



Hygienic milk production

A training guide for farm-level workers and milk handlers in Eastern Africa



TDB

Tanzania Dairy Board

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MODULE 1

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milk handlers in Eastern Africa



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It is our desire and hope that the use of this guide in training programmes will contribute to the improvement of milk quality along the marketing chain and provide income generation opportunities for those involved. We look forward to continued collaboration with the above institutions as we strive to strengthen the dairy industry and cross-border trade in the region.



Foreword

As a dairy farm worker, you know very well how raw milk can get spoilt quickly if good hygiene is not practised during milking or if the milk is kept for long periods at high temperature before being delivered to the collection point. Thus, it is important for you to know what practical steps you can take to ensure that you handle milk hygienically and safely. Maintaining the good quality of your milk is important because once it goes bad at the farm level then it cannot be salvaged later on. With this in mind, the following training guide was developed through collaboration between dairy regulatory authorities in Kenya, Rwanda, Tanzania and Uganda; the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) through its Programme for Agricultural Policy Analysis (ECAPAPA) and the International Livestock Research Institute (ILRI).

This guide is designed to give you basic knowledge on how to produce and handle milk hygienically. Not only will this help you reduce losses of milk due to spoilage, but it will also mean that the milk you produce at the farm is safe for human consumption. The aim of this guide, therefore, is to help you acquire basic knowledge and skills in the following areas:

- How to produce clean milk that is fit for human consumption
- How to handle milk in accordance with good hygienic practice
- Procedures for carrying out basic milk quality tests

The guide is designed to be used during on-site training (2-3 hours per day) at your farm or for outreach training (1-3 days) by a business development service (BDS) provider at a suitable location near your farm. After the training, you will undergo a theory and practical test to evaluate your level of competence in hygienic milk production and handling. If you pass the test, you will be awarded a **certificate in basic hygienic milking and milk handling**.



There are similar training modules for milk collection centre operators, transporters, small-scale traders and milk processors that cover the minimum competencies for hygienic milk handling and processing. A module on basic marketing and dairy business management is not mandatory for licensing of small-scale dairy operatives but is optional for those who desire basic training in this area.

As dairy regulators in Eastern Africa, we recommend this guide for training and certification of farm-level workers.

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HYGIENIC MILK PRODUCTION

Milk from the udder of a healthy cow contains very few bacteria. Poor hygiene introduces additional bacteria that cause the milk to get spoilt very quickly. To ensure that raw milk remains fresh for a longer time, you need to practise good hygiene during milking and when handling the milk afterwards.

Important factors that influence milk quality

Feeding

A well-fed and watered animal will produce high quantities of milk of good composition. If cows are fed a diet that is low in forages and high in starch, the butterfat content may fall below 2.5%.

Thus, a good balance of forage and concentrates is important. You may give the cow feed supplements but be sure to observe proper proportions. Do not feed the cow with silage during milking or shortly before milking, as this will give rise to off-flavours in the milk. It is recommended that silage feed be provided two hours before milking.



Keep your cows well-fed and healthy

Health of the cow

An unhealthy cow will feed less and produce less milk of poor quality. Cows should always be kept healthy and clean because sick animals can transmit diseases like tuberculosis and brucellosis to milk consumers. If you suspect your cow is sick, contact a qualified veterinary practitioner immediately. When the cow is being treated with antibiotics, you must not sell or consume its milk until the withdrawal period is over.



Animal and udder health

Zoonoses

Zoonotic diseases like tuberculosis and brucellosis can be spread to humans through milk. Cows suffering from such diseases should be referred to a qualified veterinary practitioner who will decide on the fate of the animal. Farmers are encouraged to vaccinate their animals against brucellosis. Animals should also be checked periodically for all types of contagious diseases and treated promptly in case of infections.

