

Hygienic and Quality Milk Production

Training Package for Dairy Extension workers



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SNV



Developed with
Dairy Training Centre

Hygienic and Quality Milk Production

Part I Training manual

Part II Training Guideline

Preface

SNV Ethiopia, through EDGET project (Enhancing Dairy Sector Growth in Ethiopia, 2013-2018), engages in the capacity building, extension services and innovative support to the Ethiopian dairy sector particularly working with smallholder dairy farmers. The aim of the project is to increase milk production and productivity in order to double the income of the smallholder dairy farmers. EDGET is operational in the regions Oromia, Amhara and SNNP, and working with 65,000 dairy farming households.

The project works closely together with livestock regional bureaus and their respective zonal, woreda and kebele staff in delivering extension and other supports. One area of collaboration is the development of practical training and coaching tools and materials for extension workers based on a need assessment.

SNV has engaged the Netherlands based Dairy Training Centre (DTC) for the development of the Training package for extension workers. The documents were more elaborated and validated with the utmost contribution of high level experts from regional Livestock and Fisheries resources Development Bureaus/Agencies and Research Centers from the three operational regions of EDGET.

Overall nine training packages were developed on Breed Improvement and Fertility Management; Dairy Cattle Feeding and Nutrition Management; Dairy Cattle Health Management; Dairy Farm Management; Dairy Housing and Manure Management; Farm Economics; Forage Production and Management; Hygienic and Quality Milk Production; Young Stock Management.

This training package is on **Hygienic and Quality Milk Production.**

SNV, also on behalf of the experts that contributed and DTC, would hope to see the materials widely used outside the project areas by all interested dairy development practitioners. The materials will be available in hard copies and soft copies including on SNV website www.snvworld.org and other relevant websites.

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Abbreviation

CMT	California Mastitis Test
DPU	Dairy Processing Unit
°C	Degree Celsius
°F	Degree Fahrenheit
GDP	Gross Domestic Product
ILRI	International Livestock Research Institute
L	Litre
MCC	Milk Collection Centre
MTS	Milk Transporting System
SDD	Smallholder Dairy Development
SNF	Solid Not Fat

I. Hygienic and Quality Milk Production Training Manual

1. Introduction

Milk is produced from the mammary glands of mammals and it is a soul food for offspring of mammals. It contains in a balanced form all the necessary and digestible elements for building and maintaining the human and animal body. It contains immuno-globulins that helps newly born against different diseases. Also due to having various properties, it can be easily convert into different milk products and to use it as an ingredient for other food items. Smallholder dairy farmers in Ethiopia produced sour milk, butter and cottage cheese for home consumption as well as for sale.

Milk is an ideal environment for microorganisms like bacteria to multiply, especially in warm conditions. Microorganisms may cause souring of the milk and hence rejection by the consumer or the milk collector. Filtering the milk after milking removes visible dirt like hairs and larger pieces of soil and dung, but not the very fine dirt particles or the invisible bacteria. Good standards of hygiene are of the utmost importance for the quality of the milk and its products, as well as for the producer since the milk price often depends on quality; poor quality milk will be rejected. Thus, the dairy farmer should take action on his/her dairy farm management activities (housing, feeding, milking and health issue) for the production of clean and hygienic milk.

The consumer wants a safe product and the processor needs good quality milk for processing. The handling of milk strongly affects the quality of the finished product. On leaving the udder milk from a healthy cow contains a negligible quantity of bacteria and no dirt. If good hygiene is practised the contamination outside the udder can be kept to a minimum. This manual deals with milk quality and hygiene under smallholder dairy production system. Milk quality and hygiene activities are pay vital role under dairy production system and should not be under estimated. Milking activity, transportation, storage and processing activities can determined milk quality and hygiene.

2. Characteristics and Composition of Hygienic and Quality Milk

Milk, a white fluid of low viscosity and slightly sweet taste. It is a yellowish-white non-transparent liquid, has a pleasant, soft, and carries hardly any smell. Milk when it emerges from a healthy udder contains only a very few bacteria. Milk contains a natural inhibitory system, which prevents a significant rise in the bacteria count during the first 2 - 3 hours. If milk is cooled within this period to 4°C, it maintains nearly its original quality. Timely cooling ensures that the quality of the milk remains good for processing and consumption. The bacterial load in fresh raw milk should be less than 50,000 per ml when it reaches the milk collection centre or dairy processing unit.

Hygienic milk only originates from mastitis free and healthy animals. Cows suffering from a disease may secrete the pathogenic bacteria, which cause the disease, in the

milk they produce. In addition, unclean equipment also will allow microorganisms to grow rapidly. However, milk is a perishable product. It is an ideal medium for microorganisms to contaminate and invade with microorganisms easily.



