

Research Article

Impact of Turmeric addition on the Properties of Paneer, Prepared from different types of Milk

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Abstract

A study was conducted to evaluate the properties of turmeric incorporated paneer prepared from different types of milk, i.e. cow milk, buffalo milk and mix milk. In the first part of the study, different types of milks are procured from the local market and paneer is prepared with the addition of turmeric. Turmeric was incorporated in the product at the rate of 0.0 (control) and 0.6 for samples i.e., 0.6 % by weight of expected yield of paneer after heat treatment of milk but before addition of coagulant. In the next part the samples are packed into an aluminium foil and kept in different temperatures i.e. room temperature and in refrigerated temperature. The prepared samples of paneer were subjected to sensory evaluation when fresh and after the interval and during storage for 3 days at room temperature (27±1 °C) and for 15 days refrigerated temperature (below 5°C). During this period of storage different tests, such as sensory evaluation, texture profile analysis and safety study (chemical analysis and microbial analysis) were conducted. The samples of paneer with 0.6 % turmeric by weight of expected yield of paneer remain acceptable up to 15 days on storage at refrigerated temperature. The present study entailed to conclude that addition of turmeric in paneer prepared from either cow milk, buffalo milk or mix milk at the rate greater than 0.6 % by weight of expected yield of paneer results into sharp decline in sensory score and texture of paneer but it is still acceptable and safe for usage. Addition of turmeric at the rate of 0.6 % by weight of expected yield of paneer and packed in aluminium foil extends the shelf life of paneer up to 15 days on storage at refrigerated temperature (below 5°C).

Keywords: Paneer, Turmeric, Coagulant, Shelf life, Texture

1. Introduction

Paneer is an important nutritious and whole some indigenous, dairy products, which occupy a prominent place among traditional milk products and carry lot of market potential. The present study is done to ensure the quality as well as the safety of the paneer with minimum processing and expenditure. Good quality paneer is characterized by a marble white colour, sweetish, mildly acidic taste, nutty flavour, spongy body and closely knit, smooth texture. According to the PFA (2010), paneer means “product obtained from cow or buffalo milk or combination thereof, by precipitation with sour milk, lactic acid, or citric acid. It shall contain not more than 70% moisture and the fat content should not be less than 50% expressed on dry matter”. Milk solids may also be used in preparation of paneer. Bureau of Indian Standards (BIS 1983) imposed maximum of 60% moisture and minimum of 50% fat in dry matter for paneer. Paneer is used in a variety of forms viz. base for variety of culinary dishes. Herbs and spices are currently used mainly for enhancing the flavour of foods rather than extending shelf

life (Almeida et al. 2000). Kaur et al. (2003) and Bajwa et al. (2005) reported that incorporation of coriander and mint at level of 10% by weight in paneer improved the overall acceptability score and yield of product. In addition to imparting flavour, certain herbs prolong the shelf life of foods due to their bacteriostatic or bacteriocidal activity and prevent rancidity by their antioxidant activity (Shelef et al. 1980). The turmeric is suitable for incorporation in paneer and also effective in extending the shelf life of paneer. The addition of turmeric in paneer at the rate of greater than 0.6 % significantly decreases the sensory score of paneer. Addition of turmeric at the rate of 0.6 % extends the shelf life of paneer up to 12 days on storage at 7±1 °C (Shweta Buch et al. 2012). No work has been reported about the proper safety, quality and texture of the turmeric incorporated paneer in different types of milks. Therefore, the present study has been contemplated to study the safety, quality and texture of the turmeric incorporated paneer prepared from different types of milk in different temperatures.

2. Materials and Methods

The study was conducted at the Food Processing Laboratories of the Department of Food Process Engineering, Vaugh School of Agricultural Engineering &

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For the preparation of paneer cow milk, buffalo milk and mix milk were collected from Student Dairy Plant, S.H.I.A.T.S. Turmeric powder (Catch, AGMARK Grade) was obtained from the local market. Hindalo Freshwrap aluminium foil with Length: 72m/Width:300/Thickness: 11 Micron (FDA) was used for packaging of samples during storage study.

Different types of milk

- 1) Cow milk :(fat 3 % and SNF 20.14%)
- 2) Buffalo milk: (fat 5.2 % and SNF 18.64 %)
- 3) Mix milk:(fat 4.25 % and SNF 20.49%)

Table 1 Experimental procedure

S.No.	Procedures
1	Collection of different types of Milk (cow milk, buffalo milk and mix milk)
2	Preparation of paneer with incorporation of turmeric
3	Pakaging and storage in different temperature
4	Sensory analysis (9 point hedonic scale)
5	Texture profile analysis
6	Safety analysis (chemical and microbiological testing)

2.1 Preparation of Paneer with different types of Milk

Firstly the milk is heated at 82°C and then cooled at 70°C. for control sample immediately coagulant (citric acid) is added where as for turmeric sample 0.6 % by weight of expected yield of paneer is added after heat treatment of milk but before addition of coagulant.