Mastitis

Mastitis is an inflammation of the mammary glands in the udder caused by infection with disease-causing bacteria. These bacteria can also end up in the milk and result in illness if the milk is consumed. For this reason, milk from cows suffering from mastitis should not be sold or drunk. You can control mastitis by observing general hygiene and proper milking procedures. Hair at the udder should be kept short by trimming. Cows suffering from mastitis should be treated by a qualified veterinary practitioner. Milk from animals that are undergoing antibiotic treatment should not be consumed or sold until the withdrawal period has elapsed because antibiotic residues may cause allergies and drug resistance in consumers.

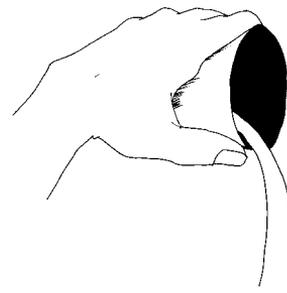
Hygienic milking

It is important to remember that quality control must begin at the farm. That way, your milk will have fewer bacteria that cause spoilage and diseases. In order to ensure good quality and protect the health of consumers, you must always carry out milking in accordance with good hygienic practice. You should observe the following points:

- Maintain clean and healthy cows. Sick animals can transmit diseases to humans through contaminated milk.
- Keep a clean milking environment, free of dust and mud. Garbage and dung in the milking area provide a good breeding ground for rats, flies and cockroaches that may transmit dirt and bacteria to the milk.



- Do not milk cows if you are suffering from communicable diseases like diarrhoea or typhoid, but seek medical treatment and resume milking only when you have fully recovered.
- Do not mix colostrum (the milk produced for the first seven days after calving) with normal milk.
- Wash your hands with soap and clean water before milking.
- Wash the udder with a clean cloth and warm water.
- Dry the udder with a clean dry cloth.
- Make the first draw into a strip cup to check for mastitis and throw away from the milking area even if the milk appears clean.
- Use clean containers for milking.
- Cows with mastitis should be milked last and their milk discarded.
- Milk from cows under antibiotic treatment should not be sold or consumed until 3 days after last treatment or as advised by the veterinary practitioner.
- After every milking, dip the teats into an “antiseptic dip”.



Make the first draw into a strip cup and throw away

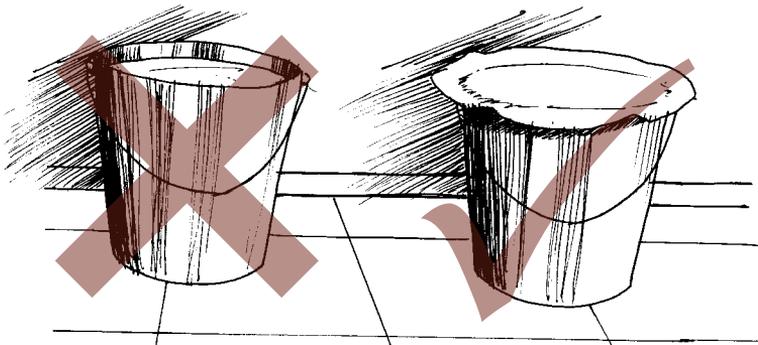


- During milking, the milker should **not**: (a) have long nails, (b) sneeze, spit or cough, (c) smoke.

During milking, do NOT...



- Release the cow from the milking area as soon as milking is finished.
- After milking, sieve the milk through a strainer or muslin cloth to remove solid particles that may have fallen in during milking.
- Cover the milk to avoid contamination.
- Move the milk to a clean and cool area.



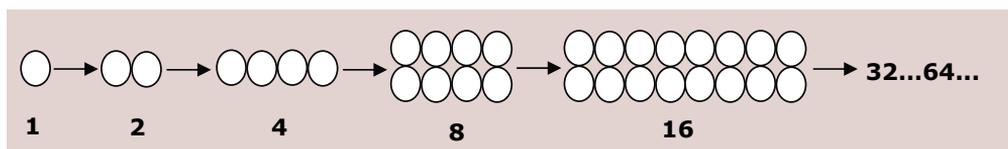
Cover the milk to avoid contamination



HYGIENIC MILK HANDLING

What causes milk spoilage?