Figure 1 Clean milk produced from clean cows and clean environment

Fresh milk has a pleasant soft and sweet taste and carries hardly any smell. Also it is very sensitive to the conditions to change/loss the normal flavours. Consumer acceptance of milk is greatly affected by its flavour. There are several factors which may produce off-flavours and/or odours in milk (For detail information refer Annex 2 of this manual). Feed type, barn (both unclean and poor ventilated house), transport, sunlight, storage equipment and temperature are common factor that change the normal milk flavour and here is some example of abnormal flavours:

- Feed and weed flavours
- Strong smelling plants, like wild onion or garlic
- Strong flavoured feedstuffs such as poor quality silage
- Cow-barn flavours from dung, etc. These are found when milk is obtained from a dirty or poorly ventilated environment or from improperly cleaned milking equipment.
- Rancid flavours. These are caused by excessive agitation of milk
- during collection and/or transport. Damage of the fat globules in the milk results in the presence of free fatty acids.
- High acidity flavours
- Oxidized flavours, from contact with copper or exposure to sunlight
- Flavours from the use of chlorine, fly sprays, medications, etc.

A. Clean and Standard Milk

Clean milk

- Milk that obtained from well managed and healthy cow
- Milk with good taste and flavour
- Containing no more foreign material
- Containing less number of bacteria and the bacteria should not be harmful

Why clean milk

- Clean raw milk has good keeping quality
- High quality dairy products can only be made from clean milk
- Clean milk protects the health of the consumer
- You can obtain higher prices for clean milk (raw milk as well as dairy products)

Standard milk

- Ranges from white-yellow
- Depends on breed and feed of the animal
- The white colour is from casein and P
- The yellow colour is from carotene
 - Cream removed off milk shows slightly bluish colour (whey – riboflavin – bluish)

About 87% of milk composition consists of water and 13% are nutritionally important components, such as proteins, carbohydrates, lipids, minerals and vitamins. The gross energy supplied by milk can be calculated from its lactose, protein and fat contents. The metabolically available energy is approximately 4.0, 4.1 and 8.9 kcal/g (16.8, 17.0 and 37.0 kJ/g) for lactose, protein and fat, respectively. It is excellent source of high quality protein, vitamins and minerals. It represents one of the best natural sources of essential amino acids for human nutrition. Moreover, milk is an outstanding source of calcium and phosphorus to build bones and teeth. Similarly, milk is the most nutritious and it can attributes for the growth, reproduction, energy source, maintenance and repairs of body.

Although, milk produced by mammals using their mammary gland, the chemical and physical properties of milk of among various mammalian species widely varied (Table 1). These variations of milk chemical and physical properties are different even between breeds of similar species and between individual animals within the same breed type.

Table 1 Average gross composition of milk (%)

Species	Total solids	Fat	Protein	Lactose	Ash
Human	12.4	3.8	1.0	7.0	.0.2
Cow	12.7	3.7	3.4	4.8	0.7
Goat	12.3	4.5	2.9	4.1	0.8
Sheep	19.3	7.4	5.5	4.8	1.0
Horse	11.2	1.9	2.5	6.2	0.5
Donkey	11.7	1.4	2.0	7.4	0.5
Domestic rabbit	32.8	18.3	13.9	2.1	1.8
Camel	12.9	4.2	3.7	4.1	0.9

Source: *EIAR, 1995*

B. Factors affecting physical and chemical properties of milk

- **Season** (Fat and SNF show slight but well defined variation during the course of the year)
- **Yield** (increase in yield per milking the percentage of lactose increases, while fat and non-fatty solids decrease)
- **Age** (Fat percentage increase up to 3rd lactation and after wards decreases. SNF will be high in the first lactation and slightly decrease as lactations increase)
- **Milking interval** (milking interval increase fat percentage decrease)
- **Completeness of milking** (fore milk contain less fat than stripping (last milk))
- **Irregularity in milking** (changing milking time intervals results less fat and not much effect on SNF)
- **Lactation effect** (milk yield increases and attains maximum within 2-4 weeks)
- **Exercise** (more exercise increase fat in milk as body fat is metabolized. No effect on SNF)
- **Excitement** (sexual or freight excitement causes decrease in fat, no-effect in SNF)
- **Hormones** (prolactin and thyroid hormone, essential for milk synthesis and increase the fat% Estrogen has stimulating and depression effect)
- **Udder disease** (Mastitis and other udder disease cause low lactose and casein%, increase in chloride content)
- **Physiological condition** (cow condition at the time of parturition has effect on fat and SNF content)
- **Pasture feeding** (pasture feeding increase both fat and SNF)
- **Feeding** (Feeding oils as palm oil, coconut oil increase fat%. Starvation increases unsaturated fatty acids in milk)

Hygienic and Quality Milk Production and Handling

3. Hygienic and Quality Milk Production and Handling

3.1 Hygienic and Quality Milk Production

Milk is the main output of a dairy farm and it is source of income and nutrition for the farm owner. Thus, dairy farmer must ensure that milk produced in clean and hygienic way to improve his/her benefits from the farm. Otherwise, wider ranges of issues are arising such as:

- From the public health point of view, milk is a very good media for bacterial and other microorganisms development so that can easily be predisposed by infected milk during production, handling, transporting and marketing.

As business, the dairy farmer is not generate income (it is rejected by collector as well as consumer).

