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Storage study and textural profile analysis of paneer at different temperature

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Abstract

Paneer is an Indian traditional milk product which occupies an important place as a base product for the production of various culinary preparations. The shelf life of paneer is a major constraint in its utilization. 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 (4 ± 1 °C). The data obtained for changes in sensory score of paneer during storage at room temperature (27 ± 1 °C). The storage period had significant effect on the sensorial attributes of the paneer. During this period of storage different tests, such as sensory evaluation, texture profile analysis, safety study and microbial analysis were conducted. Up to 9 days at refrigeration temperature.

Keywords: Sensorial evaluation, textural, microbial study

Introduction

Milk has long been recognized as almost complete ideal food in nature. It supplies fat and lactose for energy, proteins and vitamins for body building and health and minerals for bone formation. Milk contains all above nutrients in an easily digestible and assumable form, so it is regarded as most ideal complete food (Bhadekar *et al.*, 2008) [2]. Buffalo milk for making good quality paneer and considered more suitable than cow milk (Sachdeva *et al.*, 1985) [12]. The higher amounts of casein and minerals (calcium, phosphorus) were responsible for imparting firm and rubbery body to buffalo milk paneer. Fat globules and casein micelles of bigger size and higher concentration of fat, casein, calcium, phosphorus and lower voluminosity and salvation properties of casein micelles in buffalo milk compared to cow milk makes it better suited to paneer making with spongy character (Ghodekar, 1989) [6]. Textural changes in *paneer* during storage. *Paneer* was manufactured from standardized buffalo milk treated and stored at 6 to 8°C or 28 to 30°C. The refrigerator samples were of acceptable quality up to 45 days. Flavor and texture of frozen *paneer* samples were acceptable after 60 and 30 days storage, respectively. The textural profile analysis revealed that all textural properties of refrigerated *paneer* such as hardness, springiness, cohesiveness, gumminess and chewiness initially increased up to 15 days and thereafter appreciably decreased. Controversially all textural properties of frozen samples consistently deteriorated (Kanawjia and Singh, 1996) [10]. The shelf life of paneer is reported to be only 6 days under refrigeration though its freshness is lost within 3 days (Bhattacharya *et al.*, 1971). At room temperature paneer does not keep good for more than one day. The spoilage in paneer primarily occurs due to the surface growth of microorganisms. Hence, attempts have been made to curb the surface growth of microorganisms and there was decrease the shelf life of paneer. Dipping of paneer in 5% brine solution increased the shelf life from 7 days to 20 days at 6–8°C (Singh and Kanawjia, 1991) [16]. The shelf life of 32 days under refrigeration could be achieved when paneer was treated with a combination of hydrochloric acid and hydrogen peroxide (Sachdeva and Singh, 1990). Paneer packaged in laminated pouches had a shelf life of about 30 days at refrigerated storage 6°C (Sachdeva *et al.*, 1991) [13]. Keeping all above points in view the present study was done to ensure the quality as well as the safety of the paneer with minimum processing and expenditure and to study effect of storage effect on sensorial, textural and microbial quality of paneer at different temperature.

Materials and Methods

Buffalo milk and Packaging material were purchased from Parbhani local market. Coagulants citric acid, ascorbic acid, tartaric acid and lactic acid were taken from the Department of Food Chemistry and Nutrition, College Food Technology, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani.

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Standardization of milk

The buffalo milk was standardized for fat and SNF by using Pearson's square method

Preparation of paneer

Buffalo milk having 6% fat content was heated at 82 °C in a cheese vat for 5 min and cooled to 70 °C, and was coagulated with citric acid (1% solution), which was added slowly to the milk with continuous stirring until a curd and clear whey separated out. The mixture was allowed to settle down for 10 min and the whey was drained out through a muslin cloth. During this time, the temperature of whey was maintained above 63 °C. The curd was then collected and filled in a hoop (35×28×10 cm) lined with a clean and strong muslin cloth. The hoop had a rectangular frame with the top as well as bottom open. The frame was then rested on a wooden plank and filled with the curd before covering with another plank on the top of the hoop by placing a weight of 45 kg for about 15–20 min. The pressed block of curd is removed from the hoop and cut into 6–8 pieces and immersed in pasteurized chilled water (4–6 °C) for 2–3 h. The chilled pieces of paneer are then removed and placed on a wooden plank for 10–15 min to drain occluded water. Afterwards, these pieces were wrapped in parchment paper, and stored at refrigeration temperature (4±1 °C). A schematic approach for the manufacture of paneer is depicted. (Kumar *et al.*, 2011) ^[11]

