

## Danida Research Project Policy Brief Haramaya Camel Dairy

### Executive summary

The project “Haramaya Camel Dairy” have removed obstacles for processing camel milk and developed a range of high quality camel milk dairy products. The procedures and processes have been described and made available for anyone to use. Ten young researchers have been educated through the project, two at PhD level and eight at Master level. Haramaya University now has the capacity to support the emerging Ethiopian camel dairy industry. A wider implementation of camel milk dairy technology will benefit the nutritional status of particularly children and it will improve a traditional drought resilient pastoral husbandry. The food security and drought resilience will increase.

The recommendation is to support a wider implementation, in Ethiopia and all other camel rearing regions in Africa and Asia. We recommend Denmark to establish a sector focussed programme open for a wide range of countries in Africa and Asia.

### Project rationale and outcome

The project, “Haramaya Camel Dairy” was for five years supported by a grant of 8 million DKK from the Danish development agency, Danida.

The general aim of the project was to create technologies allowing a better utilization of camel milk. Camels have since ancient times been common dairy animals in dry regions of Africa and Asia. Camel milk constitutes 1% of milk produced globally and 8% of the milk produced in Africa. Camel milk is generally not processed through a dairy infrastructure, but distributed raw through informal marked channels. The reasons for not processing camel milk through the dairy infrastructures have been that the processing properties of camel milk are substantially different from cow’s milk, and most products have been difficult or impossible to produce from camel milk. The consequence is that this valuable resource is underutilized due to poor safety and keeping quality. Large amounts of camel milk are lost due to spoilage.

Camels survive drought quite well and produce milk even during dry seasons. Food security could, however, be further increased through methods to conserve the surplus milk produced during high seasons.

Several of the milk processing problems have in the course of our project, been solved. By conducting the research in Eastern Ethiopia at Haramaya University, we have in addition to solving the problems also established a local capacity for education, research, and scientific expertise to support an emerging Ethiopian camel dairy sector.

Specific outcomes of the project have been:

- Ten young Ethiopian researchers has been educated, two to PhD level eight to MSc level
- The Haramaya University Dairy lab has been equipped for state of the art dairy research
- Characterization of kinetics of syneresis of camel milk using camel chymosin as coagulant
- Characterization of acidification kinetics of standard dairy starter cultures in camel milk
- Proteolysis identified as the bottleneck of lactic acid bacteria in camel milk fermentation
- Indigenous lactic acid bacteria have been isolated for use as starter cultures in camel milk
- Characterizing the microbial quality of locally fermented camel milk

- Simple recommendations for improving artisanal fermented products
- Recipes for production of cheese curd from camel milk
- A soft white brined camel cheese has been developed
- Sensory qualities and ripening properties of the new cheese has been determined

## Implications

The immediate implication of our project is to upscale and implement. The range of camel dairy products developed during the project can be upscaled, produced, and marketed in any camel rearing region of the world. In Ethiopia we are working with two Dairy companies “Addis Kidan Milk Processing” in Awash and “Berwaqo Milk Processing” in Jigjiga. Both companies use the scientific expertise in Haramaya University as their R&D unit, and both companies are upscaling fermented camel milk and camel cheese developed in our project.

Initiatives to accelerate the implementation of camel dairy technology and to expand the geographical impact to other dry regions in Africa and Asia would greatly increase the impact of the “Haramaya Camel Dairy” project.

The scientific implications have been quite significant and not only increased our knowledge on camel milk and camel milk processing. The new insights into casein micelles, fat globules, and lactic acid bacteria have implications wider than camel dairy. Camel milk have become a very useful reagent in fundamental dairy research. We have, also in the applied research, identified new challenges in addition to some unsolved old challenges. So although we solved the goals set for “Haramaya Camel Dairy” continued research holds great promises.

The Business implications can be regarded from different angles: the pastoralists, the dairy business, and the consumers. The pastoralists will benefit from a stable demand for their camel milk. They will probably be able to increase the production, even from the existing number of animals. However, this situation does not arise by itself, dairy processing plants need to be established throughout a large number of villages.

The small dairies can be established by entrepreneurs creating a private business or they can be organised as cooperatives by the pastoralists. No matter which model will become the most viable, it seems that the development could be facilitated through the development of a standardized small dairy with a capacity of 5.000-10.000 kg camel milk/day. This dairy will have a standardized product range consisting of pasteurized camel milk, fermented camel milk, and white brined cheese. A working prototype could be established and this dairy could then be distributed in the form of blue prints available and ready to follow for anyone. It would probably be even more effective to develop a mobile dairy, which can be produced centrally and transported to the site of use and be operational as soon as water is supplied.

A widespread local production of dairy products will benefit local consumers by making safer and better products available. It will benefit the consumers in the cities by offering high quality local products as an alternative to imported dairy products. Consumers worldwide will benefit from access to camel milk dairy products which will increase diversity of choice. The diversity can be a convenience, or a necessity for the few with special needs (e.g. cow milk allergy).

The nutrition of children in Ethiopia is characterized by limited variation and a large fraction of energy derived from starch. A consequence is that a large fraction of the children are stunted. The increased production of local dairy products might make high quality protein accessible and thereby contribute to

a solution of this problem. Milk is, however, expensive in Africa, and the dairy products might not be immediately affordable for the lowest income segment. A widespread local camel dairy sector producing camel cheese will anyhow have a great potential to alleviate the problem of malnutrition although the poorest will not be able to afford the cheese. Cheese production will generate large amounts of whey as by product. Whey is nutritious as it still contains 25% of the milk protein, 30% of the fat, 50% of the lactose and 75% of the minerals of the milk. This by-product will initially be relatively cheap, as the product has not previously been available. Whey will complement cheap starch based staple foods perfectly to give a balanced diet with high quality protein.

With respect to the “UN Development Goals” the primary contribution will be goal 1, 2, 3, and 13 – “No poverty”, by generating a locally anchored business producing products for wider distribution and potentially also for export; “Zero Hunger” and “Good Health and Wellbeing”, through the generation of affordable high quality protein in the form of whey; and “Climate Action”, through the improved yield from a climate resilient drought resistant traditional animal husbandry.

## Recommendations

The recommendation is to spread the new information about camel milk processing and to support any initiative aiming at putting this information to practical use.

The project team wants give the following specific recommendation to Danish policymakers.

As the technology is completely developed and requires relatively unsophisticated equipment it is well suited for implementation in any part of the world with access to camel milk. A program with the focus on implementation of camel dairy technology across all camel rearing regions would benefit millions of people and be cost effective compared to other ways for focussed programmes. The relevant countries would be: In Africa: Algeria, Chad, Egypt, Eritrea, Ethiopia, Kenya, Libya, Mali, Mauritania, Morocco, Niger, Somalia, Sudan, and Tunisia; and In Asia: Afghanistan, India, Kazakhstan, Mongolia, Pakistan, and Turkmenistan.

Denmark could see the development of a camel dairy sector as a special obligation because we have the know-how and a unique experience from developing our own dairy sector. It is, however, also a golden opportunity; the countries listed have 2 billion inhabitants and 30 million camels - quite a number of consumers and potentially a very large new dairy sector to be served by the Danish ingredients industry and the Danish process technology industry.

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