- Thus, the dairy farmer should take action on his/her dairy farm management activities (housing, feeding, milking and health issue) for the production of clean and hygienic milk such as:
 - Keep the milking cow in well ventilated and clean barn
 - Make sure that the milking area is clean
 - Milking activity should be done by well experience person
 - Keep the milking cow clean particularly the teat before and after milking
 - Check the health record before starting milking
 - Make ready all the necessary milking equipment
 - Keep the milking time
 - Feed the milking cow good quality feed
 - Removed/avoid unclean feed
 - Floors of dairy buildings must be made of hard and washable surface. Walls should be smooth and washable to about 2 meters from floor level and painted with light colour.
 - Doors should be self-shutting while windows should be rendered insect proof by mosquito netting to keep flies out.
 - Rooms should be kept clean and in good repair.
 - Wash hands with clean water and soap before handling milk
 - Wear clean over-clothes and gumboots while handling milk
 - Not be suffering from a communicable disease or have an open sore or abscess on arms, hands, head or neck.
 - Do not cough or sneeze over milk or milk containers

3.2 Hygienic and Quality Milk Handling

Buckets, milk cans and cloths for cleaning the udder and cloths used for straining the milk are frequently the source of bacterial contamination of the milk. Therefore all product-contact surfaces should be kept cleaned immediately before and after use; Equipment and utensils should be disinfected immediately; Equipment repairs and maintenance should preferably be carried out.

i. Utensils for the harvested milk

- The milk bucket
- The strainer (filter)
- The milk cans (transport)
- Measuring cup
- Other utensils contacting the milk for consumption
- Milking and transport can (MTS) or Mazzi can (see Annex 4)
- The surface of the milk utensils like buckets and cans should be smooth and without seams and have rounded edges to make them easy to clean.

ii. Utensils for checking the milk

- Strip cup
- CMT tester

iii. Utensils to support the milking process

- Milk chair
- Restraining materials
- Cloth or towels to clean the cow
- Small bucket for water

iv. Utensils for cleaning

- Water troughs
- Detergents
- Brushes
- Disinfectants
- Storage rack

3.3 Cleaning and disinfecting utensils

Good standards of hygiene are of the utmost importance for the quality of the milk and its products, as well as for the producer since the milk price often depends on quality. Use three troughs (buckets) with water for the procedure.

- A trough with 20-40 litres of cold or warm water, with a dark brush
- A trough with 20-40 litres of warm water (about 40-50°C) with a white brush with a dairy detergent added (0.15%)
- A trough/bucket with 10-15 litres of cold water to which has been added the right quantity of disinfectants (hypochlorite)

Remember:

- Bacteria do not like:
 - ✓ lack of food (applied cleaning),
 - ✓ lack of moist (dried utensils upside down, well ventilated)
 - ✓ daylight (in the sun also UV light as a disinfectant)

Separate the utensils in different groups like mentioned in chapter “utensils”

Start cleaning group 1 as described below:

1.  +  (water + black brush)

Use the brush and water only for the outside of the utensils to be cleaned. Also do cleaning next to the trough so that the dirty water can run away immediately. This dark brush is coming in contact with manure rests and should be kept out of any "milk touching surfaces" at any time (sanitation)

2.  +  +  (water + White brush + detergent)

Use the brush and water only for the inside surfaces of milk utensils. Water goes back into the trough after being used.

Detail: the strainer is considered to have inside surfaces only, so goes straight away into trough number 2. and is cleaned in- and outside with the white brush. *This includes the strainer cloth*

3.  +  (Water + disinfectant)

Put the cleaned utensils in the disinfectant water, make sure all surfaces are in contact with the disinfectant.



Figure 2 Drying milk utensils in a rack

Continue cleaning group number 2 and 3 following the same procedure. Before doing this *remove the white brush from trough 2.*

This is to prevent this brush being infected with manure related bacteria!

After cleaning, store the brushes with the hairs down wards. They will dry better and last much longer because the wooden handles will keep dryer and not rot. Finally, do not use the water troughs for other purposes than cleaning milking utensils only!! Place the utensils upside down on a store rack (Figure 2). Preferably, in a well ventilated place in the sun.

Disinfection of dairy equipment may be carried out by means of:

- **Steam** - Steaming should be done for 10 - 15 minutes after the condensate has attained 85° C.
- **Hot water** - Hot water at 80 °C (use soft water only to prevent deposition of salts) for at least 20 minutes in circulation cleaning for 15 minutes at 85° C
- **Detergents/disinfectants** - used as part of the cleaning process at temperatures between 45-60° C in manual cleaning and for cold milk lines, storage tanks and tankers.

4. Determinants of Milk Quality

a. The milking cow

The cow as a source of pathogens: Different sorts of disease may occur in cattle, different sorts of zoonosis are present on the skin and in the cow. Particularly, the teat (the *interior and exterior* of the udder) can be a major source of bacterial contamination of milk (Refer dairy cattle health manual). Cleaning the cow before milking is necessary to prevent the entry of bacteria, present on the cows teats, into the milk.