Sensory evaluation of Paneer

Paneer were evaluated for sensory characteristics like appearance, color and appearance, body and texture, flavor and overall acceptability by 10 semi-trained panel members comprised of academic staff members of the Department of Food Chemistry and Nutrition, College of Food Technology, Parbhani. Judgments were made through rating products on a 9 point Hedonic Scale with corresponding descriptive terms ranging from 9 'like extremely' to 1 'dislike extremely'.

Texture profile analysis of Paneer

Stable Micro System *TAXT2 plus* Texture Analyzer was used for texture profile analysis (TPA) of paneer prepared in lab sample. A P75R cylindrical probe with 5mm/sec. of pre-test and post-test speeds; and 50% compression was taken for TPA analysis.

Table 1: Sensory evaluation of paneer at room temperature (lactic acid 2%)

Sr. No	Storage period (day)	Sensory attributes			
		Color /appearance	Body/texture	Flavor	Overall acceptability
1	Fresh	8.1	8.2	8.2	8.3
2	2 nd	7.7	7.5	7.8	7.7
3	3 rd	6.1	6.2	6.3	6.2
4	SE±	0.0510	0.0603	0.0707	0.0456
5	CD at 5%	0.2104	0.1817	0.2128	0.1374

*Each value represents the average of ten determinations

Color and appearance

Significant changes in color and appearance during storage at room temperature (27±1°C) was observed. The highest score was found in fresh paneer while lower score on 3rd day paneer.

Body and texture

Body and texture scores advocated that storage period had significant effect. Maximum score was recorded in fresh paneer sample.

Microbial examination of paneer

The microbial examination of soup samples was carried out as per the method cited in Indian standard institute (ISI) 1969. The results obtained for each count was recorded as colony forming unit per gram of sample i.e. cfu/gm.

Standard plate count

It was determined by the method cited in ISI (IS: 5402) 1969 by using tryptone dextrose agar medium.

Yeast and mold

Microbial analysis was done to determine total Yeast and mold count of the samples on the potato dextrose agar media for yeast and mold count by the method recommended by Harrigan and McCance (1966) ^[7]. The Yeast and mold count of paneer was determined by using potato dextrose agar (PDA) and the pour plate technique was used for the Isolation. The media was sterilized and poured into plates. The dilutions of sample were made up to 10⁻⁶ and then the 0.1 ml of aliquot was used for streaking. Plates were incubated at 37°C for 48-72 hrs, and results noted in cfu/mg. The Yeast and mold count of paneer was examined on 0, 3, 5 and 9 days

Coliform

The *Coliform* and basically *E. Coli* are the indicator microbes of water contamination by feces and therefore it is mandatory to examine the contamination. The *Coliform* gives red pink colonies on VRB agar so it was used for examination.

Using the pour-plate technique, appropriately 0.1 ml aliquots was taken in duplicate plates and tempered VRB agar was added. The agar was allowed to solidify and then overlay of about 5 ml of VRB agar was added. Allow agar to solidify. Plates were inverted and incubated at 35°C for 24 hours. Red colonies surrounded by a zone of precipitate and report as "presumptive coli forms cfu/g"

Results and discussion

Sensory evaluation of paneer stored at room temperature (27±1°C).

The data obtained for changes in sensory score of paneer during storage at room temperature (27±1°C) is to be observed the following characteristics like color, texture and flavor of the paneer given in table 1

Flavor

Storage period had showed significantly effect on flavor score of the paneer. The highest score was noticed in fresh paneer while lower score was in 3rd day paneer.

