# Heat coagulation of camel milk



**Author(s):**
Farah, Zakaria; Atkins, Deborah

**Publication date:**
1992

**Permanent link:**
https://doi.org/10.3929/ethz-b-000422797



**Originally published in:**
Journal of Dairy Research 59(2), https://doi.org/10.1017/S002202990003048X

*Journal of Dairy Research* (1992) **59** 229–231 *Printed in Great Britain* 

# Heat coagulation of camel milk

By ZAKARIA FARAH and DEBORAH ATKINS*

*Laboratorium für Milchwissenschaft, Institut für Lebensmittelwissenschaft, ETH-Zentrum, CH-8092 Zürich, Schweiz*

**Ol Maisor Farm, PO Box 9, Rumuruti, Kenya*

(*Received 30 July 1991 and accepted for publication 28 October 1991*)

Camel milk is an important component of the human diet in many parts of the world. It contains all essential nutrients and the composition is similar to that of cows' milk (Yagil, 1982). Present knowledge about the milk production potential of camels (*Camelus dromedarius*) is very limited. Data available show, however, that a camel on good feed can produce 2000 l milk per lactation (Yagil, 1982), and even higher milk yields have been recorded (Knoess, 1980). Camel milk is drunk fresh or in the form of fermented milk. Heat processing, such as pasteurization and sterilization, as a means of preserving camel milk is unknown. Information on the heat stability of camel milk is therefore scarce. In an earlier study (Farah, 1986), camel milk was heated to 63, 80 and 90 °C for 30 min and the distribution of N between the total protein, non-casein N and non-protein N fractions was determined. The whey proteins were also examined by PAGE. The camel milk whey protein showed generally higher heat stability than that from cows' milk.

In order to study the ability of camel milk to withstand higher processing temperatures, the heat coagulation time (HCT) was determined in the range 100–130 °C and pH 6·3–7·1, and compared with measurements on cows' milk.

## EXPERIMENTAL

### *Milk samples*

Camel milk samples were taken at Ol Maisor Camel Farm, which is situated just north of the equator in Kenya's Laikipia District at an altitude of between 1767 and 1889 m above sea level. The animals were of indigenous breed and were fed throughout the year exclusively by grazing. The milk samples were collected from ten individual camels. The pH of the ten samples and that of a pooled sample were determined. The milks were then kept refrigerated at 4 °C and transported to our laboratory within 24 h. Upon arrival, the milk samples were skimmed and analysed. For comparison, bulk cows' milk from our Zürich laboratory was used.

### *Determination of heat stability*

Milk was adjusted to various pH in the range 6·3–7·1 by adding 0·1 M-NaOH or 0·1 M-HCl. HCT was determined in a thermostatically controlled oil bath at 100, 120 and 130 °C according to the method of Davies & White (1966).

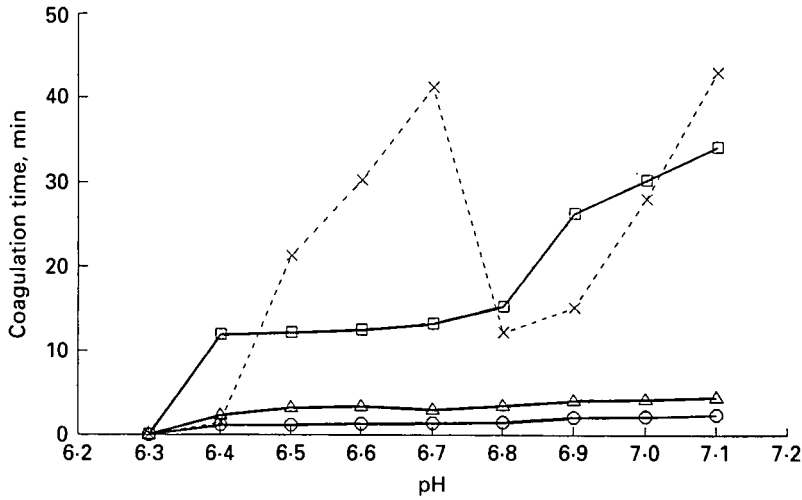


Fig. 1. Heat coagulation time–pH curves for camel milk at □, 100 °C; △, 120 °C and ○, 130 °C, and for cows' milk at 130 °C (×).

