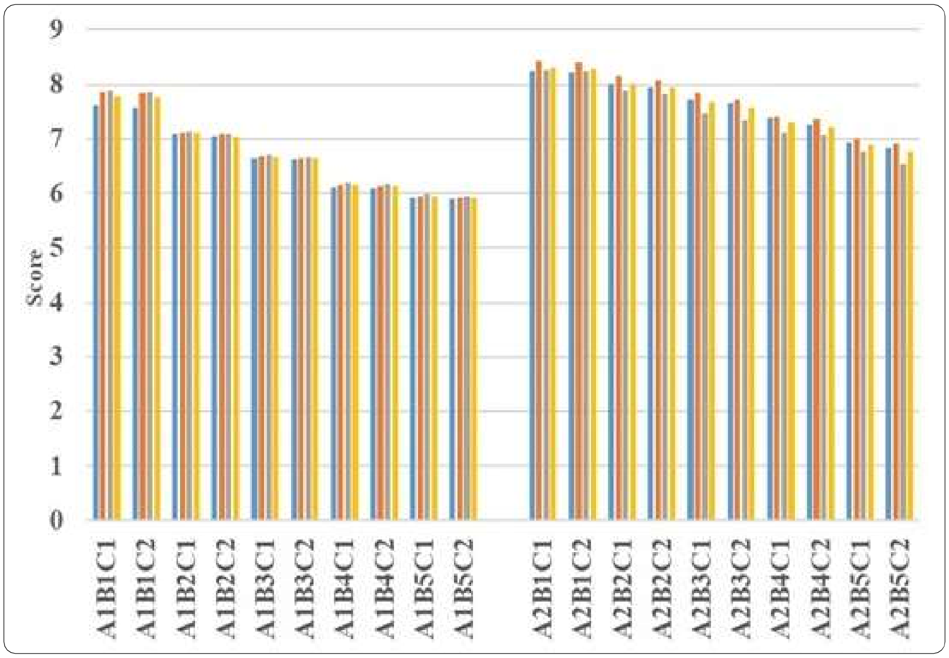

Fig. 1 : Changes in sensory qualities of *lassi* samples during storage at refrigerated temperature (5±1^{0}C)

bottles remained acceptable for up to 9 days. However, sensory attribute scores began declining from the 4th day onwards, continuing until the 18th day of storage.

Changes in Chemical Quality of *Lassi* Samples during Storage at 5 ± 1^{o}C

Fat : The changes in fat content for *lassi* samples during storage are presented in Table 3. It was observed that for the control sample, fat content decreased from 2.80 to 2.69 per cent in PP cups and from 2.80 to 2.68 per cent in pouch packaging. For the optimized sample, the fat content decreased from 2.79 to 2.70 per cent in PP cups and from 2.79 to 2.68 per cent in pouch packaging. This decline in fat content may be due to oxidation and breakdown of fat by microorganisms.

The results obtained in this study in agreement with the results obtained by Avtade *et al.* (2010), Shuwu *et al.* (2011) and Jadhav *et al.* (2014) who observed that the fat percentage was decreased during storage as compared to initial fat percentage.

Protein : The changes in protein content for *lassi* samples during storage are presented in Table 3. It was observed that the protein content of the control sample decreased from 2.78 to 2.57 per cent in PP cups and from 2.78 to 2.56 per cent in pouch packaging. For the optimized sample, the protein content decreased from 2.97 to 2.75 per cent in PP cups and from 2.97 to 2.73 per cent in pouch packaging. Overall, during the given storage period, treatment was significant and their interaction showed a significant ($P<0.05$) effect on protein value. This decline may have been due to proteolysis induced by the growth of microorganisms.

Shinde *et al.* (2015) prepared *lassi* blended with sapota pulp and observed that the protein content of all treatments declined day by day during storage.

Patel and Pinto (2017) studied the shelf life of moringa-supplemented buttermilk and found that protein content decreased progressively due to proteolysis during storage at 5 ± 2°C.