Figure 3 Cleaning the udder and teats

Physical cleaning of teats before milking is essential for lowering sediment in milk. Sediment in milk is generally due to poor pre-milking hygiene procedures that allow soil and other materials to enter the milking system. Proper environmental conditions are important in order to maintain cow cleanliness and to reduce soil on animals so that pre-milking hygiene procedures can be effective. Sediment in milk is measured by filtering the milk through a fine filter and visually examining it. High sediment levels in milk are associated with dirt and increased potential for bacterial contamination, thus adversely influencing milk quality. A clean or new filter sock fitted correctly before each milking will assist in reducing sediment levels.

b. Milking utensils

Unclean milk utensils play a vital role in affecting the quality of milk. Thus, it is important that the utensils are properly cleaned and *dried* before and after milking (Figure 4). If milk handling equipment is not cleaned immediately (30 minutes) after milk removal, milk residues adhered to milk contact surfaces, and the adhesion as well as dryness of the residue increases with time. The residue forms a deposit that is difficult to remove while washing, and provide nutrients that support the growth of many microorganisms which contaminate the milk.

It is, therefore, important that, milk handling equipment should be cleaned or washed immediately after milk removal.



Figure 4 Cleaning milking utensils

Store milking utensils upside down: Drying milking utensils on a drying rack after washing is important practice for the production of clean milk as exposure of milking equipment to sunlight during drip drying will enhance killing of the microorganisms as well as logging of water from milking equipment. Insufficiently dried milking equipment may leads to massive growth microorganisms in milking equipment and enhances the risk of contamination of milk.



Figure 5 Storage of clean milking utensils

c. Pathogens

Miscellaneous sources of bacteria in milk microorganisms occur in the air and in dust particles originating from manure, soil and feed.

d. Milking house

It is one of the factors affecting quality of milk (Refer Dairy housing and manure management manual). The milking barn or area must be kept clean and, to facilitate cleaning, the floors and walls should be constructed of smooth-surfaced

concrete or other impervious material. Adequate lighting is needed to carry out milking and cleaning operations satisfactorily and proper ventilation is required in the milk house to avoid condensation on the walls and ceiling.

e. Personal hygiene

The health of milker and personnel handling milk, is of considerable importance. The milker should be healthy, clean, have short and clean finger nails and wear clean clothes. He or she should milk the cow paying full attention to the task and not smoke, spit or cough while milking. The cow should be milked as quickly and completely as possible, and preferably always milked by the same person. By calm and gentle handling, touching the cow, talking to her and maintaining routine actions during milking, she will feel at ease.

5. Quality and Hygienic Milking Practices and Procedures

5.1 Quality and hygienic milking practices

Important points to consider for the production of clean milk and milk products are summarized below:

- I. Udder washing:** The body of the cow should be free of soil, dirt, manure, and contamination of milk from external sources such as animal hairs, dust, flies and dirty water dripping from the cow's body should be minimized. Before milking, the udder should be washed with clean water. A clean cloth or, if possible, disposable towels should be used. Udder washing stimulates milk let-down and release of the hormone oxytocin which acts on the milk secretory (alveolar) cells, causing release of milk.
- II. Use of strip cup:** A strip cup should be used to check for mastitis in each quarter before milking starts. In case of mastitis, the milker can keep the mastitis milk separated from the good milk.
- III. Milking:** Avoid using dusty bedding and avoid feeding animals during milking. Milking equipment should be clean and well maintained. A proper milking technique should be used to avoid teat damage.
- IV. Milkers:** Milkers and milk handlers should be in good health and their hands should be clean and free from cuts and sores. Wash hands with clean water and soap before milking.
- V. Milk house:** The milking barn should have a good floor that is easy to clean and drain. There should be good ventilation, lighting, and facilities for manure disposal and washing cows. A good supply of clean water is required. Clean regularly the milk house.
- VI. Cooling milk:** Cooling milk is essential to prevent an increase in bacterial numbers and spoilage of the milk. If cooling facilities are lacking on the farm, the milk should be brought to the collection centre, at least two hours after the start of milking.
- VII. Washing milk utensils:** Both the inside and outside surfaces of all milk utensils should be washed according to the protocol in chapter 3. Careful application of the above-described preventive measures helps reduce significantly the risk of contamination of milk and milk products by spoilage as well as pathogenic microorganisms thereby provide wholesome and safe product to the consumer.

5.2 Quality and hygienic milking procedures

Step 1: Preparing milking items

- Milking pail
- Graduated jug of one litre
- Milk strainer or sieve (muslin cloth)
- Milk cans (MTS) or bulk container
- Towel of 20 X 20 cm (2 towels/cow)
- Dip cups and Strip bowel
- Surgical glove
- Disinfectant: 4% Sodium hypochlorite (40% bleach + 60% clean water)
- Waste basket and Milkers seat
- Rope

Step 2: Apply milking order

- Start milking with first calvers
- Follow by uninfected cows,
- Segregate chronic mastitis cows, milk them last

Step 3: Provide well-managed and clean cows

Step 4: Wash udder with a clean towel.

- Washing the udder not only makes it clean, but also stimulates milk let-down.

