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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

# Preparation of fresh soft cheese from dromedary camel milk using acid and heat method

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## Abstract

Cheese prepared from camel milk by direct acidification (60% acetic acid and heating at 66.4C°) were evaluated. Chemical analysis of the cheese samples was done and the mean values of the main components were obtained. Thirty panellists estimated the cheese according to the sensory evaluation (colour, flavour, taste, body texture, saltiness, overall acceptability). Overall the sensory evaluation was acceptable to most of the panellist. The optimum temperature was 66.24°C and pH 4.3. It was concluded that cheese can be prepared from camel milk by coagulating milk with acidification by acetic acid and heating processes.

**Keywords:** Acetic acid; camel milk; calcium chloride; cheese; composition; sensory evaluation

**To cite this article:** Ahmed AE, IA Babiker and TE Mohamed, 2013. Preparation of fresh soft cheese from dromedary camel milk using acid and heat method. Res. Opin. Anim. Vet. Sci., 3(9), 289-292.

## Introduction

There are about 2.8 million camels (*Camelus dromedaries*) in Sudan distributed around the country (FAO, 2001). They belong to the one-humped dromedary kind. The average daily milk yield of camel in Sudan was found to be 5-10 Kg. Camel milk is extremely popular and widely consumed by nomadic tribes in Sudan both as fresh raw milk and as soured milk especially in the East and West region. The camel is a potentially important source of milk. Indeed, in some countries hosting large camel populations, camel's milk is one of the main components of the human diet (Farah et al., 1989). Yagil (1982) reported that the camels can lactate even under severe drought conditions.

The cheese is an important product of animal milk. It is a product which persists for a long time and it is prepared by several processing technique based on fermentation of milk by lactic acid bacteria. Particularly in the past, cheese was valued by most people who lived in the city or in the desert, because it has long shelf-life, which is made by reduction of water content and addition of salts to inhibit the growth of bacteria (Grahame, 1996). According to Ramet (2001), the cheese made from camel's milk is high in vitamins, low in cholesterol and low in lactose. The cheese production from animals milk in different forms (types, shape, taste, and colour), has became a new art and spread very fast throughout the world. Cheese formation from camel milk is still limited. Mehaia (1993) observed that camel milk failed to form gel like structure after 18h incubation with lactic acid culture, this was attributed to the presence antibacterial factors such as lysozymes, lactoferrin immunoglobulin in camel milk (Agmy et al., 2007). Farah (1993) studied the preparation and consumer acceptability tests of fermented milk. They found that the consistency of fermented milk (under laboratory condition) was thin and a precipitate in the form of flocks was formed rather than a coagulum after fermentation. These reports clearly show the difficulty of producing fermented camel milk products with high consistency due to the problem associated with milk coagulation. Therefore, the objective of this study was

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to use acid and heat procedure in a trial to overcome the problem of cheese production from camel milk.

## Materials and Methods

Fresh whole camel milk was obtained from two dairy private farms from different areas around eastern of Khartoum state. Milk was immediately cooled and transported to the dairy technology laboratory at the University of Khartoum and maintained at cooled temperature until use.

### Cheese preparation

Four litres of milk was filtered using clean sterile white cheese cloths into clean cheese churns to remove the dirt. The milk was heated to 63°C for 30 minutes. Then the temperature of milk was brought down to 40°C within 15 minutes. The pH of the milk was lowered from 4 to 4.3 by adding acetic acid (66%) and filtered by using clean sterile cheese cloth. Calcium salt (CaCl) was added to this coagulum at the rate of 3-4%. The coagulum was then transferred into wooden cheese moulds and left for one hour to drain the whey, and then cut into one inch cubes to assist whey drainage. The curd was transferred into clean sterile cheese cloth and hung over a long hanging metal cheese disk for 12 hours until all the whey was drained away into clean pots. Then the cheese was packed into plastic containers and kept in a refrigerator at (4°C).

### Chemical analysis

Each sample of milk, cheese was analyzed for total solids, fat and ash by A.O.A.C procedures. Crude protein was determined by Kjedhal method (Barbano et al., 1990). Subtract non-protein nitrogen content from total nitrogen content, in the sample and multiplied by 6.38 to get milk protein nitrogen content. Fat percentage was determined according to the method of Rose-Gottlieb (Pearson, 1977). The pH of the milk was measured by a pH meter (Tester Hanna Checker, HI 98103) according to the method of Frank (1988).