It is important for you to know some of the things that can cause milk spoilage so that you can avoid unnecessary losses. Milk is very rich in nutrients. Because of this, the bacteria that cause spoilage can grow very quickly in milk. Bacteria cells grow by dividing into two. If milk is stored at high temperatures for a long time then the bacteria will grow and divide very fast and soon the milk will have a very high number of bacteria and thus get spoilt quickly. Also, if the milk had a high number of bacteria to begin with then it will get spoilt in a very short time.



Bacteria cells grow by dividing into two

Poor hygiene during handling of milk and undesirable practices like addition of water and other substances can introduce the bacteria that cause milk to go bad. Here are some guidelines to follow in order to keep the numbers of bacteria in milk low and avoid milk spoilage:

- Always handle milk in clean metal containers.
- When transferring milk between containers, pour the milk instead of scooping. Scooping may introduce spoilage bacteria.
- Do not milk cows or handle milk if you are sick. Seek medical treatment and resume your work only when the doctor says you are fit to do so.
- Do not store milk at high temperatures.
- Avoid keeping milk for a long time before it is delivered to the collection point.





Scooping may introduce spoilage bacteria

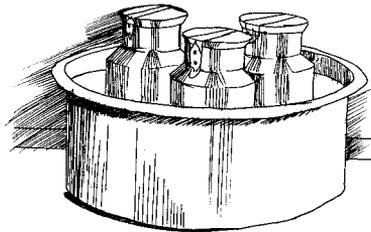


Transfer milk between containers by pouring

How to store milk to reduce spoilage

Because milk spoils easily if it is left at high temperatures for long periods, you need to keep it in a cool place soon after milking. The low temperatures reduce the rate of growth of the spoilage bacteria. If you do not have a refrigerator or cooler, you can store milk in a cold-water bath or wrap the milk can with a wet sack or blanket, but ensure that the milk container is well covered to prevent dirt from entering the milk.

You can store milk safely by keeping it covered...



...in a cold water bath



...in a cool cupboard or wet charcoal cooler



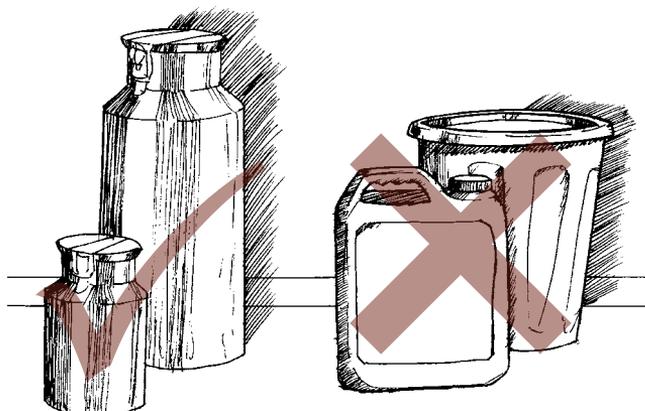
...in a milk can wrapped in a wet sack



Equipment for milk handling and storage

Always use certified foodgrade containers for milking, e.g. aluminium, stainless steel or foodgrade plastic jerry cans designed for single use only. Metal containers are preferable because these are easy to clean and sterilize.

Do not store milk in plastic jerry cans that previously contained paint, herbicides and other chemicals because traces of these substances can taint your milk.



