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## Studies on goat milk paneer stored at refrigeration temperature

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### Abstract

The present study was conducted on goat milk paneer to estimate the effect of storage period in term of acidity, pH, microbial quality (Total plate count, Yeast and mould count) of goat milk paneer. The goat milk paneer was stored at refrigeration temperature ( $4\pm 1^\circ\text{C}$ ) to analyze its acidity, pH, microbial quality (acidity, pH,) at every 3<sup>rd</sup> day of storage. The mean value of acidity, Total plate count, Yeast and mould count increase significant ( $p < 0.05$ ) while pH decrease with increasing storage period. On the basis of above study it is observed that based on pH, acidity and microbial quality the shelf life of goat milk paneer at refrigeration temperature ( $4\pm 1^\circ\text{C}$ ) was 12 days.

**Keywords:** Goat milk, paneer, refrigeration temperature, storage period

### 1. Introduction

Livestock sector plays an important role in India economy. Total milk production in India is 230.58 million tone and goat milk contribution is 3.30 percent of total milk production in India (Basic Animal Husbandry Statistics, 2023) [7]. Goat milk has been recommended as an ideal substitute for cow and human milk (Zenebe *et al.*, 2014) [13]. Goat milk can be used to prepare a wide variety of dairy products as paneer, cheese, butter, ice-cream, butter milk, condensed milk, yoghurt, flavoured milk, sweets and candy (Fazilah *et al.*, 2018) [3]. The growing consumer interest in goat's milk and its dairy products is related to the nutritional benefits offered by these products (Clark & Gacia, 2017) [2]. Good quality paneer is characterized by a marble white color, sweetish, mildly acidic taste, nutty flavour, spongy body and closely knit smooth texture (Patel, 1991) [9]. The storage period have a significant effect on the acidity, pH, microbial quality (Total plate count, Yeast and mould count) of goat milk paneer. The present research work was carried out as an attempt to utilize goat milk for the preparation of paneer, a value added product. In order to estimate the effect of storage at refrigeration temperature ( $4\pm 1^\circ\text{C}$ ) in term of acidity, pH, microbial quality (Total plate count, Yeast and mould count) of goat milk paneer.

### 2. Materials and Methods

**2.1 Preparation of paneer:** Fresh goat milk was procured from livestock research station, Bojunda, Chittorgarh and standardized to 5 percent fat for preparation of paneer. The product was prepared by the process suggested by Sachadeva and Singh (1988) [11] with slight modification. The standardized goat milk was added with 0.10 percent calcium chloride and heated to  $90^\circ\text{C}$  without holding then subsequently cooled to  $85^\circ\text{C}$  and at this temperature 1 percent citric acid solution as coagulant were added slowly with continuous agitation till clear whey separated out. The coagulum was left for 5-10 minutes in the whey and then it drained through muslin cloth and pressed in a hoof at 2-3 kg/cm<sup>2</sup> pressure. Paneer block was dipped in chilled water for 5-10 minute and packaged in pre-sterilized LDPE pouches and stored at  $4\pm 1^\circ\text{C}$ .

**2.2 pH:** The pH of product was determined by the Potentiometric Method using table top model of (SANCO, India). The method described by Franklin and Sharpe (1963) [4] for cheese was used.

**2.3 Titrable acidity:** The titrable acidity of goat milk paneer was determined as per the method specified in IS 1479 (Part - 1), (1960) [8].

**2.4 Microbiological analysis:** Total plate count, Yeast and mould count of paneer was determined as per the standard method given in APHA (1992) [1].

**2.5 Statistical analysis:** Data were statistically analyzed by using the method described by Snedecor and Cochran (1989) [12].

**3. Results and Discussion**

To study the effect of storage period, paneer was stored at refrigeration temperature (4±1°C).

**3.1. Effect of storage period on pH of paneer:** The fresh and stored samples of paneer were analyzed for pH. The data obtained for pH during storage at 4±1 °C are presented in Table 1. The tabulated values show that the storage period has a significant ( $p \leq 0.05$ ) effect on pH of paneer at refrigeration temperature on 3<sup>rd</sup> day of storage. The initial value of 5.89±0.01 pH decreased significantly ( $p \leq 0.05$ ) to 5.88±0.02 on 3<sup>rd</sup> day, 5.79±0.01 on 9<sup>th</sup> day and thereafter also it was having a decline. It reached to 5.68 ±0.01 pH on 12<sup>th</sup> day of storage and was found unacceptable by the sensory panel of judges after 12 days. The observed reduced pH value might be due to increase in acidity by lactose fermentation and/or microbial changes in the product during storage. Rai et al. (2008) [10] also reported similar declining trend for pH on storage of paneer for 15 days at (4±1°C).

