

# MICROBIOLOGICAL QUALITY STUDIES OF GOAT MILK PANEER

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## ABSTRACT

*Goat milk was incorporated at 25 per cent (T1), 50 per cent (T2) and 75 per cent (T3) levels with buffalo milk for the preparation of paneer. Paneer prepared from 100 per cent buffalo milk was used as control. Microbiological qualities of paneer at refrigerated as well as at room temperature storage were assessed. Statistical analysis revealed no significant difference between control and treatment paneer samples in total viable count, total coliform count and yeast and mould count. Freshly prepared paneer was creamy white in colour and had no goaty smell and salty taste. Coliforms and yeast and moulds were absent up to 5th day of refrigerated storage in all paneer samples.*

**Key words:** Goat milk paneer, Paneer, Microbial quality, Shelf life, Total viable count

## INTRODUCTION

Goat milk and its products play an important role in the economic viability in many parts of the world, especially in developing countries. Dairy goats produce about 15.2 million metric tons (MT) of milk, accounting for about 2% of the milk produced by livestock species in the world (FAOSTAT, 2008). The largest amount of goat milk is produced in India, followed by Bangladesh and Sudan. The current goat milk production in India is around four million metric tons (FAOSTAT, 2008). Goat milk is considered as superior than cow or buffalo milk due to its better digestibility, higher content of short and medium chain fatty acids and higher content of important minerals such as calcium, magnesium

and phosphorus. It also possesses stronger antimicrobial system in addition to its better immunological characteristics. In spite of all these benefits, goat milk in India is sold at relatively cheaper rates because of the alleged goaty smell, saltier taste and poor cream separation (Agnihotri and Prasad, 1993). The use of goat and sheep milk for the manufacture of different milk and milk products is increasing worldwide, although the proportion is much less when compared to cow and buffalo milk. A variety of value added products can be produced from goat milk, including cheese, yoghurt, ice cream and a variety of concentrated and dried products. However, cheese is the major commercial goat milk product produced and consumed in large quantities around the world. In India, the conversion of goat milk in to various

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products is very much limited and no major effort has been made to utilize the goat milk profitably. Therefore, developing a technology to process goat milk in to various value added products will certainly enhance the market value and thereby will improve the socio economic status of marginal goat farmers.

Paneer is an important nutritious and wholesome indigenous dairy product, which occupies a prominent place among traditional milk products and carries lot of market potential. Paneer is rich in high quality proteins, fat, minerals and vitamins. Paneer is used as a base material for the preparation of a large number of culinary dishes and its use is increasing in organized food chains (Shrivastava and Goyal, 2007). Good quality paneer is characterized by a marble white colour, sweetish, mildly acidic taste, nutty flavour, spongy body and smooth texture (Pal et al., 2011). Texture of paneer is the most important sensory attribute for the acceptability of paneer by the consumers. Due to the ever growing demand for paneer, researchers were encouraged to develop new techniques for the manufacture of paneer by using different types of milk. It also remains to be accepted, that technical knowledge generated through research with cow milk is most often not applicable to the manufacture of quality products from goat and sheep milk.