Overall acceptability

Overall acceptability is based on multiple organoleptic quality parameters i.e. color, flavor, texture etc. and shows the accumulative perception and acceptance by the panelists. The scores for overall acceptability of paneer samples decreased with increase in change in storage period of lactic acid paneer.

That's why fresh paneer get maximum acceptability than the stored paneer. The result of present study was in good accordance with results reported by Singh *et al.*, (2014) ^[15] Dwivedi *et al.*, (2014) ^[5], Yadav *et al.*, (2009) ^[17].

Sensory evaluation of paneer stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$).

The data obtained related to changes in sensory parameters of paneer during refrigerated temperature ($4\pm 1^{\circ}\text{C}$) are to be observed the following characteristics like color, texture and flavor of the paneer presented in table 2

Table 2: Sensory evaluation of paneer stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$).

Sr.no	Storage period	Sensory attributes			
		Color /appearance	Body/texture	Flavor	Overall acceptability
1	Fresh	8.3	8.2	8.3	8.2
2	2 nd day	7.9	7.8	7.7	7.8
3	3 rd day	7.2	7.1	7.3	7.2
4	5 th day	7.2	7.0	7.2	7.1
5	SE \pm	0.0491	0.0503	0.0607	0.0356
6	CD at 5%	0.1804	0.1617	0.1928	0.1174

*Each value represents the average of ten determinations

Color

Color score was found to be progressively decreasing with the advancement of storage period. The scores regarding to change in color and appearance the maximum score was observed in fresh paneer sample and minimum in 5th day paneer sample.

Body and texture

The scores for body and texture indicated that storage period had significant effect. Fresh paneer was noticed maximum score than the further days of storage of paneer.

Flavor

From the above table storage period had significant effect on flavor of the paneer. There was Slight loss of flavor of paneer occurred.

Overall acceptability

Overall acceptability is based on multiple organoleptic quality parameters i.e. color, flavor, taste, texture etc. and shows the accumulative perception and acceptance by the panelists. The scores for overall acceptability of paneer samples decreased with increase in change in storage period of lactic acid paneer. The result of present study was in good accordance with results reported by Singh *et al.*, (2014) ^[15]

Textural profile analysis of paneer stored at room temperature ($27\pm 1^{\circ}\text{C}$).

The data related to the effect of lactic acid coagulant on paneer at room ($27\pm 1^{\circ}\text{C}$) temperature is shown in table 3.

Table 3: Textural profile analysis of paneer stored at room temperature ($27\pm 1^{\circ}\text{C}$).

Sr. no	Storage period (days)	Hardness (kg)	Cohesiveness	Adhesiveness (kg)	Springiness (m)	Chewiness
1	Fresh	4.56	0.480	-	1.109	6.52
2	3	9.741	0.567	-	1.049	5.796

*Each value represents the average of ten determinations

Hardness

The results indicates that the significantly increase in hardness of the paneer stored at room temperature i.e. hardness of the fresh day was (4.56kg) and the hardness of the 3rd day was (9.741kg)

Cohesiveness

The strength of internal bonds making up the body and chewiness varies from 0.480 to 0.567 showing the increase in the paneer samples stored at room temperature in case of fresh and 3rd day paneer.

Adhesiveness

Adhesiveness was not observed.

Springiness

Rate at which a deformed material goes back to its undeformed condition after deforming force is removed and

springiness varies from (1.109 to 1.049 m) showing the loss of elasticity of the paneer samples during storage at room temperature. The decrease in springiness was observed with respect to fresh and 3rd day's paneer.

Chewiness

Chewiness varies from (6.52 to 5.796).The significant increase in the chewiness was observed in paneer sample during storage at room temperature. The result of present study was in good accordance with results reported by Singh *et al.*, (2014) ^[15] and Shashikumar and Puranik (2011) ^[14].

Textural profile analysis of paneer stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$).