**3.2. Effect of storage period on acidity of paneer:** The fresh and stored paneer was analyzed for acidity. The data obtained for acidity changes in paneer during storage at 4±1 °C are presented in Table 1. The values in the table suggest that the storage period has significant ( $p \leq 0.05$ ) effect on acidity of paneer at refrigeration temperature. It is observed that there is a progressive increase in acidity of paneer. Fresh paneer had the acidity of 0.34±0.00 per cent LA which increased significantly ( $p \leq 0.05$ ) to 0.39 ±0.00 on 3<sup>rd</sup> day, 0.45±0.00 on 6<sup>th</sup> day, 0.48±0.02 on 9<sup>th</sup> day and 0.50±0.02 per cent LA on 12<sup>th</sup> day of storage at refrigeration temperature. Thus, acidity of the paneer increased significantly ( $p \leq 0.05$ ) at each period of storage studied. After 12 days of storage at refrigeration temperature the product was found unacceptable by the sensory panel of judges. The results obtained are in corroboration with those obtained by Rai et al. (2008) [10] that the initial value for TA (%LA) of paneer increased gradually from 0.31 to 0.59 during 15 days of shelf life study of paneer. Thus, it can be observed from the present study of storage of paneer at refrigeration temperature (4±1°C) that paneer prepared from goat milk can well be stored up to 12 days thereafter it becomes unacceptable with respect to its physicochemical (pH and acidity) properties.

**Table 1:** Effect of storage period on pH and acidity of paneer stored at refrigeration temperature (4±1°C).

Attributes	Storage period (Days)				
	0	3	6	9	12
pH	5.89 <sup>a</sup> ±0.02	5.88 <sup>b</sup> ±0.01	5.87 <sup>b</sup> ±0.00	5.79 <sup>c</sup> ±0.01	5.68 <sup>d</sup> ±0.01
Acidity (%LA)	0.34 <sup>e</sup> ±0.00	0.39 <sup>d</sup> ±0.00	0.45 <sup>c</sup> ±0.00	0.48 <sup>b</sup> ±0.02	0.50 <sup>a</sup> ±0.02

Each observation is a mean ± SE of three replicate experiment (n=3) Mean in row bearing a common superscripts do not differ significantly ( $p < 0.05$ ).

**3.3. Effect of storage period on microbial quality of paneer** Most of the milk products have a highly perishable nature. This perishability of dairy products is mostly ruled by microbiological quality of that product. The microbiological quality of dairy products like paneer becomes more important owing to the sole dependence of product shelf life on the growth of microorganisms in product during storage. Most of the physico-chemical changes like change in pH, acidity etc. which in turn decides the fate of paneer during storage are profoundly affected by the presence and growth of various microorganisms. Taking these facts into consideration, paneer packed in low density polyethylene pouches was judged for its microbiological quality during storage at refrigeration temperature (4±1°C). The microbiological status (viz., Standard Plate Count, Yeast and Mould Count) is presented in Table 2.

**3.3.1. Total Plate Count:** Total Plate Count is the collective enumeration of the overall microbiological quality of the product, after production and during its storage period. It gives an overall idea about the status of paneer in terms of its overall microbiological quality during storage. Total Plate Count of paneer stored at refrigeration temperature is presented in Table 2. The total plate count values of paneer during storage were found to increase with the increase in storage period. It can be seen from the tabulated values that the storage period had significant effect ( $p \leq 0.05$ ) on total plate count of paneer stored at refrigeration temperature (4±1°C). Fresh paneer sample had a total plate count of 4.2±0.02 log<sub>10</sub> cfu/g which increased significantly ( $p \leq 0.05$ ) to 4.28±0.01 log<sub>10</sub> cfu/g on 6<sup>th</sup> day, 4.64±0.02 log<sub>10</sub> cfu/g on 9<sup>th</sup> day and 5.16±0.01 log<sub>10</sub> cfu/g at the end of storage period of 12<sup>th</sup> day. The value of total plate count is within limit so paneer give shelf life up to 12 days at refrigeration temperature (4±1°C). Similar permissible limit for total plate count is prescribed by FSSAI (2011) [5] which are 500000 cfu/g.