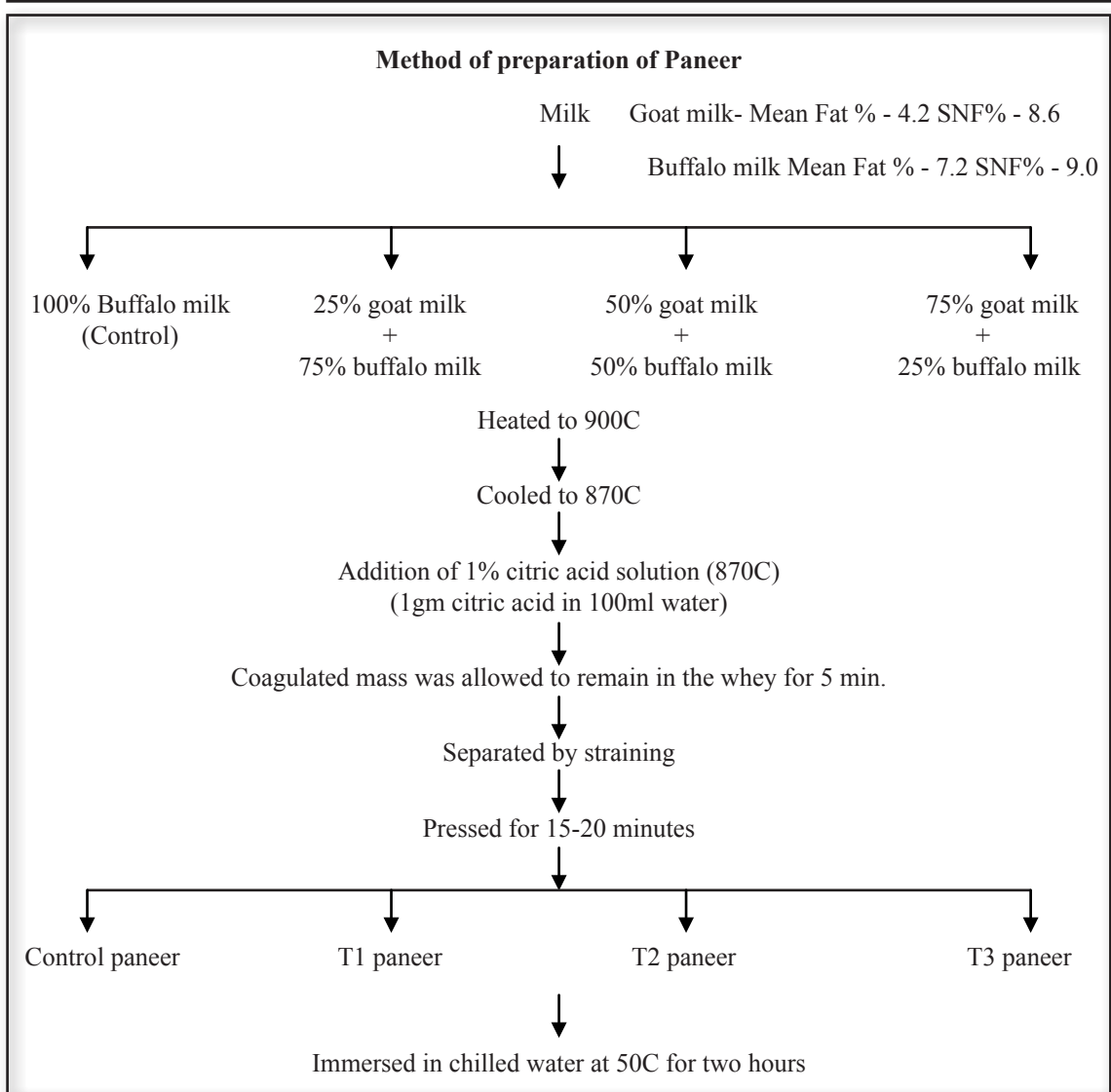
Hence, the present research work was carried out as an attempt to utilize goat milk for the manufacture of paneer, a value added product and to study the shelf-life and microbiological qualities at refrigerated and room temperature storage.

## MATERIALS AND METHODS

The work was conducted at the Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy. Fresh goat milk was procured from the University Goat and Sheep farm and

buffalo milk was procured from University Dairy plant, Mannuthy. Paneer was prepared as per the method suggested by Sachedeva and Singh (1988). The milk was brought to 90°C and promptly cooled to 87°C. Coagulation was then effected by the addition of one per cent citric acid solution slowly with gentle stirring. Coagulated mass was allowed to remain in the whey for five minutes and then separated from whey by straining through a muslin cloth. The muslin cloth with paneer was tied and pressed for 15-20 minutes. For the preparation of treatment groups of paneer, goat and buffalo milk were used in 25:75, 50:50 and 75:25 proportions. Control paneer was prepared by using buffalo milk alone. The mean fat and SNF contents in goat milk were  $4.22 \pm 0.17$ ,  $8.62 \pm 0.64$  and buffalo milk were  $7.18 \pm 0.97$ ,  $9.04 \pm 0.77$  respectively.

The prepared paneer samples were analyzed for microbiological parameters and keeping quality. Microbial qualities of paneer samples were evaluated by pour plate technique. Total viable count and coliform count of each sample was determined by the method suggested by Wehr and Frank (2004). Standard Plate Count Agar (SPC) was used for the enumeration of total viable count and Violet Red Bile Agar (VRBA) was used for the enumeration of coliforms in paneer. Yeast and Mould Count of paneer samples were determined as per the procedure described by the Bureau of Indian Standards (IS: 18, 1980). Potato Dextrose Agar (PDA) was used for the enumeration of yeast and mould count. Tartaric acid was used as the supplement for the preparation of potato dextrose agar. The data obtained were subjected to statistical analysis by following the procedure described by Snedecor and Cochran (1994). One way analysis of variance (ANOVA) was done for comparing microbiological parameters among different samples.