Raw milk

⇩

Pasteurization (63 °C for 30 minutes)

⇩

Addition of concentrated acetic acid 60% (2-3-ml)

⇩

Scooping of curd and whey into, white cloth (netting) to

⇩

Drain the component

⇩

Addition of salts (calcium chloride, 3%)

⇩

Cutting into blocks (preserve of cheese in refrigerator at 4°C)

**Diagram 1: Manufacturing procedures for fresh soft white cheese from she-camel's milk (using acid and heat in addition of different percentages of salt)**

### Sensory evaluation

Sensory evaluation of cheeses was performed after one day of storage at 5±1C°. A panel of 30 University and faculty staff members who were familiar with soft cheese evaluated the cheeses sensory attributes of body texture, saltiness, color, flavor, taste and overall acceptability of cheese. The identity of the individual samples was revealed only after the tests were completed.

### Statistical analysis

Results from the cheese making trial were analyzed by general linear methods incorporated in SPSS 10 (SPSS Inc., Chicago, IL, USA) and Microsoft Excel.

## Results and Discussion

Thirty panellists estimated the cheese according to the sensory evaluation as colour, flavour, taste, body texture, saltiness and overall acceptability. The response of the judges to different properties of the cheese is given in Table 1.

The optimum temperature and pH of camel's milk was 63°C and 4.3 (Fig. 1). The optimum pH for strong coagulation is 4 to 4.3. Ramet (2001) reported that it is very difficult to get camels milk to curdle. Saima et al. (2003) concluded that camel's milk can be coagulated with the addition of same amount of milk from other species such as goat, cow and ewe. However, many recent researchers reported that the coagulation of she-camel's milk is very difficult, and this attribute to the low concentration of Kappa casein in camel's milk (Elzubir and Samah, 2008). Another report explained that the coagulation of camel milk is two to four times slower than for cow's milk treated under the same conditions (Mehaia, 1992). So the present study showed that the Kappa casein is very weak and has low band during electrophoresis in all phases of lactation (Fig. 3). The findings of the present study are very comparable to those found by Mehaia (1992) and Ibtisam and Samah (2008). Ibtisam and Samah (2008) reported that the general acceptability of cheese made from camel's milk was 53.3%. Most people prefer Labnah and they suggested that the addition of some colour and some food as sweet and jam may increase the palatability. Actually, there is no data or scientific researches available in the literature for Labana production, from she-camel's milk. Camel's milk has different sensory properties compared with cow's milk and flavouring camel's milk with chocolate improved its acceptance among elementary school children (Hashim et al., 2009). Probably, the effect of saltines and sweatiness of camel's milk is due to the gradual changes of chemical constituents of the camel's milk during different phases of lactation such as total solids, ash and fat. Bakht and Arshad (2001) observed that the ash, fat and water

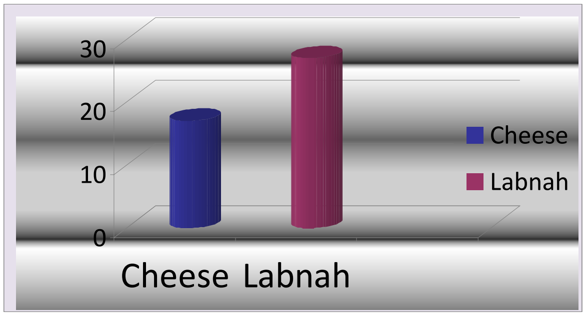


**Fig. 1: The percentage of all acceptability of cheese and Labana made from camel's milk (30 Panelists= 30n)** Cheese (17n = 56.66%) Labana (27n= 90 %)

