

UHT Processing of Camel Milk

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Summary

Camel's milk was always an important basic food in the arid regions of Africa. Driven by an ongoing urbanisation process it is increasingly commercialised and consumed in urban areas implementing storage and transport of such milk. To overcome problems of limited access to refrigeration and required shelf life UHT processing of camel's milk could be a suitable preservation method. Different UHT process (heat exchanger and direct steam injection) were investigated aiming at a shelf life of 5 weeks. In contrast to cow's milk UHT processed camel's milk is not stable enough to be stored at ambient temperature.

Introduction



In some arid regions of Africa camel's play a central role as a milk source. Milk yields per day range from 3.5 kg per animal under desert conditions up to 18 kg in irrigated areas. With progressing urbanisation camel's milk is commercialised and emerges on the informal markets of the growing suburbs. Lack of appropriate equipment for storage and transport are reasons for an important contamination risk which together with high ambient temperatures is considered as a certain health hazard. There is a growing pressure and interest for the introduction of appropriate preservation technologies. Heat sensitivity of camel's milk is different compared to cow's milk, and therefore the common heat treatment process has to be adapted taking into account heat stability of proteins, quality of the raw material (i.e. microbiology, enzymes, degradation process) as well as minimal requirements with respect to storage conditions.

Material and methods

Fig. 1: Pilot Plant for UHT processing (100 l/h)

Bulk camel milk was collected from different camel farms in Kenya. The milk was kept refrigerated at 4°C and was delivered to our laboratory within 36 hours. Upon arrival the milk was heat treated (UHT) applying both direct (150°C/2 sec) and indirect method (138°C/4 sec) on a pilot UHT plant (fig.1).

Results and discussion

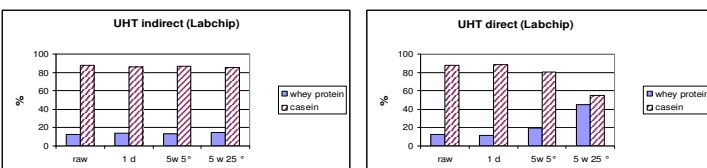
Storage Stability



Fig. 2: After 5 weeks of storage; from the left to the right: UHT direct (EH1): 5°C, 25°C and UHT indirect (EH2) 5°C, 25°C

Sedimentation of protein is the main problem of UHT preserved camel's milk. In contrast to cow's milk camel's milk proteins are much more heat sensitive. Sediment formation occurred with both UHT processing methods (direct and indirect heating) stored at 25°C. Direct UHT together with refrigeration resulted in a mostly stable product. Analysis at weekly intervals during a period of 5 weeks showed little and reversible sedimentation only. However despite of very mild process conditions stability was still unsatisfactory.

UHT direct versus UHT indirect



Proteins: Camel Milk and Cow Milk

Casein and whey protein was determined by SDS-PAGE and Agilent Labchip. In camel's milk the β -lactoglobulin is not detected but an undefined band emerges instead (fig. 3).

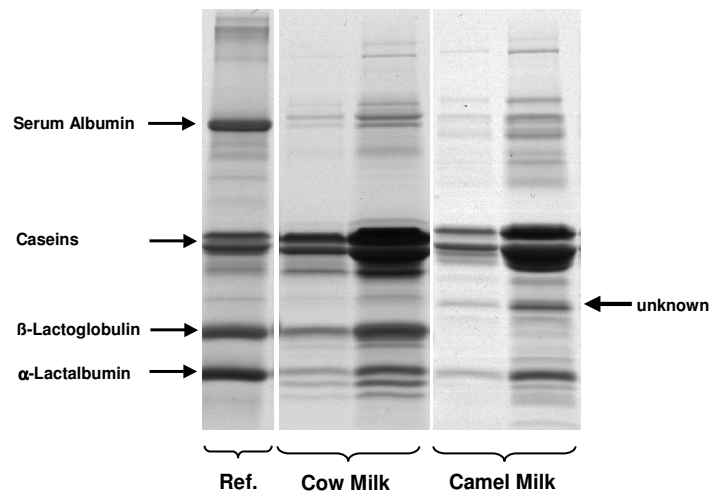


Fig. 3: SDS-PAGE of camel milk and cow milk at two different concentrations

Higher protease activity was detected after direct UHT compared to indirect. The resulting casein degradation could improve the physical stability of the system.

Fig. 4 and fig. 5: Content of casein and whey protein in raw milk and in UHT treated milk at different storage conditions

Conclusion

High heat sensitivity of proteins and therefore separation is the major quality problem in UHT camel's milk. Thus only mild UHT conditions must be applied and refrigeration is necessary to achieve 5 weeks of shelf life. Since one of the major reasons for UHT processing is microbiological stability at ambient temperature it is evident that for camel's milk physical stability must be achieved by adding selected additives.