Store milk in metal containers, NOT plastic jerry cans

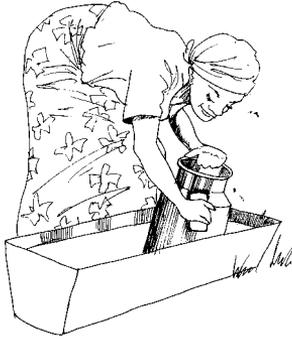
Safe use of cleaning and sanitation detergents

There are various types of cleaning and sanitation agents that have been specially designed to clean and disinfect milk-handling equipment. You may also use food-grade liquid soap, which is a good cleaning agent that also destroys bacteria. Always rinse your equipment properly after cleaning to prevent detergent residues from contaminating the milk.

Cleaning agents should be stored properly and handled with care because some of them may be corrosive to the skin. Always follow the manufacturer's instructions for proper use of detergents.



Procedure for cleaning of milk containers



Scrub container with warm water and soap

Before re-using the milk container:

- Pre-rinse the container soon after use.
- Thoroughly scrub the container with warm water and detergent or soap (using a stiff bristled hand brush or scouring pad).
- Rinse the container in clean running water.
- Dip-rinse the container in boiling water for at least one minute to kill germs. You may also rinse the container by pouring hot water into it.
- Air-dry the container in inverted position on a clean rack in the open.

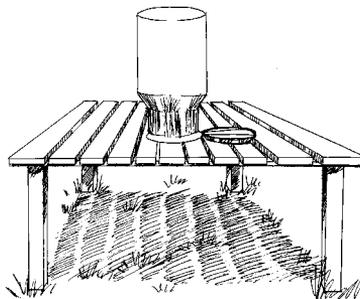


Dip-rinse the container in boiling water for at least one minute to kill germs

OR



Rinse by pouring hot water into container



Air-dry the container in inverted position on a clean rack



BASIC MILK QUALITY TESTS

There are four simple tests for milk quality:

- Sight-and-smell (organoleptic) test
- Clot-on-boiling test
- Alcohol test
- Lactometer test

These tests are routinely carried out at milk collection points to ensure that only milk of acceptable quality is received. Usually during testing, only a small amount (sample) of milk from each container is assessed. If the sample of milk doesn't pass the test, the milk from that container will be rejected and you will bear that loss. Thus, it is important that you handle your milk in accordance with good hygienic practice. The procedures of these milk quality tests are described below so that when you observe the tests being carried out, you can understand and accept their results.

Organoleptic test

This test is performed first and involves assessing the milk with regard to its smell, appearance and colour. This test is quick and cheap to carry out, allowing for segregation of poor quality milk. No equipment is required, but the tester should have a good sense of sight and smell. Milk that cannot be adequately judged in this way is subjected to tests that are more objective.

Procedure

- Open a can of milk.
- Immediately smell the milk and establish the nature and intensity of smell, if any. The milk will not be accepted if it smells slightly sour or has foreign odours like paint or paraffin.



- Observe the colour of milk. Deviation from the normal yellowish-white colour indicates damage to the udder (reddish—blood, or yellow—pus).
- Check for any foreign bodies or physical dirt, which may indicate that the milking and handling were not done hygienically.
- Touch the milk container to feel whether it is warm or cold. This indicates how long milk has taken since milking (if not chilled thereafter) and will influence the lactometer test for adulteration (see below).

Judgement

Abnormal appearance and smell that may cause milk to be rejected could be due to:

- Type of feed or atmospheric taint
- Cows in late lactation
- Bacterial taints
- Chemical taints or discolouring
- Advanced acidification or souring

Marked separation of fat may be caused by:

- Milk previously chilled and subjected to excessive shaking during transportation
- Adulteration with other solids (may also show as sediments or particles)
- Boiling, if milk fat is hardened