Step 5: Clean teats for milking

- Wear clean surgical gloves
- Wipe dirt and debris from the udder
- Clean teats and udder using towel wetted by the disinfectant
- Use a clean towel to dry the teats and udders
- Do not put soiled towels into the disinfectant
- Use more than one towel, if necessary, to dry the teats
- Wring out excess water from the towel
- Completely clean teats from base of udder to end of the teats
- Pay special attention to the tip of the teats where the opening is located
- Disinfect hands

Step 6: Fore-strip all teats

- Squirt milk onto black surface of strip-bowel (2 times)
- Abnormal milk may appear watery, bloody, or have clots or flakes
- If any abnormal milk is observed, stop milking and refer to animal health professionals
- Helps to check for abnormal colour or presence of blood clots. This may indicate infections like mastitis. The fore milk should be discarded.

Step 7: Use a strip cup. Remove the fore milk into a strip cup.

Step 8: Teat pre- and post-dip

Pre and post teat dip procedures are important to remove visible dirt and microorganisms from the outer surface of the teats. Moreover, such practices reduce the risk of occurrence of environmental mastitis in the farm.

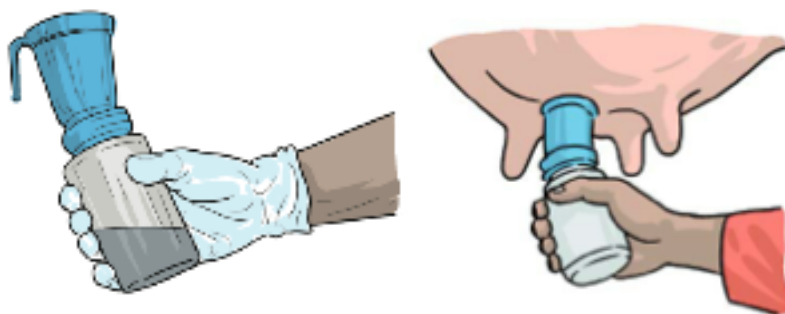


Figure 6 Dipping cow teats in disinfectant

Thus, milkers should practice pre and post teat dip procedures during milking as such practices play an important role in minimizing the risk of milk contamination with spoilage and pathogenic microorganisms at farm level.

- Immerse at least 3/4 of the teats into pre-dip disinfectant
- Allow 30 second contact time
- Dry with a clean individual towel
- Disinfect hands and dry
- Dip teats in a post teat dip disinfectant (iodophor or hypochlorite) Prevents infection of the udder.

5.3 Milking

The utensils to be used for milking should be made of non-absorbent, corrosion resistant material, could not be scratched easily, should have smooth surface and should be free from dents as well as easy to clean. Aluminum and stainless steel equipment are mostly preferred.

Steps in hand milking

- Take hold of the base of the teat
- Squeeze with thumb and forefinger
- Close the other 3 fingers and squeeze them in turn
- Repeat this in a rhythmic way
- Milk quickly and evenly (remember 7 minutes of let-down)
- Sit at the right side of the cow preferably and use both hands alternating during milking.
- Start milking both front teats, turn milking the hind teats and crosscheck to finish in the same order.

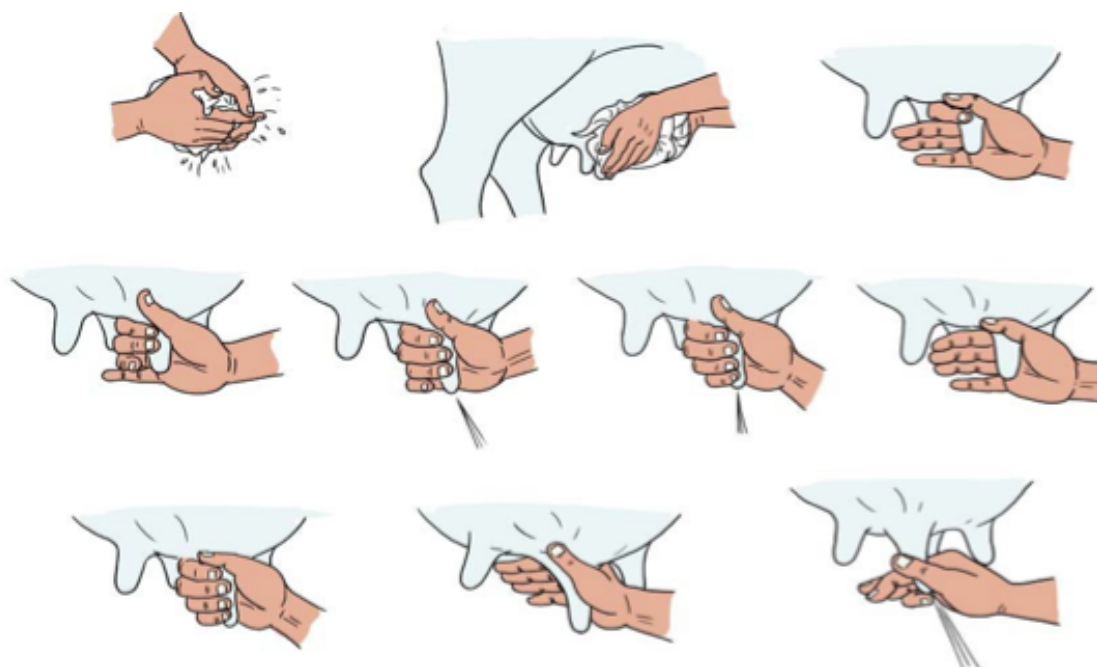


Figure 7 Step by step method of hand milking

Key note on Hand milking practices:

A skill needs some practicing and routine. Using the right technique is essential for the health of the udder and the condition of teats.