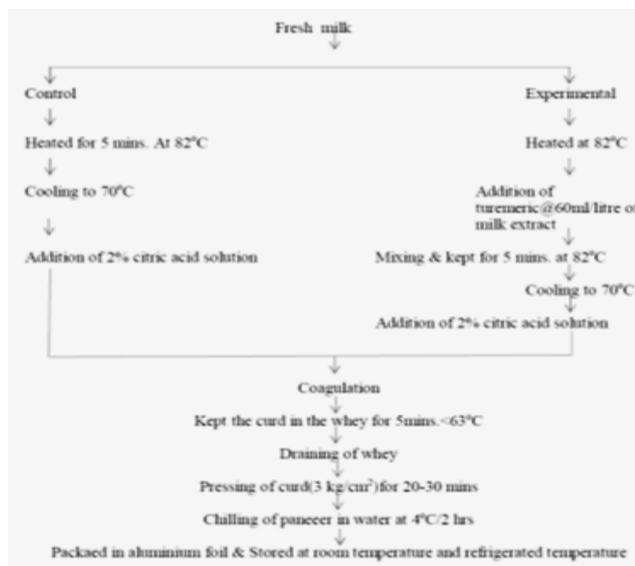


Fig.1 Preparation of turmeric incorporated paneer

After coagulation the curd is kept for 5 minutes in the whey itself at around 63°C. Then the whey is drained out

and pressing of freshly prepared product is done with the weight of 3kg/cm² for 20 minutes. Finally the freshly prepared paneer sample is chilled in cold water at 4°C for 2 hours. Now these samples are wrapped in an aluminum foil and kept in storage in different temperatures for further analysis.

2.2 Sensory Analysis

Sensory evaluation of the prepared paneer samples was done by 9 point Hedonic Scale (Rangana 1986) through a group of semi trained panelist. Hedonic scale is an organoleptic quality-rating scale where the judge expresses his degree of likings. It is the most common method used to rate the degree of likings from this we can estimate flavour, texture, colour, appearance and acidity.

2.3 Texture Profile Analysis

Textural analysis characterization of Paneer during storage was carried out on Texture Exponent Lite, version version 4.0,13.0 Texture Analyzer installed in Warner School of Food and Dairy Technology, S.H.I.A.T.S.

TPA is based on the recognition of texture as a multi-parameter attribute. For research purposes, a texture profile in terms of several parameters determined on a small homogeneous sample may be desirable.

The test consists of compressing a bite-size piece of food two times in a reciprocating motion that imitates the action of the jaw and extracting from the resulting force-time curve a number of textural parameters that correlate well with sensory evaluation of those parameters. The mechanical textural characteristics of foods that govern, to a large extent, the selection of a rheological procedure and instrument can be divided into the primary parameters of hardness, cohesiveness, springiness (elasticity), and adhesiveness.

2.4 Safety Analysis

It consists of both chemical and microbial analysis to ensure the safety of the product.

2.4.1. Chemical Testing

Here, in this section acidity and peroxide value is evaluated and analyzed.

2.4.1.1. Acidity

Procedure: Determination of Acidity percentage was determined by titrating with N/10 sodium hydroxide solution.

2.4.1.2. Peroxide value

Procedure: weigh the extract from sample into a conical flask. Add 25ml of the solvent and displace the air above the liquid with CO₂. Add 1 ml of potassium iodide solution, stopper the flask and allow it to stand for 1 min (with shake). Now add 35ml of water and titrate the

liberated iodine with 0.1 N sodium thiosulphate, using starch as indicator.

2.4.2 Microbiological Testing

2.4.2.1. Standard Plate Count

Procedure: Cleaning, sterilization, preparation of media, pouring of plates. Standard plate Count (SPC) procedure was used to determine the number of microorganisms in the sample. It is an agar plate method for estimating population of bacteria. The serial dilution (10^{-3}) of the fresh sample was prepared. 1ml of each dilution was transferred so sterilized Petri plate, 10ml of the sterilized melted cooled agar medium was added to each plate and each plate was rotated gently, immediately after addition of the medium for uniform distribution of the organisms and the agar was allowed to solidify.

2.4.2.2. Yeast and Mold count

Procedure: Pipette 1 ml of sample of dilution which has been selected for plating into a petridish in duplicate. Acidify PDA or malt agar with sterile 10% tartaric acid to pH 3.5. Do not re heat medium once acid has been added. Pour 10-12 ml of the agar medium (tempered to 45°C) mix by swirling & allow to solidify. Incubate at 20 to 25 c for 2 to 5 to 7 days. Discard the plate after seven days if growth is not observed. Count colonies, multiply by the inverse of the corresponding dilution and report as yeast and mold count per gm or ml.

3. Results and Discussion

The study was conducted in 2 phases in a systematic approach to know the characterization of paneer. The first phase is sensory evaluation , textural analysis and safety analysis (chemical analysis and microbial analysis) of the fresh paneer samples made by cow milk, buffalo milk and mix milk stored at room temperature(27 ± 1 °C). Whereas the second phase consists of same series of tests performed in refrigerated temperature (*below 5°C*).

Note: samples C1,B1, M1 are Without Turmeric whereas C2, B2, M2 are With Turmeric.

