

# DAIRY PROCESSING

## Introduction

Milk is a valuable nutritious food which, if untreated, has a shelf life of only a few days before it spoils. There are however, a variety of preservation techniques applied to milk to extend its shelf life to several weeks or months and also to change its qualities by developing different flavours and textures. For small-scale processing, it is not possible to attempt production of dried milk powder or UHT (Ultra-High Temperature) sterilised milk, but other dairy products are potentially suitable.

To preserve milk it is necessary to destroy or inhibit the action of enzymes and contaminating bacteria. Milk is a low-acid food which contains all of the nutrients required for bacteria to grow. It is therefore a potential cause of food poisoning if not adequately processed. *In all dairy processing it is essential that full and proper hygiene precautions are taken to ensure the safety of the products.*



Figure 1: Milking domestic cattle in Kenya  
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The four main methods of preservation suitable for small-scale operation are:

- Cooling - to extend the shelf life of fresh milk by a day or two.
- Heating - (pasteurisation, sterilisation or concentration) to destroy enzymes and micro-organisms.
- Acidification - to inhibit spoilage or food poisoning bacteria from growing and also change the physical characteristics of milk.
- Separation - of the milk components.

## Cooling

Refrigeration is expensive and milk coolers based on refrigerated brine or other coolants are unlikely to be affordable on a very small-scale. However, for cottage/village or medium-scale processing this equipment is often essential to maintain the quality of raw milk before processing and to cool processed products such as yoghurt, cheese, butter and pasteurized milk for temporary storage before distribution. This operation does not destroy bacteria or enzymes but slows down their activity to extend the shelf life of the products.

## Heating

Milk should be heated to 63°C for 30 minutes to adequately pasteurise it or, if in bottles, to 121°C for 15-20 minutes to adequately sterilise it. Higher temperatures and shorter times are used in larger commercial operations but this type of equipment is very expensive and is not considered to be 'small-scale'.

Pasteurisation can be done in open pans with continuous stirring, then filling the milk into pre-sterilised bottles (100°C for ten minutes in steam or water) and sealing immediately. Sterilisation requires the use of a pressure cooker to achieve 121°C at 104 kPa (15 psi) which increases the capital cost of processing. Milk is filled into bottles which are then sealed and

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placed in the pressure cooker. The temperature and pressure are *gradually* raised and lowered to give the correct processing time. Sterilised milk has a shelf life of several weeks/months if unopened but *extreme care is needed to ensure adequate heating in order to prevent food poisoning*. This is not recommended for inexperienced processors.

Boiling milk to evaporate some of the water and produce a brownish gel is a low technology process which produces a snack food/sweet popular in some parts of Asia. The product has a shelf life of a few weeks and may be used in other foods or have ingredients such as sugar, colour, spices, fruits and nuts added to give variety.

### **Acidification**

The natural acidification of milk occurs by the presence and growth of certain types of harmless bacteria called 'lactic acid bacteria'. These bacteria convert milk sugar (lactose) into lactic acid, this increases the acidity of the milk and causes the formation of the characteristic gel of yoghurt (or curd) and inhibits bacterial growth. The shelf life is extended by several days and the changes in flavour and texture make this a popular product in most regions. The technology involved can be very simple eg inoculating milk, in a loosely covered pan, with some of yesterday's batch and allowing it to ferment at room temperature for several hours. More sophisticated developments include the use of new starter cultures for each batch and packaging in plastic pots sealed with hand operated foil lid sealers.

Cheese making requires more skill and experience than yoghurt production and with the exception of cottage cheese or simple curd cheese, it is recommended that training is obtained from an experienced cheese maker. There are more than 700 recognized types of cheese in the world and care should be taken to find which ones are likely to be popular in your region before contemplating production. Two excellent books on this subject are: 'Traditional Cheesemaking' by Josef Dubach, published by ITDG Publishing/SKAT, and 'Traditional Cheesemaking Manual' by Charles O'Conner of the International Livestock Centre for Africa (ILCA). Contact details for these organisations are shown at the end of this Technical Brief.

### **Separation**

Milk contains fat and a complex mixture of water, proteins and vitamins/minerals. By separating the fat from the watery part it is possible to obtain cream. This product is extremely susceptible to food poisoning and food spoilage. It is not recommended for all except the most experienced small-scale dairies.

By churning cream it is changed to butter which, if prepared and stored correctly, can have a shelf life of several weeks. Clarified butter (ghee) has a shelf life of several months. Both are high value products for which there is often a ready market.

In summary, yoghurt, milk gel and ghee are highly suitable for small-scale operation. Cheese, cream and pasteurised milk require greater care. Sterilised milk requires considerable care and experience to produce a safe, high quality product. Dried milk and UHT milk are not suitable for most small-scale operations.

### **References and Further Reading**

*Dairy Processing: Food Cycle Technology Source Book*, UNIFEM 1996

*Preparation of Dairy Products: Agrodok 36*, Agromisa 1991

*Tools for Agriculture: A Guide to Appropriate Equipment for Smallholder Farmers*, ITDG Publishing, CTA, & GRET 1992

*Rural Dairy Technology, ILRI Training Manual*, International Livestock Research Institute 1995

## Useful Organisations and Contacts

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