For young cows in first lactation, it is wise to restrain the legs to teach the animal the feeling of being restrained. This is necessary to make sure that an animal will accept being restrained when later in case milking will be painful due to for instance a wound.

Many farmers restrain the legs of the cow during milking always, although cows that are well trained can be milked properly even in the open field without any restraining.

Tips after milking

Mastitis is an udder infection that can occur due to many reasons. After milking the cow the sphincter in the teat tip is open. Bacteria that possibly cause mastitis can enter the udder easily. The sphincter will stay open for about an hour.

Dipping the teats with a special teat dip right after milking can help to prevent udder infections. Next to that it will help to keep a cow standing for more than an hour directly after milking. In a zero grazing unit it will help for instance to make sure fresh feed is available directly after milking for each cow. An eating cow is standing. At the end of milking using teat cream or teat dip is advisable.

By recording the amount of milk of each regularly, it is easy to keep an eye on the production performance of each cow. Changes in milk production of individual cows or the total herd rapidly may have a health or management reason.

Use a scale or a measuring cup to find out the amount of milk produced and write it in a recording book. Most importantly use the information for management reasons!

6. Milk Storage and Transport

Equipment used for milk handling, storage and transportation determine the quality of milk, and might be the main source for the contamination of milk with microorganisms. The use of plastic equipment is not advisable as the surface is easily scratched by the common cleaning systems, which makes it difficult to clean and provide hiding places for microorganisms. This allows the multiplication of microorganisms during the intervals between milk handling. Plastic equipment is also unsuitable for milk handling as they are sensitive to heat and prolonged exposure to cleaning agents. Due to these facts, the use of plastic equipment for milk handling can be a potential source for the contamination of milk with spoilage and pathogenic microorganisms, and make the milk unsafe for both consumption and processing before it reaches to its final destination points.

Therefore, milk handlers need to pay particular attention for the type of milk equipment to be used. Aluminum cans or stainless steel equipment is preferred for milk handling. In addition to milk vessels being made of the right material they should:

- Have smooth finishes free from open seams, cracks and rust
- Have wide openings such that every surface that comes into contact with milk can be accessed easily for cleaning and sanitation. In this regard, both metal and plastic containers with dead ends should not be used for handling and storage of milk.
- Be used only for handling and storing milk

6.1 milk transport

Milk must be transported from producers to processors to consumers. Because milk is a very perishable product, transporters must ensure high levels of hygiene, speedy transport and careful handling. This will minimize losses due to spillage and spoilage, avoid contamination of milk by pathogens, and also increase the profits from your milk transportation business. Vessels used to transport milk must meet the specifications in the code of hygienic practices. Vessels made of copper or copper alloys should not be used for milk as copper oxidises butterfat, resulting in off-flavours. Aluminium and stainless steel containers are ideal. Non-food grade plastic cans, buckets and jerry cans must not be used.

6.2 Milk storage

Milk and milk products should be stored in clean conditions at appropriate temperature and humidity to prevent deterioration or permit maturation. Never add milk of a



Figure 8 Stainless steel or aluminium milk cans and buckets

cow with mastitis to cans for delivery to the MCC or DPU. Also, do not deliver colostrum or any milk produced by a cow less than 5 days in lactation. Although there is no reason to consume this milk in the processing plant it will give problems.

NEVER! Deliver milk of a cow treated with antibiotics, this milk is dangerous even for home consumption. Withdrawal period of milk of animals treated with

antibiotics vary! The considered waiting (withdrawal) time is found in the instructions of use found in and on the package materials of the medicine. This waiting time starts from the moment of LAST treatment.

All utensils contacting milk for consumption must be clean and disinfected. Bacteria found in milk shortly after milking come from this source for more than 90%. Milk cans, strainers and milk buckets should be made of stainless steel or aluminium or food grade plastics such as mazzi can.

Be aware of milk taking odour from surrounding substances (think of fuels, chemicals, feeds etc.) Give attention to prevent this!

To filter the milk often cloths are used. These cloths or any other filter materials used more than one time must be cleaned and disinfected after each milking and it must be dried properly afterwards (in full sunshine). Filters used improperly are famous sources of bacteria in milk. Besides a hygienic way of working and clean utensils the



Figure 9 Milk filtering

bacterial number found in milk is also influenced by storage time and temperature. When the temperature of stored milk stays high, bacteria can multiply (double in number) every 20 minutes.

If milk is arriving at the MCC or DPU within 2-3 hours after finishing milking the first cow at the farm the number of bacteria found in milk is only influenced by working hygiene.

All milk transport vessels should be cleaned in the same way as outlined for milk cans above. There should be provision for water at milk cooling centres to enable ALL milk suppliers' vessels or cans to be rinsed with cold water.