## RESULTS AND DISCUSSION

### Keeping quality

The prepared paneer could be stored at refrigerated storage condition for one week without any deterioration in quality. At room temperature, paneer could be stored for one day.

However, Agnihotri and Pal (1996) reported that, Paneer from goat milk (Barbari) can be stored safely only for 3 days under refrigeration temperature.

In a study conducted by Dharam Pal and Agrawala (2007), it was observed that the shelf life of paneer was about seven days under refrigeration,

though its freshness was lost within four days. At room temperature, paneer did not keep good for more than a day.

In the present study, the prepared paneer samples had a better shelf life than the earlier reports due to the strict hygienic conditions followed during the preparation and storage.

### Storage study at refrigerated temperature

#### Total viable count

The mean total viable count of control paneer samples were  $2.660 \pm 0.058$ ,  $3.153 \pm 0.037$ ,  $3.634 \pm 0.029$ ,  $4.199 \pm 0.043$  and  $4.726 \pm 0.011$  log cfu/g respectively for the 0, 3, 5, 7 and 14 days of storage. The corresponding values of T1 paneer were  $2.784 \pm 0.040$ ,  $3.181 \pm 0.037$ ,  $3.536 \pm 0.068$ , and  $4.109 \pm 0.033$  and  $4.705 \pm 0.014$  log cfu/g respectively. The values of T2 paneer were  $2.738 \pm 0.048$ ,  $3.149 \pm 0.035$ ,  $3.633 \pm 0.078$ , and  $4.161 \pm 0.028$  and  $4.747 \pm 0.009$  log cfu/g respectively. The values of T3 paneer were  $2.659 \pm 0.042$ ,  $3.183 \pm 0.034$ ,  $3.620 \pm 0.022$ , and  $4.148 \pm 0.021$  and  $4.728 \pm 0.007$  log cfu/g respectively (Table 1). Total viable count increased progressively as the storage period elapsed. However, no significant difference in total viable count between control and treatment groups was observed.

Agnihotri and Pal (1996) studied the microbiological quality of goat milk paneer at refrigerated storage. The initial total viable count in their study was  $3.94 \pm 0.41$  log cfu/gm and the count at seventh day was  $6.08 \pm 0.76$  log cfu/gm.

The lower total viable count obtained in the present study can be attributed to the relatively higher heat treatment given to the milk during the preparation of paneer. T2 paneer showed relatively higher total viable count than control and other treatment groups. However, the difference was not statistically significant.

#### Total coliform count

Coliforms were absent up to 5th day of storage in all paneer samples. The mean total coliform count of control paneer was  $1.95 \pm 0.21$  and  $2.51 \pm 0.13$  log cfu/g on the 7th and 14th days of storage respectively. The corresponding values of T1 paneer were  $1.81 \pm 0.17$  and  $2.32 \pm 0.14$  log cfu/g respectively. The values of T2 paneer were  $1.76 \pm 0.17$  and  $2.45 \pm 0.11$  log cfu/g respectively. The values of T3 paneer were  $1.87 \pm 0.16$  and  $2.61 \pm 0.13$  log cfu/g respectively. The coliform count of paneer samples showed no significant difference between control and treatments.

Yadav et al. (2009) reported that coliforms were absent in fresh paneer samples.

Yadav et al. (2010) have also reported that coliform organisms were completely absent in fresh paneer samples.

In the present study, coliforms were within the acceptable limit prescribed by BIS (1983) until seven days of refrigerated storage. This is in agreement with the results reported by earlier authors. The absence of coliform organisms in paneer indicated the strict hygienic conditions maintained during preparation and storage.

#### Yeast and mould count

Yeast and moulds were absent up to 5th day of storage in all paneer samples. The mean yeast and mould count of control paneer sample was  $2.86 \pm 0.59$  and  $3.72 \pm 0.26$  log cfu/g respectively for the 7th and 14th day of storage. The corresponding values of T1 paneer were  $2.66 \pm 0.95$  and  $3.63 \pm 0.88$  log cfu/g respectively. The values of T2 paneer were  $2.63 \pm 0.96$  and  $3.71 \pm 0.46$  log cfu/g respectively. The corresponding values of T3 paneer were  $2.65 \pm 0.54$  and  $3.46 \pm 0.55$  log cfu/g

respectively. The yeast and mould count of paneer samples showed significant difference between ( $P>0.05$ ) control and treatment groups of paneer (T1 and T3) samples.

Agnihotri and Pal (1996) observed that yeast and mould count showed a marked increase after day three of storage. Yadav et al. (2009) reported that yeast and mould were absent in fresh samples of paneer.