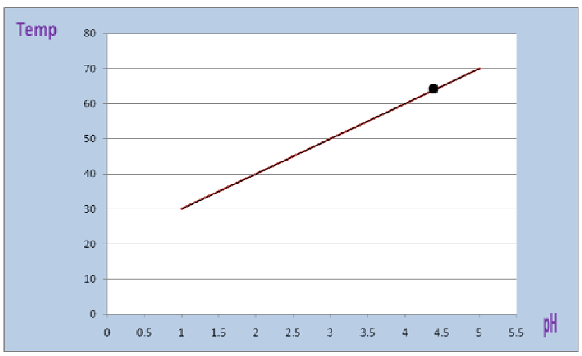


**Fig. 2: The optimum pH & temperature for camel's milk curdling;** The optimum temperature is (66.24°C) and pH (4.3)

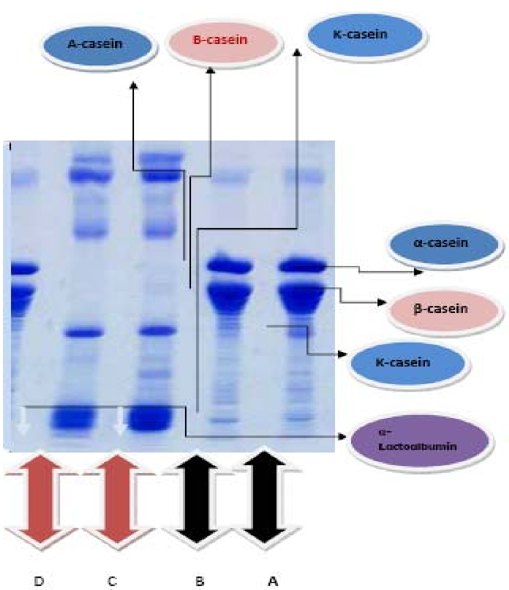


**Fig. 3: protein fractionation during period from (over one week to 16 weeks) & (16-32 weeks), over 32 weeks to 48 weeks )** Where,
*a: Casein 1-16 weeks*
*b: (Casein 16-32 weeks*
*c: whey protein 1-16 weeks*
*d: whey protein 16-32 weeks*

**Table 1: Sensory evaluation score for cheese made from camel's milk**

| Sensory | Score | Frequency |
|---|---|---|
| Colour | Acceptable | 17 (56.66%) |
| | Slightly acceptable | 11 (36.66%) |
| | Moderately accept | 1 (3.33%) |
| | Unacceptable | 1 (3.33%) |
| Flavour | Extremely intense | 14 (46.66%) |
| | Moderately intense | 11(36.66%) |
| | Slightly intense | 4 (13.33%) |
| | Bland | 1 (3.33%) |
| | Acid absent | 3 (10%) |
| | Slightly acid | 5 (16.66%) |
| Taste | Acid | 6 (20 %) |
| | Excessive acid | 16 (53.33%) |
| Body texture | Smooth | 3 (10% ) |
| | Slightly smooth body | 0 (0% ) |
| | Harsh body | 0 (0%) |
| | Pasty | 27 (90%) |
| Saltiness | Moderately salty | 11 (36.66%) |
| | Salty | 17 (56.66%) |
| | Over salty | 2 (6.66%) |

**Table 2: The yield and nutritive value of cheese from camel**

| Parameters | Nutritive value (mg/l) | Cheese yield (mg/l) |
|---|---|---|
| Protein | 9.56 | 9.63 |
| Fat | 10.99 | 11.15 |
| Moisture | 75.33 | 74.32 |
| Total solids | 24.68 | 25.48 |
| pH | 5.44 | 3.89 |
| Acidity | 1.35 | 1.35 |
| Lactose | 3.05 | 3.05 |

contents showed an increasing trend towards the end of lactation, while protein, lactose and total solids showed decreasing trend towards the last lactation. Ramet (2001) reported that the most important factor affecting the overall composition of camel's milk is water content. It has been clearly demonstrated that experiments which restricted drinking water caused an increase in water content and a subsequent decrease in total solids. On the other hand, the camel's milk is characterized by the absence of β-lactoglobulin. This seems to be important for two reasons. First, there is compositional similarity with human milk. According to Shamsia (2009), α-lactalbumin is part of the enzyme system responsible for lactose synthesis. Interestingly, in the present study, the camel's milk contains no β-lactoglobulin, in all phases of lactation as shown in the Figure 3. Merin et al. (2001) reported that the proteins of camel's milk are the decisive components for preventing and curing food allergies because camel's milk contains no β-lactoglobulin. The camel's milk contains no β-lactoglobulin, and has a different beta-casein. In the present study, the fractionation of protein during one week is very difficult, while during milking from over one week to sixteen weeks of the band, concentration of α-casein was medium, β-casein was high, and K-casein was very low. Meanwhile, the concentration of α-lactalbumin was medium. The β-latoglobulins appears absent in whey protein. On the other hand, in the present study, the casein fractionation during 32 to 48 weeks of lactation contained high concentration of α-casein and β-casein. The K-casein was very weak or absent. According to Merin et al. (2001), it was shown in colostrum and milk that most camel serum proteins are similar in molecular weights to bovine whey proteins. The present results agreed with that reported by Halima et al. (2006) who concluded that the main components of whey proteins in camel milk and colostrum were similar to that in bovine, except for the lack in β-lactoglobulin. However, the literature was very few in field of electrophoresis and fractionation of camel's milk proteins. It was concluded that cheese can be prepared from camel milk by coagulating milk with acidification by acetic acid and heating processes.

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