

# TECHNOLOGIES

Developed by

ICAR- NATIONAL RESEARCH CENTRE

ON

# Camel



Institute Technology Management Unit (ITMU)  
ICAR National Research Centre on Camel  
Post Bag- 07, Jorbeer, Bikaner 334001 Rajasthan, India







## **Technologies**

**Developed by**

**ICAR- National Research Centre on Camel**

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## Preface

ICAR-National Research Centre on Camel (NRCC) has key role in advancing the frontiers of Science and Technology in Camel Research. In the recent past, NRCC developed number of technologies and number of them have been popularized. Which was possible through the concerted efforts of the scientists and technical persons. These technologies are being showcased at various events at Institute level as well as in other outreach programmes of the Centre.

At a times, some of the technologies were available with organization but cannot be communicated to industries although the Institute Technology Management Unit (ITMU) of NRCC make sincere efforts for converting innovations into technologies for its ultimate use by stakeholders and the publication titled **“Technologies developed by ICAR National Research Centre on Camel”** is one attempt of the Centre to have a compilation of these technologies for ultimate use by various stockholders may be industries or farmers. I appreciate the efforts of ITMU and inventors of technologies in bringing out this publication. It is hoped that this publication will facilitate a concerted effort to increase transparency between innovators and industry and shall encourage further cooperation between two.



**(N. V. Patil)**  
**Director**



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## 1. CAMEL FERMENTED MILK PRODUCT (DAHI)

- The process of camel milk fermentation was standardized using different combination of heat treatment, incubation and starter.
- The fermented milk product (dahi) was served in three different taste viz., (i) addition of cumin and salt (ii) rose and sugar and (iii) without any flavor.
- The technology is economically viable as no involvement of additional input as compared to fermentation of cattle and buffalo milk and feasible even in rural and field conditions.

## 2. CAMEL MILK CHEESE

- Cheese is a product prepared from milk by the coagulation of casein and carrying with it the rest of the milk ingredients.
- High acceptability was observed in the form of sandwich, cheese spread and pakoras.
- The camel milk cheese contains moisture 61.07%, total solids 38.99%, fat 9% and acidity 0.068% with the yield of 12.17%.



## 3. FLAVORED CAMEL MILK

- Pineapple/Kesar/Chocolate/Vanilla flavoured processed milk with stabilizer.
- Sweet in Taste.
- It contains moisture 83.3 -85.0%, total solids 15.0-16.8%, SNF 11.6-14.5%, Fat 1.6-5.1% and pH 6.38-6.50.





#### 4. CAMEL MILK KESAR KULFEE (KARABH KULFEE)

- Kesar kulfee was prepared from boiled and concentrated camel milk followed by the addition of sugar, custard powder with continuous stirring and after that it was kept for cooling.
- Milk concentrate was added with saffron, dry fruits and essence.
- It was mixed and filled in cones and kept for freezing.
- Moisture and fat contents in camel milk kulfee were 48-50 % and 8-9 % respectively.
- It is low fat product with high quality, rich in micro-minerals and protective protein.



#### 5. ELECTRICITY GENERATED THROUGH CAMEL DRAUGHT

- A power generation and agro-processing unit have been set up for studying camel draught ability and its utility in agricultural operations at the centre.
- This system offers a viable source of eco-friendly energy in the non-electrified rural areas with camel population.





## 6. CAMEL MILK SKIN CREAM

- Fresh raw camel milk is centrifuged and the upper cream layer was separated and used for preparation of camel milk skin cream.
- Results of 3 month trial of Karabh skin cream were very encouraging in imparting fairness and smoothness to skin and with reduction in roughness.
- The spread per unit area was very high.



## 7. ELECTRIFICATION OF TRADITIONAL TWO WHEELED CAMEL CART

- Traditional two wheel camel cart is electrified like other motorized vehicles.
- In this device a 22 inches diameter pulley is attached/fitted with the scan of camel cart wheel. This pulley is attached to another small pulley of 5 inches diameter which enable the small pulley to revolve at about 4.5 times more of the revolving speed of camel cart wheel, on the axis of small pulley one more pulley of 22 inches diameter is attached which in turn is connected by v-belt to small pulley dynamo.
- This enable the pulley of dynamo to revolve at about 20-22 times more than the speed of camel cart wheel.
- This dynamo can revolve at 450 to 600 rpm and can produce 3-4 ampere of electric current, which is used to charge a 12 volt 25 amp battery fitted underneath camel cart. This battery is sufficient for two head lights and two indicator rear lights with a total consumption of 12 volts and 1.5 amp.
- This charged battery can be used by farmers to arrange lights in the remote Dhanis/villages where electricity has not reached.