Yadav et al. (2010) have also reported no yeast and mould in fresh paneer samples. However, during storage, yeast and mould count increased as the storage period elapsed. In the present study T2 samples had the lowest yeast and mould count followed by T3, T1 and control samples at seven days of storage.

### **Microbial qualities of paneer stored at room temperature**

#### **Total viable count**

The mean total viable count for control and treatment samples of paneer (T1, T2, and T3) were  $2.631\pm 0.050$ ,  $2.784\pm 0.040$ ,  $2.746\pm 0.058$  and  $2.695\pm 0.02700$  log cfu/g respectively (Table 4) at eight hours of storage. The values were uncountable after 24 hours of storage in all paneer samples. The total viable count showed no significant difference between control and treatment groups.

Sachdeva and Singh (1985) found that paneer was highly susceptible to spoilage and did not keep good for more than a day at room temperature. The growth of bacteria, yeast and moulds were the major causes of spoilage.

In the present study, fresh samples of paneer met the legal standards. After 24 hours of storage the total viable count increased enormously and became uncountable. The results are in agreement with the above findings.

#### **Total coliform count**

Coliforms were absent in all paneer samples at eight hours of storage. The mean total coliform count of control and treatment paneer samples at 24 hours (T1, T2, and T3) were  $2.25\pm 0.13$ ,  $2.31\pm 0.87$ ,  $2.28\pm 0.10$  and  $2.47\pm 0.11$  log cfu/g respectively. The total coliform count between control paneer and different treatment groups showed no significant difference.

Sachdeva and Singh (1985) found that paneer was highly susceptible to spoilage and does not keep good for more than a day at room temperature.

Yadav et al. (2009) reported that coliforms were absent in fresh sample. The results obtained in the present study are in agreement with the above findings.

#### **Yeast and mould count**

Yeast and moulds were absent in all paneer samples at eight hours of storage. The mean yeast and mould count for control and treatment groups of paneer (T1, T2, and T3) were  $2.95\pm 0.67$ ,  $2.92\pm 0.48$ ,  $2.89\pm 0.92$  and  $2.82\pm 0.77$  log cfu/g respectively at 24 hours of storage. The yeast and mould count showed no significant difference between control and treatments.

According to Bureau of Indian Standards (1983) yeast and mould count per gram should not exceed 250/g.

Yadav et al. (2009) reported that during room temperature storage yeast and mould count increased as the storage period elapsed.

In the present study, fresh samples of paneer met the legal standards. After 24 hours of storage the yeast and mould count increased enormously. The results are in agreement with the above findings.

**Table 1****Total viable count (Means±SE) of paneer (log cfu/g) stored at refrigerated temperature**

Treatments	0 Day	3 <sup>rd</sup> Day	5 <sup>th</sup> Day	7 <sup>th</sup> Day	14 <sup>th</sup> Day
Control	2.660±0.058	3.153±0.037	3.634±0.029	4.199±0.043	4.726±0.011
T1 (25:75)	2.784±0.040	3.181±0.037	3.536±0.068	4.109±0.033	4.705±0.014
T2 (50:50)	2.738±0.048	3.149±0.035	3.633±0.078	4.161±0.028	4.747±0.009
T3 (75:25)	2.659±0.042	3.183±0.034	3.620±0.022	4.148±0.021	4.728±0.007
F value	1.642 <sup>ns</sup>	0.249 <sup>ns</sup>	0.579 <sup>ns</sup>	1.236 <sup>ns</sup>	3.007 <sup>ns</sup>

Mean ±SE are averages of five replications

ns- Non significant at 0.05 levels

**Table 2****Coliform Count (Mean ± SE) of paneer (log cfu/g) stored at refrigerated temperature**

Treatments	0 Day	3 <sup>rd</sup> Day	5 <sup>th</sup> Day	7 <sup>th</sup> Day	14 <sup>th</sup> Day
Control	0	0	0	1.95±0.21	2.51±0.13
T1 (25:75)	0	0	0	1.81±0.17	2.32±0.14
T2 (50:50)	0	0	0	1.76±0.17	2.45±0.11
T3 (75:25)	0	0	0	1.87±0.16	2.61±0.13
F value	0	0	0	0.19 <sup>ns</sup>	0.84 <sup>ns</sup>