3.1 Phase I: Evaluation of different properties of samples stored at room temperature (27 ± 1 °C)

3.1.1. Sensory Evaluation

The results obtained for sensory evaluation of fresh and

Table 2 Sensory evaluation samples stored at room temperature (27 ± 1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	8	7	9	9	8	8
1st day	6	7	7	6	7	7
2nd day	6	6	6	6	7	6
3rd day	6	5	6	5	6	5

stored samples of paneer are presented in table 3.1. The data obtained for changes in sensory score of paneer during storage at room temperature (27 ± 1 °C) are presented in Table 3.1. The storage period had significant effect on flavour score of the paneer. The interaction between type of paneer and storage period was also significant ($P<0.05$).

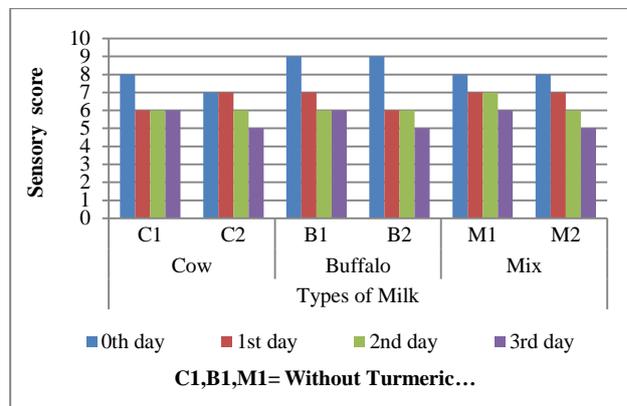


Fig.2 Sensory scores of samples stored at room temperature (27 ± 1 °C)

The changes in colour and appearance and body and texture scores revealed that storage period had significant ($P<0.05$) effect on these parameters.

3.1.2 Safety Analysis

It consists of both chemical and microbial analysis to ensure the safety of the product.

3.1.2.1 Chemical Analysis

3.1.2.1(a) Acidity

The acidity of the samples stored at room temperature varied from 0.162 to 0.432 signifying that the acidity of the paneer samples prepared from different types of milk increases during the storage. The rate of change in acidity of samples containing turmeric is slower than the samples without turmeric.

3.1.2.1(b). Peroxide Value

The peroxide values of the paneer varies from 0.486 to 2.38 which shows that the peroxide value increased gradually during the storage.

Table 3 Acidity of samples stored at room temperature (27 ± 1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.162	0.18	0.144	0.162	0.18	0.18
1st day	0.234	0.198	0.234	0.198	0.27	0.216
2nd day	0.306	0.234	0.288	0.234	0.36	0.252
3rd day	0.396	0.288	0.396	0.288	0.432	0.342

The rate of change in peroxide value of samples containing turmeric is slower than the samples without turmeric. It is shown in table 4.

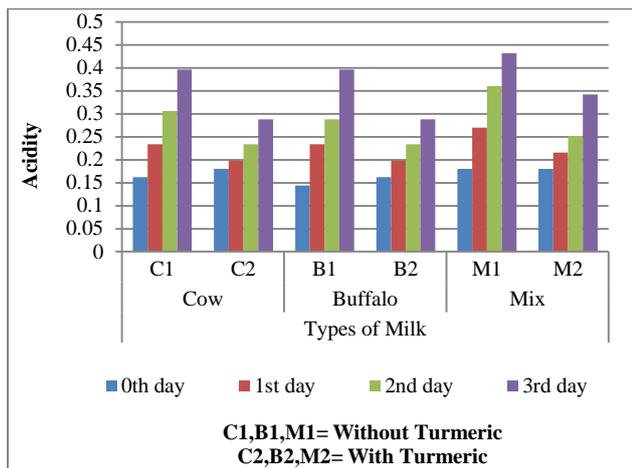


Fig 3 Acidity of samples stored at room temperature (27±1 °C)

Table 4 Peroxide values of samples stored at room temperature (27±1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.496	0.486	0.512	0.507	0.517	0.518
1st day	0.893	0.489	0.916	0.508	0.929	0.522
2ndday	1.482	0.553	1.511	0.564	1.527	0.571
3rd day	2.38	0.801	2.143	0.813	2.153	0.811

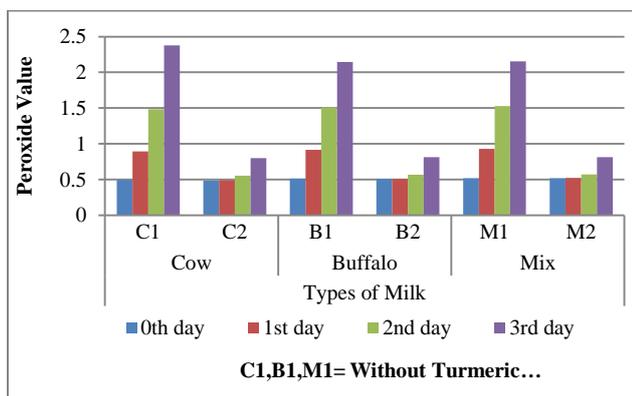


Fig.4 Peroxide values of samples stored at room temperature (27±1 °C)

3.2.2. Microbial Analysis

3.2.2.1. Standard Plate count

The SPC values of the samples varies from 30x10³ to 705x10³ showing the growth of the microbial colonies per cm² The rate of change in standard plate count of samples containing turmeric is slower than the samples without turmeric.