Figure 10 Common equipment for collection and transporting milk

Bulk milk or In-can (MTS can) milk transportation

- To make sure milk will arrive at the MCC or DPU fresh with a low bacterial count storage and transport of milk must be organized well
- Insulated, so the milk will remain cold until it reaches the plant (provided the transport is fast, i.e. short distance or good roads enabling milk to be delivered before the temperature of milk rises above 10° C).

Chilling milk at the farm:

When arrival at MCC or DPU will take longer than two hours, everything that can be done to reduce the temperature of milk directly after milking has a positive effect on the reduction of multiplication of bacteria later. Even a reduction of the milk temperature by only 10 degrees from 35° C to 25° C is very effective. Simple methods of chilling milk like putting the cans at a cool (windy) place or in a cool water bath will help to maintain a better quality of milk.



Figure 11 Electrical or solar operated can cooler

Methods that are more sophisticated need investment.

A modern method to chill milk at farm (or farmers group) level is an electrical or solar operated milk can cooler. It allows good harvested milk to be stored longer and maintains milk quality.

For the buyer of the milk, usually the processor, a lower bacteria count increases the possibilities to make better products. In a cooperative, this means a higher price can be paid for milk.

7. Quality Milk Control Method and Standardization

Milk quality control is the use of various tests to ensure that milk and milk products are safe, healthy, and meet the standards for chemical composition, purity, and levels of bacteria and other microorganisms. Production of quality milk is a complicated process. It is the concern of different dairy value chain actors such as:

Milk producers: with a good quality control system, farmers can get a fair price in accordance with the quality of milk.

Milk processors: the milk processor who pays the farmer can be sure that the milk is of good quality and is suitable for making various dairy products.

Consumers: they will pay a fair price, e.g. moderate price for medium quality, high price for excellent quality.

Government agencies: with a good system, the government can protect the health of consumers, prevent contaminated and sub-standard products, and ensure that everyone pays or receives a fair price.

NB: All this is possible only if we have a proper system for quality testing and assurance, which conforms to national or internationally acceptable standards.



Figure 12 Quality milk grants quality milk products

7.1 Milk sampling at collection centres

After the milk has left the farm where it is produced, the first control takes place when it arrives at the milk collection centre or at the DPU. Information is required about the quantity, quality, hygiene, composition, water content, etc. This is needed to determine the payment that the producer will receive for his or her milk.

There is no need to test the whole quantity of milk – we can test only a small sample, to check the quality. Accurate sampling, however, is essential for a proper quality control system. Liquid milk in cans and bulk tanks should be thoroughly mixed to

disperse the milk fat. Then, a sample for testing is taken from the can, using a plunger or a dipper. In the case of packed products, representative samples must be taken to make sure that the samples actually reflect the whole batch.

7.2 Common milk tests at small scale dairy plants

Quality control must begin at the farm where the milk is produced. Farmers must use the correct practices for milk production and handling; and observe government regulations about adulteration of milk, use of veterinary drugs on lactating animals etc.

At the milk collection centre, all milk from different farmers (or bulked milk from different collecting centres) must be checked before processing. This checking, using organoleptic, bacteriological and chemical quality tests will ensure that milk is safe and healthy.

The following common tests can be applied during milk collection and reception at the Milk collection centre and/or the milk plant.

7.2.1. Organoleptic tests

In these tests the milk quality is judged by the use of a person's senses view, smell, and taste. The organoleptic tests are always used for the first screening of the incoming raw milk. In order to judge the appearance of the milk, remove the lid of the milk container and note the appearance of the surface of the milk and the lid, note any abnormal colour of the milk, visible dirt and particles, changes in viscosity etc. The tester smells the milk, observes the appearance, checks the can for cleanliness, looks for sediment, flies, etc. and tastes if necessary.

7.2.2. Lactometer or density test

If during the organoleptic inspection the milk appears to be too thin and watery and its colour is "blue thin", it is suspected that the milk contains added water. The lactometer 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. The test is based on the fact that the specific gravity of whole milk, skim milk and water differ from each other. With a lactometer the specific density of milk is measured.

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. 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.
- Make sure lactometer is floating and it is not touches the side of cylinder or its bottom.

- When lactometer becomes stationary, take scale reading. It should be taken from the line on the scale which is in level with the surface of the milk.
- Note down the temperature, if the temperature is according to standard (20°C), no need to correct the lactometer reading.

If the temperature of the milk is different from the lactometer calibration temperature (20°C), then use the following 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).

Table 2 Lactometer reading correction for lactometer calibrated at 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.



Figure 13 Lactometer test

7.2.3. Clot-on-boiling test

This test is performed simply by heating a small amount (5 ml) of milk in a test tube over a flame or by immersing it in boiling water for four minutes. The result can be seen immediately. If the milk is sour or if the milk is abnormal (colostrum or mastitis milk) the milk will clot and not pass this test.