## **8. COLLECTION OF SEMEN FROM CAMELS, ITS EVALUATION AND PRESERVATION**

- The technique of artificial collection of semen from camels through artificial vagina method has been perfected.
- Freshly ejaculated camel semen exhibits no mass motility.
- It was documented that absence of mass motility in camel semen is apparently due to entrapment of spermatozoa in a unique kind of sperm depot, in which spermatozoa are non-motile.
- Spermatozoa develop motility only after liberation from the depot.
- The liberation of spermatozoa from this depot is a continuous uninterrupted process continuing for a prolonged period.
- Apparently this serves a purpose of sperm bank in the female genital tract.
- It has been observed that although the sperm depot remained non-miscible with the extenders but despite that Tris extender used to extend camel semen can maintain the viability of spermatozoa for several weeks in the laboratory.

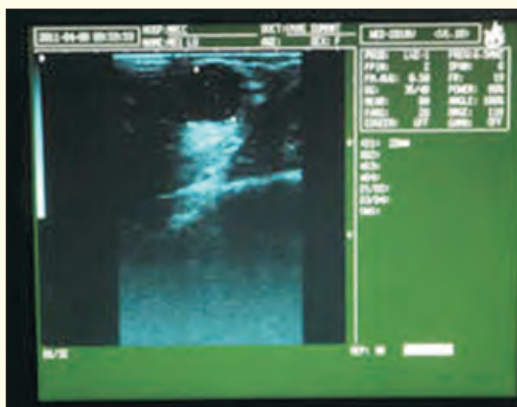
## **9. ELISA AND PCR BASED DIAGNOSIS OF SURRA**

- ELISA based on detection of anti-trypanosoma antibodies and PCR based on ITS-1 and ITS-2 primers for diagnosis of camel surra have been successfully standardized for diagnosis of surra in camel.
- These technologies have greatly improved the efficiency of diagnosis of surra over routinely used field tests.

## **10. EARLY POST PARTURIENT BREEDING**

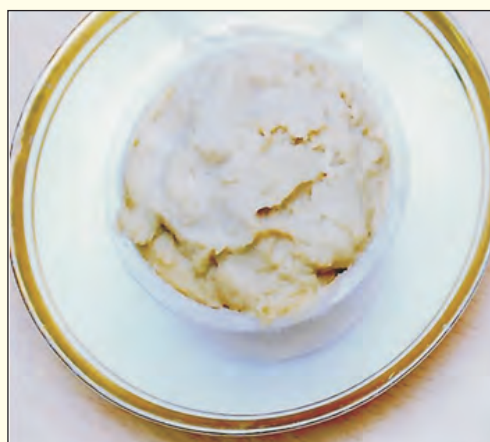
- The long gestation period (390 days approximately) coupled with seasonality of breeding (December to March) makes camel reproduction less attractive economically.
- Traditionally the female camels are bred in one season, calve in subsequent breeding season and then remain sexually quiescent until the following breeding season, leading to long inter-calving period and significant economic losses.
- The research by reproduction unit of the Centre has revealed that it is possible to breed the female camels during early post-parturient period.
- The breeding at 30, 50 or 70 days after parturition have resulted in successful conception in 20-25 percent of the parturient females.
- This is an unorthodox way of breeding reducing the inter-calving period by at least 300 days.

- The adoption of this technique/practice can yield 20 percent more calves from the present adult breedable female camels.
- This technique does not involve costly chemicals or inputs, and only require examination of females by expert.



## 11. CAMEL MILK KHOA OR MAWA

- Hot mawa has butter- like consistency, after cooling it turns into semi-solid dough.
- No change in taste has been observed up to 30 days at refrigerated temperature. It can be kept for longer periods after addition of sugar.
- Moisture, protein, fat, ash and acidity (%) in camel milk mawa were  $28.21 \pm 1.04$ ,  $22.72 \pm 0.52$ ,  $17.577 \pm 0.23$ ,  $7.72 \pm 0.13$  and  $0.63 \pm 0.03$  respectively.
- The sensory evaluation for smell, color, body, taste and overall acceptability for camel milk mawa were found to be satisfactory with score of  $7.43 \pm 0.34$ ,  $6.94 \pm 0.45$ ,  $7.37 \pm 0.37$ ,  $7.62 \pm 0.46$  and  $7.28 \pm 0.29$  respectively on hedonic scale.