TABLE 3

Change in fat and protein contents (per cent) of *lassi* samples during storage at 5±1^{0}C

Treatments Interaction	Mean (per cent)	
	Fat	Protein
$A_1B_1C_1$	2.80	2.78
$A_1B_1C_2$	2.80	2.78
$A_1B_2C_1$	2.78	2.72
$A_1B_2C_2$	2.77	2.71
$A_1B_3C_1$	2.75	2.66
$A_1B_3C_2$	2.74	2.65
$A_1B_4C_1$	2.72	2.62
$A_1B_4C_2$	2.70	2.61
$A_1B_5C_1$	2.69	2.57
$A_1B_5C_2$	2.68	2.56
$A_2B_1C_1$	2.79	2.97
$A_2B_1C_2$	2.79	2.97
$A_2B_2C_1$	2.77	2.90
$A_2B_2C_2$	2.76	2.89
$A_2B_3C_1$	2.74	2.84
$A_2B_3C_2$	2.73	2.82
$A_2B_4C_1$	2.72	2.79
$A_2B_4C_2$	2.71	2.78
$A_2B_5C_1$	2.70	2.75
$A_2B_5C_2$	2.68	2.73

Mean of four replications

TABLE 4

Change in total solids and ash content (per cent) of *lassi* samples during storage at 5±1^{0}C

Treatments Interaction	Mean (per cent)	
	Total Solids	Ash
$A_1B_1C_1$	18.12	0.65
$A_1B_1C_2$	18.12	0.65
$A_1B_2C_1$	17.76	0.64
$A_1B_2C_2$	17.71	0.63
$A_1B_3C_1$	17.42	0.63
$A_1B_3C_2$	17.38	0.62
$A_1B_4C_1$	17.14	0.61
$A_1B_4C_2$	17.10	0.60
$A_1B_5C_1$	16.86	0.60
$A_1B_5C_2$	16.84	0.59
$A_2B_1C_1$	18.87	0.74
$A_2B_1C_2$	18.87	0.74
$A_2B_2C_1$	18.63	0.73
$A_2B_2C_2$	18.60	0.72
$A_2B_3C_1$	18.43	0.72
$A_2B_3C_2$	18.41	0.71
$A_2B_4C_1$	18.16	0.70
$A_2B_4C_2$	18.12	0.69
$A_2B_5C_1$	17.88	0.69
$A_2B_5C_2$	17.86	0.68

Mean of four replications

Total Solids : The changes in total solids content for *lassi* samples during storage are presented in Table 4. It was observed that the total solids content of the control sample decreased from 18.12 to 16.86 per cent in PP cups and from 18.12 to 16.84 per cent in pouch packaging. For the optimized sample, the total solids content decreased from 18.87 to 17.88 per cent in PP cups and from 18.87 to 17.86 per cent in pouch packaging. Overall, during the given storage period, treatment was significant and their interaction showed a significant ($P<0.05$) effect on total solids value.

Mohamed *et al.* (2014) studied physico-chemical and microbiological properties of papaya functional whey beverage and noted the TS content was18 per cent on day 0 and reduced up to 17.70 per cent on 30th day of storage.

Ash : The changes in ash content for *lassi* samples during storage are presented in Table 4. It was observed that for the control sample, ash content decreased from 0.65 to 0.60 per cent in PP cups and from 0.65 to 0.59 per cent in pouch packaging. In comparison, the ash content of the optimized sample decreased from 0.74 to 0.69 per cent PP cups and from 0.74 to 0.68 per cent in pouch packaging. The reduction in ash content can be attributed to the degradation or loss of minerals over the storage period.

Mohamed *et al.* (2014) examined the physicochemical and microbiological properties of a papaya functional whey beverage and found that the ash content slightly decreased during storage.

Acidity : The changes inacidity content (% lactic acid) for *lassi* samples during storage are presented in Table 5. It was observed that the acidity content of the control sample increased from 0.82 to 0.93 per cent in PP cups and from 0.82 to 0.94 per cent in pouch packaging. For the optimized sample, the acidity content increased from 0.86 to 0.96 per cent in PP cups and from 0.86 to 0.97 per cent in pouch packaging. Significant effects on acidity value were observed due to storage period, treatment and their combined interaction (P<0.05). The observed acidity increase can be attributed to the growth and activity of microorganisms.