The data related to the effect of lactic acid coagulant on paneer at refrigeration temperature ($4\pm 1^{\circ}\text{C}$) is shown in table 4

Table 4: Textural profile analysis of paneer stored at refrigeration temperature ($4\pm 1^{\circ}\text{C}$).

Sr. no	Storage period (days)	Hardness (kg)	Cohesiveness	Adhesiveness (kg)	Springiness (m)	Chewiness
1	Fresh	8.331	0.490	-	1.042	4.253
2	7	14.223	0.525	-	1.036	7.736

*Each value represents the average of ten determinations

Hardness

The hardness varies from (8.331 to 14.223 kg) showing the increase in the hardness of the paneer samples stored at the refrigerated temperature, with respect to fresh and 7th day paneer.

Cohesiveness

Cohesiveness varies from (0.490 to 0.525) showing the slow increase in the paneer samples stored at refrigerated temperature.

Adhesiveness

In this table adhesiveness of paneer was not observed.

Springiness

Springiness varies from (1.042 to 01.036 m) showing the loss of elasticity of the paneer samples during storage at refrigerated temperature was observed.

Chewiness

Chewiness varies from 4.253 to 7.736. I.e. increase in the chewiness of the paneer sample during storage at refrigeration temperature was observed. The result of present study was in good accordance with results reported by Singh *et al.*, (2014) [15] and Shashikumar and Puranik (2011) [14].

Microbial quality of paneer without packaging stored at room temperature (27±1 °C)

The data regarding microbial quality of paneer at room temperature with respect to standard plate count (SPC), yeast and mold and coliform count putfourthed in table 5.

Table 5: Microbial quality of paneer without packaging stored at room temperature (27±1°C).

Sr. No	Storage (in day)	Microbial quality (cfu/gx10 ³)		
		SPC	Yeast and mold	Coliform count
1	Fresh	31.5	24.7	ND
2	2	72	71.5	ND
3	3	220	143.2	ND
4	4	625	234.2	ND

ND: Not detected

SPC had shown increasing trend with extended storage however on storage at room temperature. SPC value of the sample ranged between from 31.5 x 10³ to 625 x 10³ showing the growth of the microbial colony per cm². There was significant microbial growth up to 3 days of storage at room temperature.

The yeast and mold count varies from 24.7 x 10³ to 234.2 x 10³. Concluding fact that count of yeast and mold increasing during storage at room temperature. In the present study the coliform was not observed. SPC values of the samples varies

from 30x10³ to 705x10³ and yeast and mold count varies from 24x10³ to 275.5 x10³ these results are more or less similar to Singh *et al.*, (2014) [15] and Shashikumar and Puranik (2011) [14] and Dhankhar (2014) [4]; Yadav *et al.*, (2009) [17].

Microbial quality of paneer without packaging stored at refrigeration temperature (4±1°C).

The data regarding microbial quality of paneer at refrigeration temperature with respect to standard plate count (SPC), yeast and mold and coliform count are shown in table 6

Table 6: Microbial quality of paneer without packaging stored at refrigeration temperature (4±1°C).

Sr. No	Storage (in day)	Microbial quality (cfu/gx10 ³)		
		SPC	Yeast and mold	Coliform
1	Fresh	31.5	24.7	ND
2	7	114.4	89.2	ND
3	9	182.3	123.8	ND

ND: Not detected

SPC value of the sample varies from 31.5 x10³ to 182.2 x10³ shown the growth of the microbial colony per cm². There was significant microbial growth up to 9 days of storage at refrigeration temperature. The yeast and mold count varies from 24.7 x 10³ to 123.8 x 10³.concluding fact that count of yeast and mold increasing during storage at refrigeration temperature. In the present study coliform found to be absent in paneer.

SPC values of the samples varies from 31.5x10³ to 185x10³ and yeast and mold count varies from 24.7x10³ to 125 x10³ these results were more or less similar to the views expressed by Singh *et al.*, (2014) [15] and Archana *et al.*, (2012) [1] and Shashikumar and Puranik (2011) [14], Yadav *et al.*, (2009) [17].

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