Mean ±SE are averages of five replications

ns- Non significant at 0.05 levels

**Table 3****Yeast and mould count (Mean ± SE) of paneer (log cfu/g) stored at refrigerated temperature**

Treatments	0 Day	3 <sup>rd</sup> Day	5 <sup>th</sup> Day	7 <sup>th</sup> Day	14 <sup>th</sup> Day
Control	0	0	0	2.86±0.59	3.72±0.26a
T1 (25:75)	0	0	0	2.66±0.95	3.63±0.88b
T2 (50:50)	0	0	0	2.63±0.96	3.71±0.46a
T3 (75:25)	0	0	0	2.65±0.54	3.46±0.55b
F value	0	0	0	1.55 <sup>ns</sup>	4.02*

Mean ± SE are averages of five replications

ns- Non significant at 0.05 levels

\* Significant at 0.05 levels

**Table 4**

**Total Viable Count (Mean  $\pm$ SE) of paneer (log cfu/g) stored at room temperature**

Treatments	Eight hours
Control	2.631 $\pm$ 0.050
T1 (25:75)	2.784 $\pm$ 0.040
T2 (50:50)	2.746 $\pm$ 0.058
T3 (75:25)	2.695 $\pm$ 0.027
F-value	2.080 <sup>ns</sup>

Mean  $\pm$  SE are averages of five replications

ns- Non significant at 0.05 level

**Table 5**

**Coliform count (Mean  $\pm$ SE) of paneer (log cfu/g) stored at room temperature**

Treatments	Eight hours	24 hours
Control	0	2.25 $\pm$ 0.13
T1 (25:75)	0	2.31 $\pm$ 0.87
T2 (50:50)	0	2.28 $\pm$ 0.10
T3 (75:25)	0	2.47 $\pm$ 0.11
F Value	0	0.84 <sup>ns</sup>

Mean  $\pm$ SE are averages of five replications

ns- Non significant at 0.05 levels

**Table 6**

**Yeast and Mould Count (Mean  $\pm$ SE) of paneer (log cfu/g) stored at room temperature**

Treatments	Eight hours	24 hours
Control	0	2.95 $\pm$ 0.67
TI (25:75)	0	2.92 $\pm$ 0.48
T2 (50:50)	0	2.89 $\pm$ 0.92
T3 (75:25)	0	2.82 $\pm$ 0.77
F- Value	0	0.49 <sup>ns</sup>

Mean  $\pm$ SE are averages of five replications

ns- Non significant at 0.05 levels

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**REFERENCES**

- Agnihotri, M.K. and Prasad, V.S.S. (1993). Biochemistry and processing of goat milk and milk products. *Small Rumin Res.* 12: 151-170.
- Agnihotri, M.K. and Pal, U.K. (1996). Quality and shelf life of paneer in refrigerated storage. *Small Rumin Res.* 20: 75-81.
- BIS (1983). Specification of paneer. IS 10484. Bureau of Indian Standards. New Delhi. 3-8.
- Dharam Pal and Agrawala, S.P. (2007). Paneer manufacturing. Monograph of the IDA: 002/TE/2007. Indian Dairy Association, R.K. Puram, New Delhi.
- FAOSTAT (2008): <http://faostat.fao.org/default.aspx>
- Godbole, S., Pranoti, D. and Ashwini, P. (2013). Evaluation of bacteriological quality of Indian cheese (paneer) sold in Nagpur city. *J. Global Biosci.* 2: 53-56.
- IS: SP 18, Part XI. (1980). ISI handbook of food analysis, Dairy products. Bureau of Indian standard, New Delhi, India.
- Pal, U.K., Mandal, P.K., Rao, V.K. and Das, C.D. (2011). Quality and utility of goat milk with special reference to India: An overview. *Asian. J. Anim. Sci.* 5: 56-63.
- Shrivastava, S. and Goyal, G.K. (2007). Preparation of paneer-A Review. *Indian J. Dairy Sci.* 60: 377-388.
- Sachdeva, S. and Singh, S. (1985). Shelf life enhancement of paneer preservatives. *Indian J. Dairy Sci.* 34:150-154.
- Snedecor, G.W. and Cochran, W.G. (1994). *Statistical methods.* (8th Ed.). Oxford and IBH Publishing company, New Delhi.
- Wehr, H.M. and Frank, J.F. (2004). *Standard Methods for the Examination of Dairy Products.* American Public Health Association. 134p.
- Yadav, Y.N., Singh, C., Dwivedi, B.R. and Gupta, M.P. (2009). Effect of various coagulants on sensory, chemical and microbiological quality of paneer. *J. Rural and Agric Res.* 9: 11-14.
- Yadav, Y.N., Singh, C. and Gupta, M.P. (2010). Effect of brine treatment on sensory, chemical and microbiological quality of paneer. *J. Rural and Agric Res.* 10: 14-16.