Table 5 SPC count of samples stored at room temperature (27±1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	30	38	32.5	33.5	63.5	61.5
1st day	90.5	45.5	75	35	120	70
2ndday	245	65.5	222	61	298.5	93
3rd day	655	175	630	150	705	195

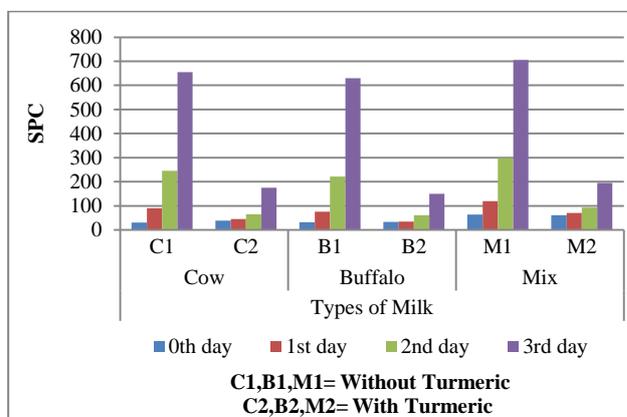


Fig. 5 SPC count of samples stored at room temperature (27±1 °C)

3.1.4. Yeast and Mold count

The yeast and mold count varies from 24x10³ to 275.5 x10³ concluding the fact that the count of yeast and mold increases during the storage. The rate of change in yeaste and mold count of samples containing turmeric is slower than the samples without turmeric.

Table 6 Yeast and Mold count of samples stored at room temperature (27±1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	31.5	26	25.5	24	25	16.5
1st day	87	25.5	75	25	98	25
2nd day	150	40.5	145.5	34.5	168	46.5
3rd day	253	70.5	236	65	275.5	97

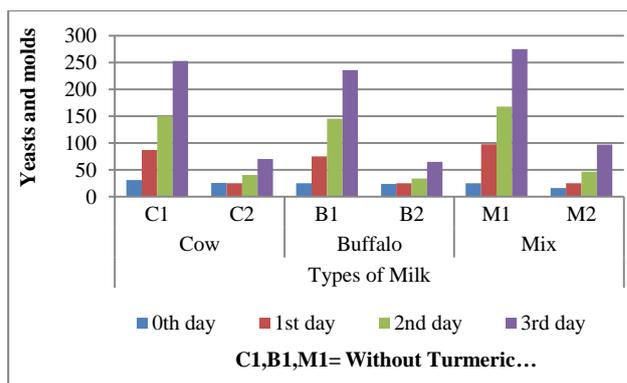


Fig.6 Yeast and Mold count of samples stored at room temperature (27±1 °C)

3.3 Texture Profile Analysis

3.3.1. Hardness

It is defined as the force necessary to attain deformation. The hardness varies from 11.33 to 2 g (between force and time) showing the decrease in the hardness of the paneer samples stored in the room temperature. The rate of decrease in hardness of samples containing turmeric is slightly slower than the samples without turmeric.

Table 7 Hardness variation of samples stored at room temperature (27±1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	10.6	7.924	12.2	10.2	11.33	8.94
1st day	8.99	6.23	10.03	8.89	9.22	6.78
2nd day	7.33	6	7.88	8.11	7.44	5
3rd day	2.1	2.87	3.04	3.2	1.98	2

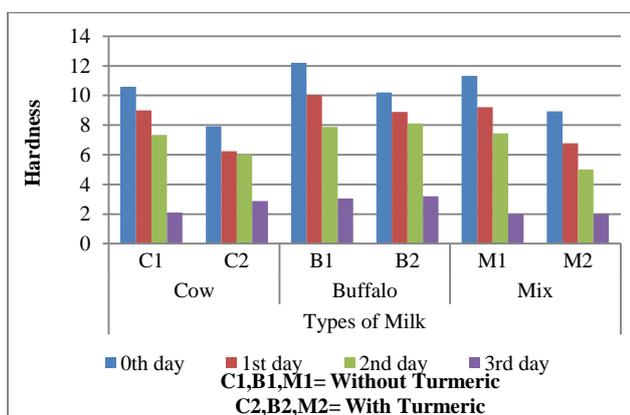


Fig.7 Hardness variation of samples stored at room temperature (27±1 °C)

3.3.2. Adhesiveness

The work necessary to overcome the the attractive forces between the surface of the food and surface of in contact with it, for the samples it varies from -30 to -0.98, showing the increase in adhesiveness of the product during storage at room temperature. The rate of increase of adhesiveness of samples containing turmeric is slower than the samples without turmeric.

Table 8 Adhesiveness variation of samples stored at room temperature (27±1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	-30	-22.2	-31	-35	-28	-31
1st day	-18	-16.22	-19.77	-17.8	-15.21	-14
2nd day	-8.11	-9.2	-7.2	-7.88	-6.22	-7.56
3rd day	-2.1	-2	-3	-2.88	-0.88	-0.98