**3.3.3. Yeast and Mold Count (YMC).** The Yeast and Mold Count of paneer stored at refrigeration temperature (4±1°C) are presented in Table 2. The yeast and mold count of paneer during storage was found to increase with the increase in storage period. There was a significant effect ( $p \leq 0.05$ ) of storage period on yeast and mould count. Fresh paneer sample had a yeast and mold count of 1.47±0.12 log<sub>10</sub> cfu/g which increased up to 1.52±0.13 on 3<sup>rd</sup> day, 1.58±0.08 on 6<sup>th</sup> day but from 0 day to 6<sup>th</sup> day difference were non-significant to each other after that increased significantly ( $p \leq 0.05$ ) to 2.12±0.03 log<sub>10</sub> cfu/g on 9<sup>th</sup> day and 2.30±0.02 log<sub>10</sub> cfu/g on 12<sup>th</sup> day. Similar increasing trend of Yeast and Mould count were found by Goel (2000) [6] who studied the market samples of paneer with its initial population of Yeast and Mould count 3.817 log<sub>10</sub> cfu/g which increased to 5.85 log<sub>10</sub> cfu/g on 12<sup>th</sup> day at 7±2°C.

**Table 2:** Effect of storage period on microbial quality of paneer stored at refrigeration temperature (4±1 °C)

Attributes%	Storage period (Days)				
	0	3	6	9	12
Total plate count (Log <sub>10</sub> cfu/g)	4.20 <sup>d</sup> ±0.02	4.24 <sup>cd</sup> ±0.02	4.28 <sup>c</sup> ±0.01	4.64 <sup>b</sup> ±0.02	5.16 <sup>a</sup> ±0.01
Yeast and mould count (Log <sub>10</sub> cfu/g)	1.47 <sup>b</sup> ±0.12	1.52 <sup>b</sup> ±0.13	1.58 <sup>b</sup> ±0.08	2.12 <sup>a</sup> ±0.03	2.30 <sup>a</sup> ±0.02

Each observation is a mean ± SE of three replicate experiment (n=3) Mean in row bearing a common superscripts do not differ significantly ( $p < 0.05$ ).

#### 4. Conclusion

Based on the results obtained in this study it can be concluded that paneer gave an acceptable product till the storage period of 12 days at refrigeration temperature ( $4\pm 1^{\circ}\text{C}$ ).

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#### 6. References

1. APHA. Recommended methods for the microbiological examination of foods. American Public Health Association, Inc. New York; c1992.
2. Clark S and García MB. A 100-year review: Advances in goat milk research. *Journal of Dairy Science*. 2017;100(12):10026-10044.
3. Fazilah NF, Ariff AB, Khayat ME, Solis RI, Halim M. Influence of probiotics, prebiotics, synbiotics and bioactive phytochemicals on the formulation of functional yoghurt. *J of Functional Foods*. 2018;48:387-399.
4. Franklin JG, Sharpe ME. The incidence of bacteria in cheese milk and Cheddar cheese and their association with flavour. *J. Dairy Res*. 1963;30(1):87-99.
5. FSSAI. Food Safety and Standards (Food Products Standards and Food Additives) Regulations, New Delhi; c2011. p. 293
6. Goel BK. Reduction in the level of air borne contamination by the use of air washing and UV rays and its effect on shelf life of Paneer. Ph.D. Thesis submitted to Gujarat Agricultural University, Anand Campus, Anand, Gujarat; c2000.
7. <http://www.dahd.nic.in>. 20 Jun 2023.
8. IS. Methods of test for dairy industry Part I. Rapid examination of milk. Indian Standards Institution, Manak Bhavan, New Delhi, 1960, 1479.
9. Patel RK. Indigenous milk products of India. *Indian Dairyman*. 1991;43:120-125.
10. Rai S, Goyal GK, Rai GK. Effect of modified atmosphere packaging and storage on the chemical quality of paneer. *J Dairy, Food Home Sci*. 2008;27:33-37.
11. Sachdeva S, Singh S. Optimization of processing parameters in the manufacture of paneer. *J FD. Sci. Technol*. 1988;25(3):142-145.
12. Snedecor GW, Cochran WJ. *Statistical methods*, 8th ed. Iowa state university press, Amer, Iowa, US; c1989.
13. Zenebe T, Ahmed N, Kabeta T, Kebede G. Review on medicinal and nutritional values of goat milk. *Acad. J Nutr*. 2014;3(3):30-39.