Patidar and Prajapati (1998) observed a similar rise in titratable acidity in probiotic *lassi* produced with *L. acidophilus* and *S. thermophilus*, stored in both pouches and bottles.

pH : The changes in pH of *lassi* samples during storage are presented in Table 5. It was observed that the pH of the control sample decreased from 4.34 to 4.11 in PP cups and from 4.34 to 4.08 per cent in pouch packaging. For the optimized sample, the pH decreased from 4.31 to 4.09 in PP cups and from 4.31 to 4.07 in pouch packaging. Overall, the given storage period, treatment was significant and their interaction showed a significant (PĀ0.05) effect on pH value.

Shinde *et al.* (2015) prepared *lassi* blended with sapota pulp and noted the pH value 4.04, 4.08, 4.12, 4.15 and 4.18 on day 0 and decreased up to 3.93, 3.95, 3.98, 4.01 and 4.03, respectively, on 8th day of storage for *lassi* prepared underfive different treatments.

Table 5

Changes in acidity and pH of *lassi* samples during storage at 5±1⁰C

Treatments Interaction	Mean (per cent)	
	Acidity (%LA)	pH
$A_1B_1C_1$	0.82	4.34
$A_1B_1C_2$	0.82	4.34
$A_1B_2C_1$	0.84	4.29
$A_1B_2C_2$	0.85	4.27
$A_1B_3C_1$	0.87	4.23
$A_1B_3C_2$	0.88	4.21
$A_1B_4C_1$	0.90	4.18
$A_1B_4C_2$	0.91	4.16
$A_1B_5C_1$	0.93	4.11
$A_1B_5C_2$	0.94	4.08
$A_2B_1C_1$	0.86	4.31
$A_2B_1C_2$	0.86	4.31
$A_2B_2C_1$	0.88	4.26
$A_2B_2C_2$	0.89	4.25
$A_2B_3C_1$	0.91	4.20
$A_2B_3C_2$	0.92	4.18
$A_2B_4C_1$	0.94	4.14
$A_2B_4C_2$	0.95	4.13
$A_2B_5C_1$	0.96	4.09
$A_2B_5C_2$	0.97	4.07

Mean of four replications

Sugar

Reducing Sugar : The changes in reducing sugars content of *lassi* samples during storage are shown in Table 6. It was noted that the reducing sugars content significantly declined during the storage period for both the control and optimized samples across both packaging materials. For the control sample, reducing sugar content decreased from 3.58 to 3.30 per cent in PP cups and from 3.58 to 3.28 per cent in pouch packaging. In comparison, the optimized sample's reducing sugar content decreased from 3.56 to 3.30 per cent in PP cups and from 3.56 to 3.29 per cent in pouch packaging. The decrease in reducing sugar content may be attributed to bacteria utilizing lactose and converting it into lactic acid during storage.

Madhavi *et al.* (2023) reported that the reducing sugar content was 3.38 per cent on day 0 and 3.31 per cent on 9th day of storage period in whey beverage with jamun juice.

Total Sugar : The changes in Total sugar content of *lassi* samples during storage are shown in Table 6.

Table 6

Changes in sugar content (per cent) of *lassi* samples during storage at 5±1^{0}C

Treatments Interaction	Mean (per cent)	
	Reducing sugar	Total sugar
$A_1B_1C_1$	3.58	14.86
$A_1B_1C_2$	3.58	14.86
$A_1B_2C_1$	3.52	14.72
$A_1B_2C_2$	3.50	14.69
$A_1B_3C_1$	3.45	14.61
$A_1B_3C_2$	3.44	14.59
$A_1B_4C_1$	3.39	14.52
$A_1B_4C_2$	3.38	14.50
$A_1B_5C_1$	3.30	14.40
$A_1B_5C_2$	3.28	14.37
$A_2B_1C_1$	3.56	14.77
$A_2B_1C_2$	3.56	14.77
$A_2B_2C_1$	3.50	14.68
$A_2B_2C_2$	3.48	14.65
$A_2B_3C_1$	3.44	14.57
$A_2B_3C_2$	3.43	14.55
$A_2B_4C_1$	3.38	14.45
$A_2B_4C_2$	3.36	14.42
$A_2B_5C_1$	3.30	14.30
$A_2B_5C_2$	3.29	14.27