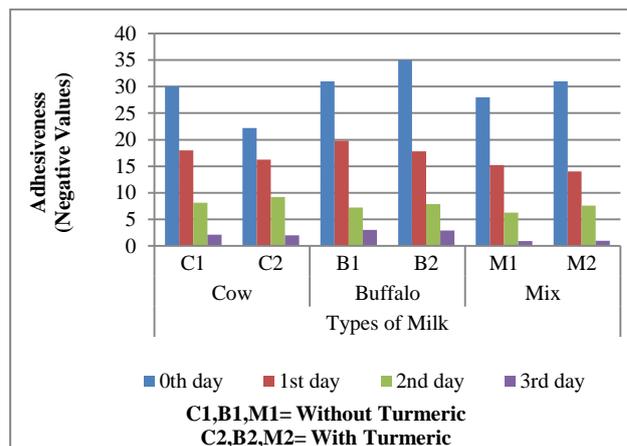


Fig.8 Adhesiveness variation of samples stored at room temperature (27±1 °C)

3.3.3. Springiness

Rate at which a deformed material goes back to its undeformed condition after deforming force is removed, it varies from 0.89 to 0.11 showing the loss of elasticity of the paneer samples during storage at room temperature. The decrease in springiness of samples containing turmeric is slower than the samples without turmeric.

Table 9 Springiness variation of samples stored at room temperature (27±1 °C)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.89	0.71	0.67	0.668	0.86	0.765
1st day	0.77	0.87	0.56	0.63	0.723	0.687
2nd day	0.45	0.23	0.56	0.321	0.45	0.38
3rd day	0.31	0.11	0.32	0.18	0.21	0.147

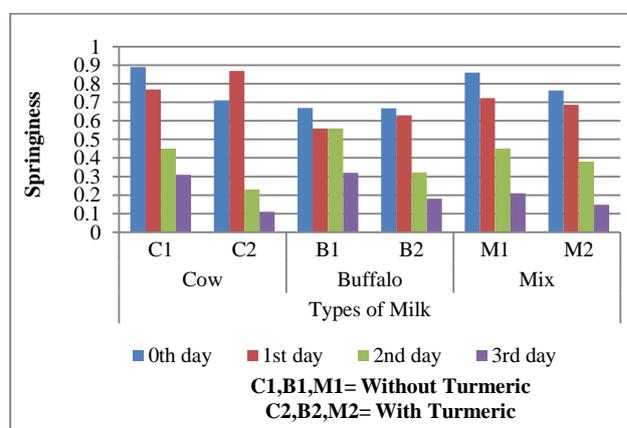


Fig.9 Springiness variation of samples stored at room temperature (27±1 °C)

3.3.4. Cohesiveness

The strength of internal bonds making up the body the product, it varies from 0.236 to 1.2 showing the increase in the paneer samples stored at room temperature. The

increase in cohesiveness of samples containing turmeric is slower than the samples without turmeric.

Table 10 Cohesiveness variation of samples stored at room temperature ($27\pm 1\text{ }^\circ\text{C}$)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.236	0.368	0.324	0.355	0.677	0.684
1st day	0.754	0.687	0.556	0.657	0.889	0.768
2nd day	0.876	0.832	0.845	0.89	0.912	0.89
3rd day	1.2	0.967	0.978	0.921	1.132	1.05

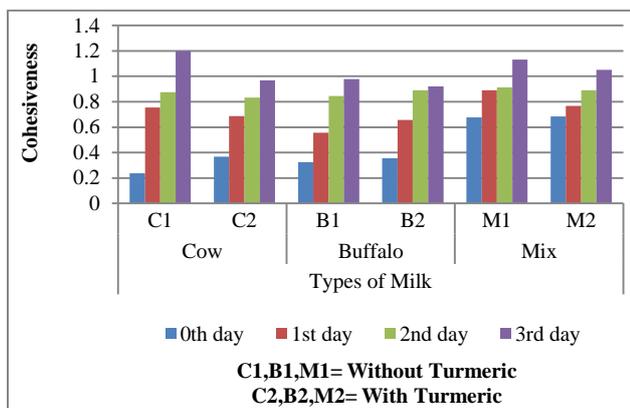


Fig.10 Cohesiveness variation of samples stored at room temperature ($27\pm 1\text{ }^\circ\text{C}$)

3.2 Phase II: Evaluation of different properties of samples stored at refrigerator temperature

Sensory Evaluation: The results obtained for sensory evaluation of fresh and stored samples of paneer are presented below. The data obtained for changes in sensory score of paneer during storage at refrigerated temperature (below 5°C) are presented in Table 3.2. The storage period had significant effect on flavour score of the paneer. The interaction between type of paneer and storage period was also significant. The changes in colour and appearance and body and texture scores revealed that storage period had significant effect on these parameters

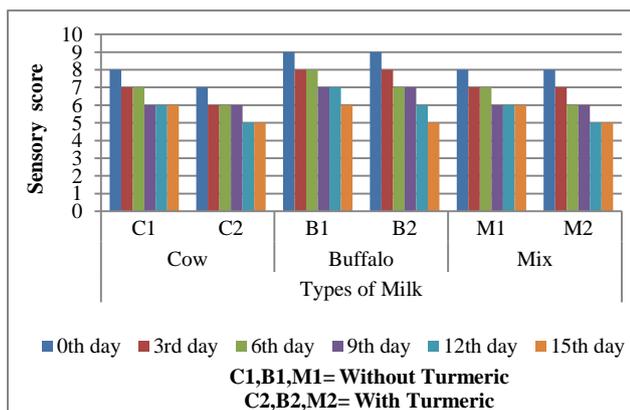


Fig.11 Sensory evaluation of samples stored at refrigerated temperature ($below\ 5\text{ }^\circ\text{C}$)

Table 11 Sensory evaluation of samples stored at refrigerated temperature ($below\ 5\text{ }^\circ\text{C}$)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	8	7	9	9	8	8
3rd day	7	6	8	8	7	7
6th day	7	6	8	7	7	6
9th day	6	6	7	7	6	6
12th day	6	5	7	6	6	5
15th day	6	5	6	5	6	5

3.2 Safety Analysis

3.2.1. Chemical Analysis

3.2.1.1 Acidity

The acidity of the samples stored at room temperature varied from 0.162 to 0.414 signifying that the acidity of the paneer samples prepared from different types of milk increases during the storage at refrigerated. The rate of change in acidity of samples containing turmeric is slower than the samples without turmeric.