## RESULTS AND DISCUSSION

The heat stability of milk can be defined in terms of the time required to induce coagulation at a given temperature. For bovine milk, the most widely used temperature for heat coagulation is 130 or 140 °C. Preliminary experiments showed that in camel milk the HCT at 140 °C was too short (< 1 min) for the present assay. Coagulation times were therefore determined at 100, 120 and 130 °C. Fig. 1 shows the HCT–pH curves for pooled camel and cows' milks. All ten individual camel milk samples gave similar HCT–pH curves.

The HCT–pH curve of cows' milk is in agreement with findings reported previously (Rose, 1963; Fox, 1982). It showed a marked maximum around pH 6·7 and a minimum near pH 6·8. The heat stability increased above pH 6·9.

The shape of the HCT–pH curve for camel milk at low temperature was different from those at high temperatures. The milks heated at 130 and 120 °C were very unstable at all pH and coagulated in 2–3 min. At 100 °C the HCT initially increased with pH, remained constant between pH 6·4 and 6·7 and then increased progressively with increasing pH.

Milks from different species differ in their heat stability. Compositional differences and heat-induced interaction between the caseins and whey proteins, particularly $\kappa$-casein and $\beta$-lactoglobulin, are reported to be responsible for these differences (Hoynes & Fox, 1975; Fox & Hoynes, 1976; Ganguli, 1979).

Casein fractions homologous with bovine $\alpha$- and $\beta$-casein were isolated and identified by PAGE and ion-exchange chromatography (Farah & Farah-Riesen, 1985; Larsson-Raźnikiewicz & Mohamed, 1986). In these studies no protein fraction corresponding to $\kappa$-casein could be clearly detected. It is possible that camel casein contained so little $\kappa$-casein that it escaped detection or was obscured by other casein fractions.

On the other hand, four whey proteins have been isolated from camel milk: two proteins similar to serum albumin and $\alpha$-lactalbumin, and two novel milk proteins of no structural similarity to other milk proteins. The evidence for the presence of $\beta$-lactoglobulin in camel milk is conflicting (Farah, 1986; Beg *et al.* 1984, 1987).

The present study found that the heat stability of camel milk differs markedly from that of cows' milk. $\kappa$-Casein and $\beta$-lactoglobulin play an important role in the stability of bovine milk. Therefore, the absence or deficiency of these two proteins in camel milk might be a cause of its poor stability at high temperatures. However, this remains to be confirmed.

## REFERENCES


Beg, O. U., von Bahr-Lindström, H., Zaidi, Z. H. & Jörnvall, H. 1984 A small camel-milk protein rich in cysteine/half-cystine. *Bioscience Reports* **4** 1065–1070

Beg, O. U., von Bahr-Lindström, H., Zaidi, Z. H. & Jörnvall, H. 1987 Characterization of a heterogeneous camel milk whey non-casein protein. *FEBS Letters* **216** 270–274

Davies, D. T. & White, J. C. D. 1966 The stability of milk protein to heat. I. Subjective measurement of heat stability of milk. *Journal of Dairy Research* **33** 67–81

Farah, Z. 1986 Effect of heat treatment on whey proteins of camel milk. *Milchwissenschaft* **41** 763–765

Farah, Z. & Farah-Riesen, M. 1985 Separation and characterization of major components of camel milk casein. *Milchwissenschaft* **40** 669–671

Fox, P. F. 1982 Heat-induced coagulation of milk. In *Developments in Dairy Chemistry—1 Proteins* pp. 189–228 (Ed. P. F. Fox). London: Applied Science Publishers

Fox, P. F. & Hoynes, M. C. T. 1976 Heat stability characteristics of ovine, caprine and equine milks. *Journal of Dairy Research* **43** 433–442

Ganguli, N. C. 1979 Stability of buffalo casein micelles. *Journal of Dairy Research* **46** 401–405

Hoynes, M. C. T. & Fox, P. F. 1975 Some physico-chemical properties of porcine milk. *Journal of Dairy Research* **42** 43–56

Knoess, K. H. 1980 Milk production of the dromedary. In *Camels* pp. 201–214. *International Foundation for Science Provisional Report* No. 6

Larsson-Raźnikiewicz, M. & Mohamed, M. A. 1986 Analysis of the casein content in camel (*Camelus dromedarius*) milk. *Swedish Journal of Agricultural Research* **16** 13–18

Rose, D. 1963 Heat stability of bovine milk: a review. *Dairy Science Abstracts* **25** 45–52

Yagil, R. 1982 Camels and camel milk. Rome: Food and Agriculture Organization (*FAO Animal Production and Health Paper* No. 26 pp. 14–19)