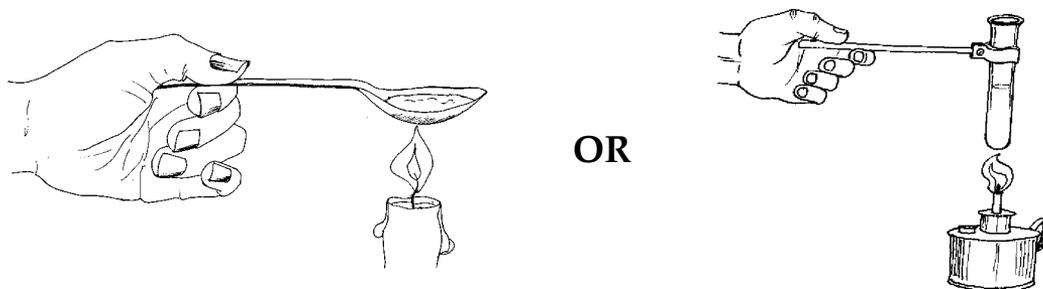
Clot-on-boiling test

This test is quick and simple. It allows for detection of milk that has been kept for too long without cooling and has developed high acidity, or colostrum milk that has a very high percentage of protein. Such milk does not withstand heat treatment hence this test could be positive at a much lower acidity.



Procedure and judgement

- Boil a small amount of milk for a few seconds in a spoon or other suitable container.
- Observe immediately for clotting.
- The milk will be rejected if there is visible clotting, coagulation or precipitation.



Carrying out the clot-on-boiling test

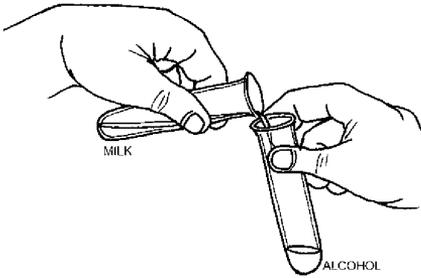
Alcohol test

The test is quick and simple. The specific type of alcohol used is known as “ethanol”. This test is more sensitive to lower levels of acidity and can therefore detect bad milk that may have passed the previous two tests. It also detects milk that has kept for long without cooling, colostrum or milk from a cow with mastitis. Because this test is quite sensitive, milk that passes this test can keep for some hours (at least two hours) before it goes bad.

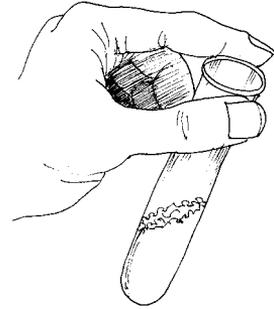
Procedure and judgement

- Use a syringe to draw equal amounts of milk and 70% alcohol solution into a small tube or glass cup (such as those used to administer medicine to children).
- Mix 2 ml milk with 2 ml 70% alcohol and observe for clotting or coagulation.
- If the tested milk sample coagulates, clots or precipitates, the milk will be rejected.



The alcohol test

Mix 2 ml of milk with 2 ml of 70% alcohol



If the milk coagulates, it fails the test

Lactometer test

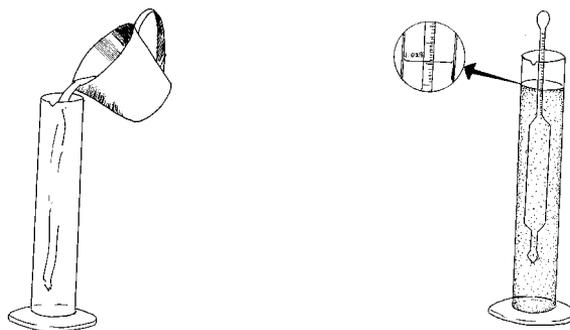
This test is used to determine if the milk has been adulterated with added water or solids. Addition of anything to milk can introduce bacteria that will make it spoil quickly. Adulteration of milk is dishonest to consumers and is therefore illegal.

The lactometer test is based on the fact that milk has a heavier weight or density (1.026–1.032 g/ml) compared to water (1.000 g/ml). When milk is adulterated with water or other solids are added, the density either decreases (if water is added) or increases (if solids are added). If milk fat (cream) is added to milk, the density decreases. The equipment used to measure milk density is called a lactometer. Most lactometers are usually marked from “0” (representing density of 1.000 g/ml) to “40” (representing density of 1.040 g/ml).