Table 12 Acidity evaluation of samples stored at refrigerated temperature ($below\ 5\text{ }^\circ\text{C}$)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.162	0.18	0.144	0.162	0.18	0.174
3rd day	0.198	0.198	0.216	0.196	0.195	0.18
6th day	0.252	0.216	0.27	0.216	0.27	0.198
9th day	0.304	0.225	0.298	0.216	0.311	0.216
12th day	0.324	0.234	0.342	0.252	0.342	0.27
15th day	0.414	0.306	0.432	0.324	0.414	0.342

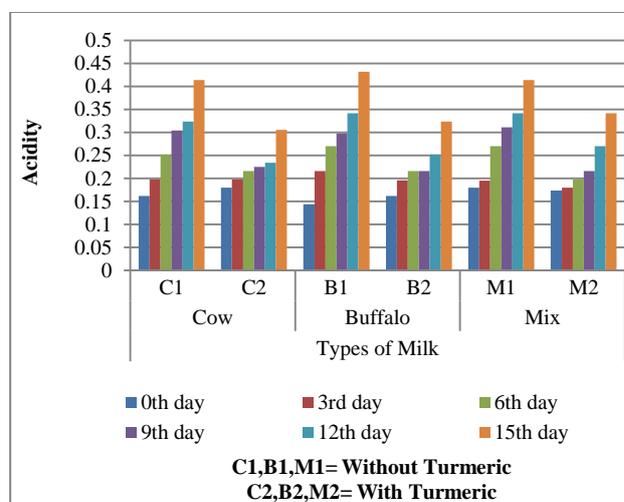


Fig.12 Acidity evaluation of samples stored at refrigerated temperature ($below\ 5\text{ }^\circ\text{C}$)

3.2.1.2.. Peroxide Value

The peroxide values of the paneer varies from 0.486 to

2.43 which shows that the peroxide value increased gradually during the refrigerated storage. The rate of change in peroxide value of samples containing turmeric is slower than the samples without turmeric.

Table 13 Peroxide values of samples stored at refrigerated temperature (*below 5 °C*)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.496	0.486	0.512	0.507	0.517	0.518
3rd day	0.512	0.507	0.517	0.518	0.519	0.522
6th day	0.916	0.522	0.78	0.52	0.745	0.571
9th day	1.123	0.557	0.929	0.538	0.935	0.583
12th day	1.321	0.571	1.527	0.571	1.517	0.645
15th day	2.43	0.811	2.153	0.811	2.145	0.829

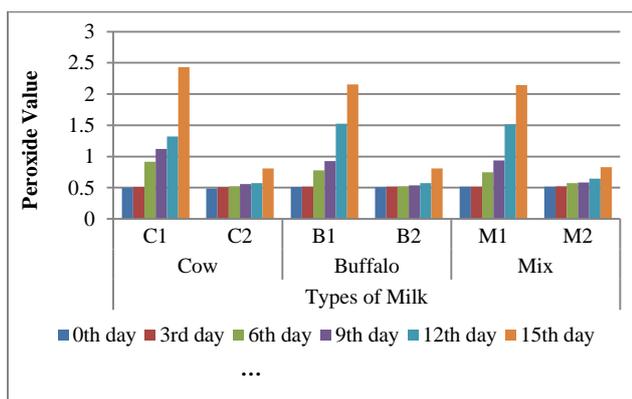


Fig.13 Peroxide values of samples stored at refrigerated temperature (*below 5 °C*)

3.2.2. Microbial Analysis

3.2.2.1. Standard Plate count

The SPC values of the samples varies from 30×10^3 to 475×10^3 showing the growth of the microbial colonies per cm^2 . The rate of change in standard plate count of samples containing turmeric is slower than the samples without turmeric.

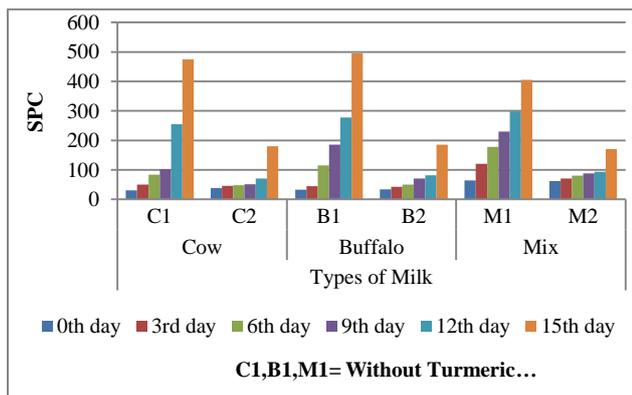


Fig.14 SPCof samples stored at refrigerated temperature (*below 5 °C*)

Table 14 SPCof samples stored at refrigerated temperature (*below 5 °C*)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	30	38	32.5	33.5	63.5	61.5
3rd day	50	45.5	45	42.5	120	70
6th day	84	48	115	50	178	80
9th day	102	50.5	185	70	230	88
12th day	255	71	278	81	298	93
15th day	475	180	495	185	405	170

3.1.4. Yeast and Mold count

The yeast and mold count varies from 24×10^3 to 275.5×10^3 concluding the fact that the count of yeast and mold increases during the refrigerated storage. The rate of change in yeaste and mold count of samples containing turmeric is slower than the samples without turmeric.

