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Evaluation of Cheese Prepared by Processing Camel Milk

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Abstract.- Cheese prepared from camel milk by direct acidification of milk and by adding starter culture of lactic acid bacteria were evaluated. Milk coagulated by starter culture addition (13.22±4.487) gave higher cheese yield as compared to cheese prepared by direct acidification (11.70±2.345). The cheese prepared by using starter culture also had higher amounts of total solids, protein and fat. It is concluded that cheese can be prepared from camel milk by coagulating milk with the use of starter culture. The transfer of cheese preparation technology from camel milk, to camel keepers in the dry areas can help to improve their economic condition by finding a proper market of camel milk cheese.

Key words: Camel milk, cheese.

INTRODUCTION

Milk is the most important product obtained from camel milk being a complete food, helps to provide a nutritious and balanced diet to nomatic desert people under harsh conditions. The composition of milk varies widely and contains 2.9-5.5% fat, 2.5-4.5% protein, 2.9-5.8% lactose, 0.35-0.95% minerals and 8.9-14.3% solids-not-fat. It also contain the essential vitamins, which include vitamin A, vitamin D, vitamin B1, B2 and B12 and vitamin C. The content of vitamin C is of specific interest as its levels are three times that of cow milk and one-and-a-half that of human milk (Gast *et al*., 1969). The vitamin C content varies between 5.7 and 9.8 mg percent.

Cheese making technology aims to preserve milk so that consumption can be postponed for periods from few days to several months. The preservation of the product is obtained mainly through lactic acidification and limited dehydration. However, the processing of camel milk into cheese is technically more difficult than milk from other domestic dairy animals. This is mainly due to its low total solids content, unique composition and casein properties. Its suitability for cheese making decreases significantly in the hot season, when camel milk production is influenced by water and feed availability, as under water shortage conditions camel milk contains abnormally low milk solids and its cheese processing ability is poor.

In spite of the above difficulties, efforts have been made for cheese preparation from camel milk. These include laboratory experiments in Saudi Arabia (Ramet, 1990), pilot production in Tunisia (Ramet, 1987) or commercial production in Mauritania (Ramet, 1995). But no such effort has been reported in Pakistan. Therefore, a research project was planned to evaluate cheese prepared from camel milk under local conditions. The project was aimed to develop and transfer cheese-making technology from camel milk, to camel keepers of the arid regions of Pakistan. This will also help to improve the socioeconomic condition of the camel keepers by finding a suitable market for camel milk cheese.

MATERIALS AND METHODS

Materials

Fresh whole camel milk was obtained from Barani Livestock Production Research Institute (BLPRI), Kheri Moorat, Fateh Jang, District Attock. Milk was immediately cooled to 5±1°C and transported to the Dairy Technology Research Laboratory (DTRL), National Agricultural Research Centre (NARC), Islamabad and maintained cold until use.

Cheese preparation

Four litres of milk was taken in a stainless steel

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container and heated to 65°C for 30 minutes. The temperature of milk was brought down to 40°C. The milk was then divided into two parts. Two methods were then used to manufacture soft white cheese from camel milk (Fig. 1). One method utilized addition of 10% citric acid solution to one portion of milk till pH came down to 5.5. The starter culture was then added at the rate of 5% to second portion. After about an hour rennet was then added to both portions of milk at the rate of 0.15 ml/litre of milk and mixed thoroughly. The milk was allowed to coagulate for five hours. After curd formation the coagulum was cut and whey was drained off. The coagulum so obtained was cut and scalding was done by gradually raising the temperature of the curd to 38°C within 30 minutes. The curd was moulded and pressed for 2-3 hours at room temperature (25°C). Cheese was removed from mould, weighed, packaged in aluminum packaging sheet, sampled and stored at 4°C for further evaluation.

Chemical and organoleptic evaluation

Each sample of milk, cheese and whey was analyzed for total solids, fat and ash by AOAC, 1990 methods. Crude protein was determined in accordance with the procedure of Mickelson (1974). Lactose content was determined by difference Cheese was evaluated by a panel of seven judges on hedonic scale 1-9 as described by Larmond (1977) for flavour/taste and body/texture and colour.

Statistical analysis

Results from the cheese making trials were analyzed by the Analysis of Variance (ANOVA). Standard error of the means was derived from the error mean square term of the ANOVA.

RESULTS AND DISCUSSION

Cheese manufacturing

The manufacturing procedure and composition of milk used for camel milk cheese are summarized in Figure 1 and Table I, respectively. Three trials were conducted to study the manufacturing of fresh soft white cheese from camel milk. Direct acidification and lactic starter cultures were used for cheese manufacturing. Lactic cultures are primarily responsible for the production of lactic acid, which improve curd firmness and suppresses the growth of undesirable bacteria in the curd, and produce the flavour compounds that contribute to the aroma of fresh cheese (Chapman and Sharpe, 1983). The results on cheese making from camel milk indicated that a good fresh soft white cheese could be produced using the procedures shown in Figure 1.