Mean of four replications

It was observed that total sugar content decreased significantly throughout the storage period. Sugar levels dropped in both control and optimized samples, regardless of packaging materials, due to decreases in both reducing and non-reducing sugars. Specifically for control sample, total sugar content decreased from 14.86 to 14.40 per cent in PP cups and from 14.86 to 14.37 per cent in pouch packaging. In comparison, the optimized sample's total sugar content decreased from 14.77 to 14.30 per cent in PP cups and from 14.77 to 14.27 per cent in pouch packaging.

Ismail *et al.* (2011) conducted a study on the microbial and chemical evaluation of a whey-based mango beverage, finding that the total sugar content was 16.28 per cent on day 0 and decreased slightly to 16.17 per cent by the 30th day of the storage period.

Changes in Microbial Quality of *Lassi* Samples during Storage at 5 ± 1^{0}C

Lactic Acid Bacteriacount : The changes inlactic acid bacteria count of *lassi* samples during storage are presented in Table 7 and graphically in Fig. 2. It was observed that in PP cups, the lactic acid bacteria counts of the control sample initially increased from 2.48 to 2.62×10^7 cfu/mL by day 9, then subsequently decreased to 2.59×10^{7}cfu/mL by day 12, while for the optimized sample similarly initially increased from 2.45 to 2.61×10^{7}cfu/mL by day 9, then subsequently

Plate 3 : Treatment combination

TABLE 7

Changes in lactic acid bacteria counts, yeast and mould counts and coliform counts of *lassi* samples during storage at 5±1^{0}C

Treatments Interaction	Lactic acid bacteria counts (×10^{7}cfu/mL)	Yeast and mould counts (×10^{1}cfu/mL)	Coliform count
$A_1B_1C_1$	2.48	0	ND
$A_1B_1C_2$	2.48	0	ND
$A_1B_2C_1$	2.51	0.87	ND
$A_1B_2C_2$	2.52	0.89	ND
$A_1B_3C_1$	2.56	1.44	ND
$A_1B_3C_2$	2.57	1.47	ND
$A_1B_4C_1$	2.62	1.83	ND
$A_1B_4C_2$	2.63	1.85	ND
$A_1B_5C_1$	2.59	2.10	ND
$A_1B_5C_2$	2.60	2.14	ND
$A_2B_1C_1$	2.45	0.0	ND
$A_2B_1C_2$	2.45	0.0	ND
$A_2B_2C_1$	2.49	0.82	ND
$A_2B_2C_2$	2.50	0.85	ND
$A_2B_3C_1$	2.57	1.40	ND
$A_2B_3C_2$	2.58	1.42	ND
$A_2B_4C_1$	2.61	1.76	ND
$A_2B_4C_2$	2.62	1.78	ND
$A_2B_5C_1$	2.58	2.03	ND
$A_2B_5C_2$	2.59	2.05	ND