Table 15 Yeast and Mold count of samples stored at refrigerated temperature (*below 5 °C*)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	31.5	26	25.5	24	25	16.5
3rd day	35	30	40	28	42	25
6th day	80	32.5	90	34.5	75	46.5
9th day	116	38	125	40	82	48
12th day	167	43.5	168	46.5	158	53
15th day	255	74	275.5	97	271.5	93.5

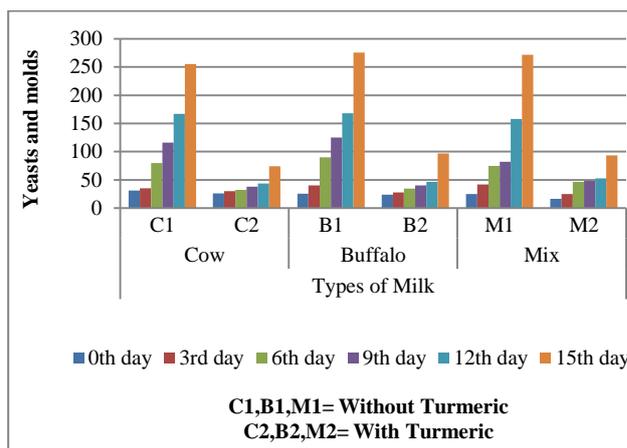


Fig.15 Yeast and Mold count of samples stored at refrigerated temperature (*below 5 °C*)

3.3 Texture Profile Analysis

3.3.1. Hardness

It is defined as the force necessary to attain deformation. The hardness varies from 11.33 to 477 g showing the increase in the hard ness of the paneer samples stored in the refrigerated temperature. The rate of decrease in hardness of samples containing turmeric is slightly slower than the samples without turmeric

Table 16 Hardness variation of samples stored at refrigerated temperature (*below 5 °C*)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	10.6	7.924	12.2	10.2	11.33	8.94
3rd day	23	17.69	25.2	19.3	22.4	18
6th day	38	29.5	40	35.6	35	32.33
9th day	128	114.96	168	138.5	172.6	158.65
12th day	293.55	263.339	285.76	226.588	280	263.339
15th day	400	333	450	369.88	453	477

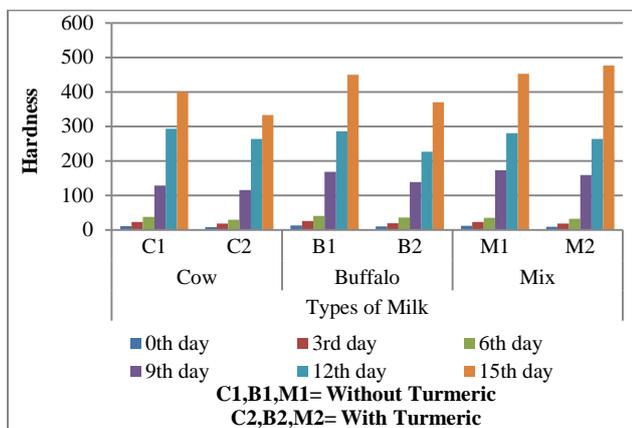


Fig.16 Hardness variation of samples stored at refrigerated temperature (*below 5 °C*)

3.3.2. Adhesiveness

The work necessary to overcome the attractive forces between the surfaces of the food and surface of in contact with it, for the samples it varies from -30 to -0.89, showing the increase in adhesiveness of the product during storage at refrigerated temperature. The rate of increase of adhesiveness of samples containing turmeric is slower than the samples without turmeric.

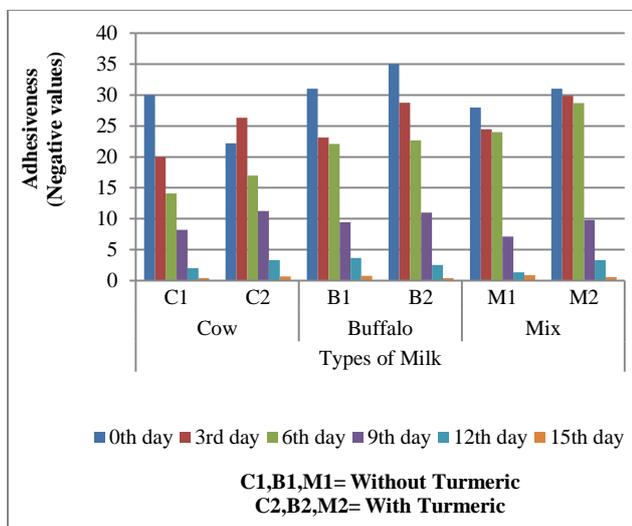


Fig.17 Adhesiveness variation of samples stored at refrigerated temperature (*below 5 °C*)