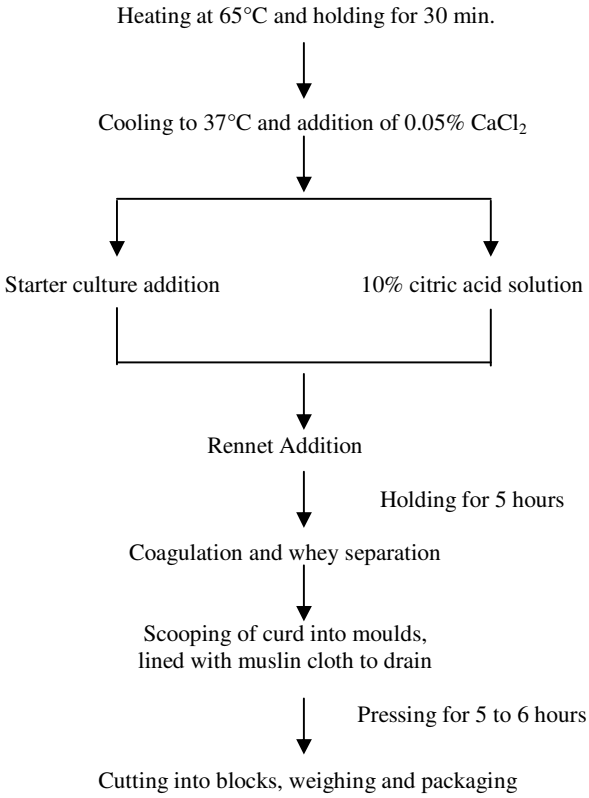

Fig. 1. Manufacturing procedures for fresh soft white cheese from camel milk with 10% citric acid solution or starter culture.

Calcium chloride was added prior to rennet addition to reduce clotting time and to improve the renneting properties. Cheese was difficult to make from camel milk under natural conditions, but success was achieved when pH of milk was lowered and calcium chloride was added prior to rennet addition. Farah and Ruegg (1989) reported that, because of differences in availability of K-casein, camel milk has more large casein micelles than does

cow milk, which may relate to the poor rennetability of camel milk.

Table I.- Average chemical composition (Mean±SD) of camel milk used for cheese preparation.

Parameter	Value in camel milk
pH	6.52±0.21
Total solids (%)	11.07±2.15
Fat (%)	3.08±1.34
Solids-not-fat (%)	8.03±0.72
Protein (%)	3.11±0.69
Lactose (%)	4.08±0.48
Ash (%)	0.90±0.12
Moisture (%)	88.94±2.15

The milk to which 10% citric acid solution was added for lowering pH formed a light and fragile curd, whereas the curd obtained after addition of starter culture was firmer.

Milk and cheese composition

Mean composition of milk used to manufacturing cheese samples is showing in Table I. The table shows that the milk had mean pH of 6.52 and mean total solids content of 11.07%. The mean fat and protein contents were 3.08% and 3.11% respectively.

Table II shows mean composition of fresh soft white cheese made from camel milk either by starter culture addition by direct acidification. The result showed that higher yield was obtained when cheese was prepared of addition of starter culture *i.e.* 13.22% with a standard deviation of 4.49, as compared to cheese prepared by addition of citric acid solution, *i.e.* 11.70% with a standard deviation of 2.35% (Table II). However, the difference was statistically non-significant. Similarly, the total solids contents were higher in cheese prepared by addition of starter culture, but statistically the difference was non-significant. The results of the protein content showed that the cheese prepared by starter culture addition contained 21.30±0.638% protein whereas cheese prepared by direct acidification contained 17.67±1.528% protein. Thus, the cheese prepared by starter culture had significantly higher amount of protein. However, the difference between the fat contents of cheeses prepared by two difference types of methods was statistically non-significant.

Athar *et al*. (1989) prepared cheese from cow and buffalo milk using direct acidification and starter culture processes. The cow milk had mean total solids content of 12.6% whereas, buffalo milk had mean total solids content of 16.1%. The results of cheese analysis showed that cheese prepared from cow milk had total solids contents of 48.73% when prepared by direct acidification and 48.21% when prepared by starter culture process. The cheese prepared from buffalo milk had 49.43% total solids when prepared by direct acidification and 52.04% total solids when prepared by starter culture addition. When these results are compared with total solids content of camel milk cheese in the present study it is found that the total solids contents were significantly lower in camel milk cheese as compared to cheese prepared from cow or buffalo milk. This is due to the reason that the camel milk had lower total solids (11.07%) content, as compared to the total solids content of cow (12.6%) and buffalo (16.1%) milk. Secondly the camel milk has poor rennet ability because of differences in availability of K-casein, camel milk has more large casein micelles than does cow and buffalo milk.

Table II.- Physico-chemical analysis (Mean±SD) of cheese prepared by two different types of methods.

Parameter	Starter culture	Acidification
pH	4.94±0.242	5.80±0.087
Yield	13.22±4.487	11.70±2.345
Total solids	44.36±3.433	41.16±3.159
Fat	19.00±2.646	16.50±1.323
Protein	21.30±0.638	17.67±1.528
Lactose	2.53±1.275	4.00±1
Ash	1.53±0.577	2.99±1.181
Moisture	55.64±3.433	58.84±3.159

Organoleptic evaluation of cheese

The panel results indicated that the cheese prepared by using starter culture was liked more as compared to that prepared by acidification process. The preference recorded was 70% in case of cheese obtained by using starter culture and 30% in case of cheese obtained using citric acid. The panel results revealed that the cheese prepared by using starter culture was given more preference on the basis of

flavour and body/texture as compared to cheese obtained by using citric acid. The texture of cheese prepared by using starter culture was specifically highly preferred over the cheese obtained by citric acid addition.

Conclusion

From the above discussion it can be concluded that manufacture of fresh soft white cheese is feasible. The average cheese yield obtained from camel milk was, however, was lower than that reported for cow or buffalo milks (Athar *et al*., 1989). Fresh soft white cheese made from camel milk with starter culture was most acceptable. The cheese made from camel milk without use of starter cultures had high moisture and very high pH, which could cause serious health problems by growth of pathogens. Moreover, the resulting cheese had lower sensory quality and lower yield than cheese made with starter culture. Thus, our data indicate that cheese making without use of starter cultures should be discouraged.

However, more research is needed to study the mechanism of enzymatic coagulation of camel milk, to improve the quality and the yield of camel milk cheese, and to utilize the nutritious whey that is produced from cheese making with camel milk.

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