## 12. CAMEL MILK GULABJAMUN

- Gulabjamun was prepared from camel milk khoa or mawa.
- Moisture, protein, fat, ash, acidity (%) in camel milk gulabjamun were  $19.92 \pm 0.54$ ,  $5.66 \pm 0.15$ ,  $2.97 \pm 0.21$ ,  $4.23 \pm 0.08$  and  $0.8 \pm 0.01$  respectively.
- The sensory evaluation for smell, color, body, taste, and overall acceptability for camel milk gulabjamun were found to be  $7.61 \pm 0.17$ ,  $8.28 \pm 0.16$ ,  $7.71 \pm 0.19$ ,  $7.93 \pm 0.29$  and  $7.97 \pm 0.15$  respectively on hedonic scale.



## 13. CAMEL MILK BARFI

- Camel milk barfi can be used for at least 3-4 weeks without any change in the taste at room temperature and more than 3 month, when stored at refrigerating temperature.
- Moisture, protein, fat, ash and acidity (%) in camel milk barfi were  $6.23 \pm 0.31$ ,  $13.96 \pm 0.26$ ,  $9.78 \pm 0.51$ ,  $4.01 \pm 0.13$  and  $0.55 \pm 0.03$  respectively.
- The sensory evaluation for smell, color, body, taste and overall acceptability for camel milk barfi were found to be  $7.15 \pm 0.45$ ,  $7.23 \pm 0.54$ ,  $7.54 \pm 0.33$ ,  $6.85 \pm 0.65$  and  $7.04 \pm 0.30$  respectively on hedonic scale.



#### 14. CHOCOLATE BARFI

- It was prepared from camel milk mawa and sugar by mixing them in 4:1:5 ratios along with 10-15% Chocolate powder.
- Moisture and fat contents in barfi were 5-6% and 10-12% respectively.



#### 15. CAMEL MILK PEDA

- The mawa made up of camel milk was mixed with well powdered sugar in 3:1 ratio.
- The mixture was given different shapes. Moisture and fat content in peda were 6-7% and 10-11% respectively.



#### 16. LYOPHILIZED SKIM MILK POWDER

- It was prepared from the raw, pasteurized and boiled camel milk.
- It was white in color with normal odor and salty taste.
- The percent value of moisture and fat in skim milk powder were 5-6% and 1-1.5% respectively.
- A yield of 6.8-7.65 was observed by this method.



### 17. CAMELMILK PANEER

- Paneer can be prepared from the camel milk by using Citric acid and  $\text{CaCl}_2$  for the coagulation.
- The moisture and fat content were 51.245.21% and 18.523.40% respectively.



### 18. CAMELMILK RASOGOLLA

- Chhana made from camel milk plus cow milk and camel milk plus buffalo milk at optimum ratio showed good binding as compared to pure camel milk.



## 19. CAMEL MILK SANDESH

- Chhana and skim milk powder were mixed in different ratios.
- Thereafter, sugar, vanilla essence, cardamom powder were added and mixed until smooth dough is formed.
- Little topping mixture of pista + saffron in each mould was placed.
- The product was kept overnight for chilling and unmoulded.
- Moisture and fat contents in sandesh were 40-50% and 16-18% respectively.



## 20. CAMEL MILK CHOCOLATE

- Processing technology for the camel milk chocolate was standardized utilizing different levels of chocolate powder and sugar in concentrated milk.
- Ingredient - camel milk powder, cardamom and saffron.
- Moisture and fat content in chocolate were 5-6% and 8-10% respectively.



## 21. CAMEL MILK RAABRI

- It is well known that fermented milk product are good for human health.



- Bajara and Moth flour was utilized at different levels in fermented camel milk to develop a good quality raabri.
- Overall acceptability for Raabri was  $7.45 \pm 0.46$ . Moisture and fat contents in Raabri were 80-85% and 2.5-3.5% respectively.



## 22. SWEET LASSI

- Process for production of camel milk sweet lassi was standardized utilizing skim milk powder at different levels to improve its texture and sensory properties.
- Camel milk lassi containing 5% skim milk powder and 10% sugar was found to be highly acceptable.
- Overall acceptability for sweet lassi was  $7.27 \pm 0.29$ . Moisture and fat contents in lassi were 82-83.5% and 2.3-2.5% respectively.



## 23. FROZEN YOGHURT WITH OAT FLOUR

- Oat grains are well known cereal for its health benefits like as a source of dietary fiber, cholesterol lowering effect, beneficial effect in diabetes etc.
- Oat flour was added to camel milk and textural and sensory qualities of the products were assessed.



- Moisture and fat contents in the product were 67-68% and 4.3 -4.6 respectively.