Mean of four replications; ND-Not detected

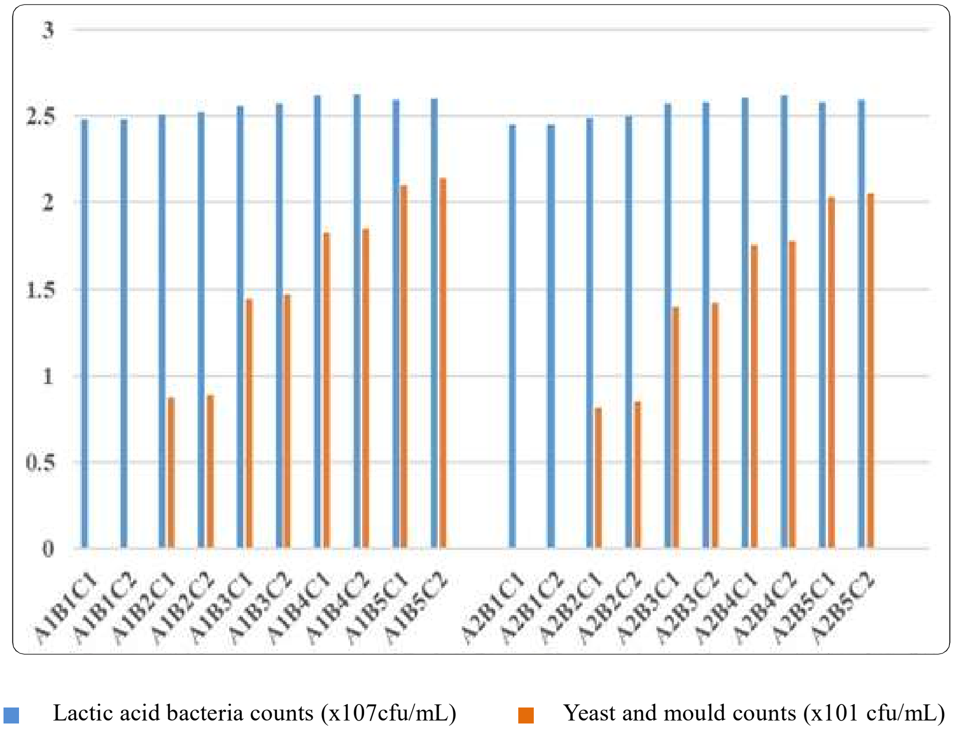

Fig. 2 : Changes in lactic acid bacteria count and yeast and mould counts of *lassi* samples during storage at 5±1^{0}C

decreased to 2.58×10^{7}cfu/mL by day 12. In pouch packaging, the lactic acid bacteria counts of the control sample initially increased from 2.48 to 2.63×10^{7}cfu/mL by day 9, then subsequently decreased to 2.60×10^{7}cfu/mL by day 12, while for the optimized sample similarly initially increased from 2.45 to 2.62×10^{7}cfu/mL by day 9, then subsequently decreased to 2.59 ×10^{7}cfu/mL by day 12.

Patel *et al.* (2020) studied storage related changes in *lassi* supplemented with Amaranthus flour and found that initially, the standard plate counts (SPC) were 7.49 log cfu/mL in the control and 7.46 log cfu/mL in the experimental *lassi*. Throughout the storage period, SPC showed a non-significant increase up to 7th day, followed by a non-significant decline ($P < 0.05$) thereafter.

Yeast and Mould Count : The changes in yeast and mould count of *lassi* samples during storage are presented in Table 7 and graphically in Fig. 2. It was observed that in PP cups, the yeast and mould counts for the control sample was found to be nil on day 0 and then from day 3 increased from 0.87 to 2.10×10^{1}cfu/mL by the 12th day of storage, while for the optimized sample also it was found be nil on day 0 from day 3 onwards increased 0.82 to 2.03×10^{1}cfu/mL until the 12th day. In pouch packaging, the yeast and mould count for the control sample increased from 0.89 to 2.14×10^{1}cfu/mLfrom day 3 onwards up to 12th day, whereas for the optimized sample it increased from 0.85 to 2.05×10^{1}cfu/mLfrom day 3 onwards up to 12th day.

These findings align well with the research by Patel *et al.* (2020) investigated storage-related changes in *lassi* supplemented with Amaranthus flour and found that the yeast and mould count for both samples were nil on day 0. After 7th day of storage, the average yeast and mould count for the control *lassi* was 0.7 log cfu/mL, increased to 1.71 log cfu/mL after 21th day. For the experimental *lassi*, the count increases from 0.78 log cfu/mL after 7th day and rose up to 1.81 log cfu/mL after 21th day.

Coliform Counts : During the storage of 12 days period no coliform growth was observed. It indicates that the proper hygienic conditions were followed throughout the manufacture of *lassi* samples.

Lassi sample prepared by the sensorily superior treatment combination T_3 packaged in polypropylene cups maintained the better overall acceptability up to 12th day of storage at refrigeration temperature (5±1^{0}C). The content of fat, protein, ash, total solid, reducing sugars, non-reducing sugar and total sugar and pH decreased during storage while acidity increased significantly during storage. The lactic acid bacteria counts and yeast mould counts increased during storage and no coliform counts were observed.

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