Table 17 Adhesiveness variation of samples stored at refrigerated temperature (*below 5 °C*)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	-30	-22.2	-31	-35	-28	-31
3rd day	-20	-26.3	-23.1	-28.76	-24.4	-29.89
6th day	-	-17	-22.1	-22.67	-24	-28.71
9th day	-8.22	-11.2	-9.43	-10.98	-7.11	-9.8
12th day	-2	-3.33	-3.66	-2.55	-1.33	-3.33
15th day	-0.43	-0.67	-0.77	-0.42	-0.89	-0.587

3.3.3. Springiness

Rate at which a deformed material goes back to its undeformed condition after deforming force is removed, it varies from 0.89 to 0.11 showing the lose of elasticity of the paneer samples during storage at refrigerated temperature. The decrease in springiness of samples containing turmeric is slower than the samples without turmeric.

Table 18 Springiness variation of samples stored at refrigerated temperature (*below 5 °C*)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.89	0.71	0.67	0.668	0.86	0.765
3rd day	0.77	0.71	0.6	0.619	0.66	0.632
6th day	0.543	0.569	0.645	0.621	0.544	0.568
9th day	0.447	0.646	0.534	0.473	0.456	0.634
12th day	0.324	0.426	0.489	0.433	0.677	0.71
15th day	0.675	0.894	0.766	0.775	0.786	0.832

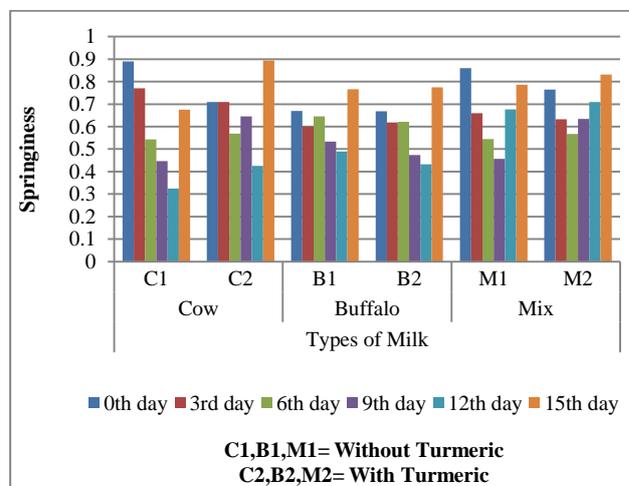


Fig.18 Springiness variation of samples stored at refrigerated temperature (*below 5 °C*)

3.3.4. Cohesiveness

The strength of internal bonds making up the body the product, it varies from 0.236 to 0.66 showing the slow

increase in the paneer samples stored at refrigerated temperature. The increase in cohesiveness of samples containing turmeric is slower than the samples without turmeric.

Table 19 Cohesiveness variation of samples stored at refrigerated temperature (*below 5 °C*)

Storage	Types of Milk					
	Cow		Buffalo		Mix	
	C1	C2	B1	B2	M1	M2
0th day	0.236	0.368	0.324	0.355	0.677	0.684
3rd day	0.322	0.411	0.223	0.335	0.276	0.251
6th day	0.331	0.402	0.543	0.631	0.123	0.198
9th day	0.342	0.268	0.387	0.436	0.445	0.566
12th day	0.338	0.4	0.311	0.542	0.222	0.4
15th day	0.376	0.477	0.598	0.66	0.573	0.683

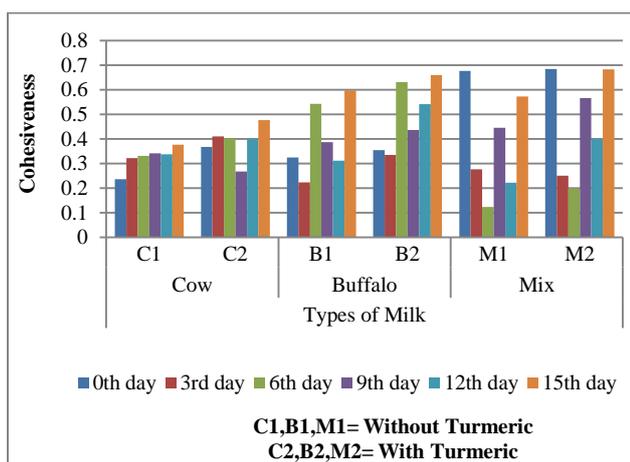


Fig.19 Cohesiveness variation of samples stored at refrigerated temperature (*below 5 °C*)

Conclusion

It can be concluded from the study that

- 1) Turmeric is suitable for incorporation in cow milk paneer, buffalo milk paneer and mix milk paneer and also effective in extending their shelf life.
- 2) The addition of turmeric in paneer at the rate of 0.6 % and packaging it in aluminium foil significantly decreases the sensory score of cow milk paneer, buffalo milk paneer and mix milk paneer.
- 3) It slows down the chemical, microbial and textural changes during storage, especially in refrigerated temperature (below 5°C) and extend the self life upto 15 days.

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