## 24. SPRAY DRIED MILK POWDER

- Moisture and fat contents in spray dried camel milk powder were found to be 3-5% and 9.5-14.1% respectively.



## 25. COMPLETE FEED BLOCK

- Complete feed blocks were prepared by mixing dry and green fodders and agricultural by-products.
- It provides appropriate amount of energy, protein and mineral elements for optimum health and production. It has been proved as a perfect technology for maximizing the efficiency of the utilization of the scarcely available feed and fodder, decrease the fodder losses, provide convenient transportation and storage.





## 26. AREASPECIFIC MINERAL MIXTURE (ASMM)

- Commonly fed basal fodders, trees, bushes and shrubs browsed by camel collected from different 4 agro- climatic zones were analyzed for macro and micro nutrients based on feeding practices adopted by farmers in the area, the deficient minerals in diet of camels under prevalent feeding were worked out. ASMM (CAMIN) was prepared.
- Evaluation of ASMM at farmer door steps was found better for improving the health and production of camels.



## 27. COMPLETE FEED PELLET

- Complete feed pellets having integration of various fodder resources, agriculture byproducts and concentrate ingredients- conventional and non conventional available locally has been prepared on low cost basis.
- The use of complete feed pellet has significantly reduced the feed refusal and has maximized the nutrient utilization for various physiological and production functions like growth, pregnancy and lactation.
- It is suitable technology for the area where draught is common and the performance of camel is affected due to lack of balanced feeding.



## 28. ACIDOPHILUS MILK

- In order to improve the utility and functionality of camel milk, attempts were made to develop acidophilus milk, a probiotic milk product from camel milk.
- Whole camel milk was boiled and sugar was added and then it was cooled and fresh culture of *Lactobacillus acidophilus* was added and incubated at 37°C for 14hr.
- The fermented product thus obtained was cooled; homogenized and rose essence were added.
- The fermented product was packed aerobically in LDPE bags and stored in refrigerator.
- The product was also subjected for sensory evaluation score which was more than 8 on hedonic scale.



## 29. CAMEL MILK YOGHURT

- The whole camel milk was boiled and 12% camel milk chhana was added and allowed cooling up to 35-37°C and 1% starter culture was added.
- It was well mixed and kept at 30°C for fermentation. Total solids after mixing chhana with boiled camel milk were between 14.75-15.50%.
- Initial pH was 6.00-6.06 and after 16h incubation it was 4.19-4.23. The texture of the yoghurt was found improved.





### 30. CAMEL MILK WHEY ENRICHED DRINK

- Whey obtained after making the chhana was mixed with cumin powder and salt was added to taste.
- The pH and protein (%) of the whey beverage was between 5.60-5.62 and 1.10-1.19, respectively.
- No froth formation was observed when it was concentrated at temperature ranges 55-70°C in rotary evaporator.
- Hence whey was allowed to concentrate nearly to half of its original volume to enrich it with high protein.
- The protein (%) in concentrated whey beverage was between 2.22-2.30%.

### 31. SUGAR FREE CAMEL LASSIE

- The production of sugar free camel lassie was standardized by using starter cultures as SARAS dahi culture, NCDC-167 and NCDC-263 at different concentration and at different time intervals with suitable sweetener as per test and essence as saffron, rose and pineapple.
- The sensory evaluation using hedonic scale was conducted and best acceptability was recorded in SARAS dahi culture.



### 32. THORNLESS CACTUS AS AN ALTERNATE CAMEL FEED

- A thorn free cactus (*Opuntia ficus-indica*) has been grown in the NRCC fields as an alternate feed resource and was also tested for its survivability in the geoclimatic condition of Bikaner region.
- The nutritional composition of cactus indicated possibility of use of this cactus in the ration of camels which can met almost one third dry matter need and it can be exploited as source of water.

- 4-5 cultivars of *Opuntia ficus-indica* from different area like Italy, Jordan, Latin America have been tested for its survival and production.



### 33. AZOLLA-SUPPLEMENTARY PROTEIN FEED FOR CAMEL CALVES

- Azolla cultivation has been started with establishment of ponds of the size 1x2 meters having daily production rate of about 1-2 kg per pond.
- The feeding of azolla on fresh basis to growing camel calves is being practiced and it was found to improve the growth rate.





**Technology promotion at KisanMela,  
Muzaffarnagar**



**Camel milk promotion and awareness  
at Public Park Bikaner**



**Show casing of technologies at Camel museum**



**Technology demonstration to farmers**



**Technology demonstration to farmers**



**One day seminar on IPR organized by ITMU**





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