Procedure

- Leave the milk to cool at room temperature for at least 30 minutes and ensure its temperature is about 20°C.
- Stir the milk sample and pour it gently into a 200 ml measuring cylinder or any container deeper than the length of the lactometer.
- Let the lactometer sink slowly into the milk.
- Take the lactometer reading just above the surface of the milk.





Equipment used for determining the milk density

If the temperature of the milk is different from the lactometer calibration temperature (20°C), then use this correction factor:

- For each °C above the calibration temperature, add 0.2 lactometer “degrees” (°L) to the observed lactometer reading.
- For each °C below calibration temperature, subtract 0.2 lactometer “degrees” (°L) from the observed lactometer reading.
- Note: These calculations are done on the lactometer readings (e.g. 29 instead of the true density of 1.029 g/ml).

Examples of how to calculate the true lactometer readings when the milk temperature differs from the calibration temperature of 20°C

Milk temperature °C	Observed lactometer reading °L	Correction °L	True lactometer reading °L	True density g/ml
17	30.6	- 0.6	30.0	1.030
20	30.0	nil	30.0	1.030
23	29.4	+ 0.6	30.0	1.030

Judgement

If the milk is normal, its lactometer reading will be between 26 and 32. If the lactometer reading is below 26 or above 32, the milk will be rejected because it means that it has been adulterated with added water or solids.



REMEMBER!

- ➔ **Quality assurance begins at the farm.**
- ➔ **Good hygiene practice in milk production and handling is the key to milk quality and safety.**
- ➔ **Cooling milk will slow down the growth of spoilage bacteria and prolong the milk's shelf life.**
- ➔ **But milk that already has many bacteria in it will not keep for long, even when cooled.**
- ➔ **Good milk quality means good profits for your farm.**



APPENDIX

Training curriculum and minimum competencies for farm-level workers

Target Group	Course Title	Type of course & location	Course units (sessions)				
Farm-level workers (milkers, handlers)	Hygienic milk production	Residential/on-site/outreach	Milk production				
Subunits	Objectives (Competency sought)	Course content	Duration		Training method/materials	Evaluation	Award
			Theory	Practical			
1. Hygienic milk production	Milkers and milk handlers knowledgeable and skilled in production of safe and clean milk	Factors influencing milk quality Feeding Animal health Milking practices	1 hour		Lectures Discussions Questions & answers Participatory adult learning techniques	End of course theoretical written or oral test End of course practical test	Pass or fail
		Animal and udder health - zoonoses - mastitis	45 min				
		Hygienic milking	45 min	2 hours			
2. Milk handling	Milkers and milk handlers knowledgeable and skilled in hygienic milk handling	Factors contributing to milk spoilage	½ hour		Lectures Discussions Questions & answers Participatory adult learning techniques Hands-on milking practice		
		Types of milk handling & storage equipment	½ hour				
		Cleaning and sanitation agents	½ hour				
		Cleaning & sanitation of equipment	½ hour	1 hour			
3. Basic milk quality tests	Milkers and milk handlers knowledgeable on basic milk quality tests and reasons for raw milk testing	- Sight and smell (organoleptic) - Alcohol - Clot on boiling - Lactometer	½ hour	2 hours	Lecture Discussion Demonstration Hands-on testing		
			5 hr	5 hr	End of course theoretical/oral ½ hour) and practical (1 hour) test	Certificate in basic hygienic milking & milk handling	

Residential courses are carried out at training institution/farmer centres for the entire duration of the course; on-site training involves shorter training sessions of 2-3 hours per day at a farmer's premises/community centre over a period of 1-2 weeks to cover the 40-hour module. Outreach training involves BDS training provider conducting training sessions at or near clients' location for 1-3 days on continuous basis.