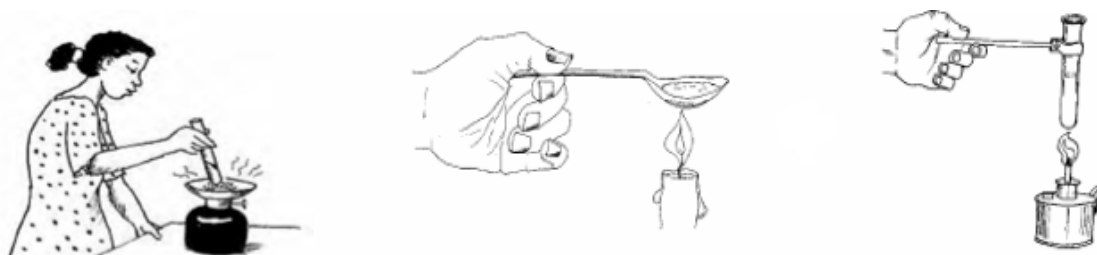


Figure 14 Different methods of clot-on-boiling tests

7.2.4. Alcohol test

The alcohol test is used for rapid determination of an elevated acidity of milk. The test is carried out by mixing equal quantities (2 ml) of milk and of a 68% or 70% ethanol solution in a test tube (See Figure 15). Alcohol gun (see figure 16) is the best alternative for advanced farms/collection centres. If the milk contains more than 0.21% acid, this results in coagulation of the milk proteins and the milk is sour. The milk will clot and is not fit for any process which involves heating, like pasteurization.

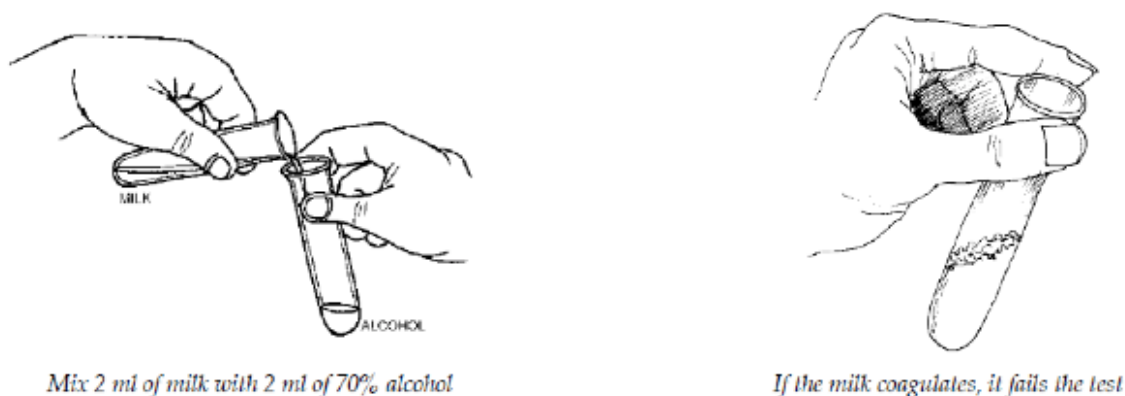


Figure 15 Alcohol test procedures

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. It is based on tendency of milk protein to get unstable as a result of disturbance in the mineral balance of milk. Milk with high developed acidity, or having calcium and magnesium compounds in greater than normal amounts, will coagulate when alcohol is added. Increased levels of albumen (colostrum milk) and salt concentrates (mastitis) may also results in a positive test. Because this test is quite sensitive, milk that passes this test can keep for some hours (at least two hours) before it goes bad.



Figure 16 Alcohol gun (side and back view) for milk stability test

Use only pure ethanol, free from additives, for alcohol stability tests of raw milk. Ethanol with additives, so called denatured ethanol, gives false results with raw milk. Raw milk of good quality may precipitate (clot) if denatured ethanol is added, regardless of the concentration.

7.2.5. Lacto scan or lactic check

Milk quality test by using lacto scan or lacti check at laboratory level is essential. The laboratory should be able to control the following:

- Quality of raw milk during collection and at reception;

Various quality aspects related to processing;

- Quality of the finished milk products;
- Quality of the milk products during storage and distribution;
- Cleanliness and hygiene at the milk processing plant.



Figure 17 Milk test using lacti check

LACTOSCAN SA

Parameter	Measuring range	Accuracy
Fat	From 0.01% to 4.0%	± 0.05%
SNF	From 24.0 to 47%	± 0.15 %
Density	From 1020 to 1030 kg/m³	± 0.1 kg/m³
Protein	From 2.4 to 12%	± 0.15%
Lactose	From 4.0 to 10%	± 0.20%
Adjust Water content	From 0 to 10 %	± 0.5%
Temperature of milk	From 0 to 40 °C	± 1 °C
Freezing point	From -0.400 to -1.700 °C	± 0.005 °C
Salts	From 0.4 to 4%	± 0.05%
pH	From 3.0 to 14	± 0.05%
Conductivity	From 2 to 14 mS/cm	± 0.05 mS/cm

Lactoscan MCC

Parameter	Measuring range	Accuracy
Fat	From 0.01% to 4.0%	± 0.05%
SNF	From 24.0 to 47%	± 0.15 %
Density	From 1020 to 1030 kg/m³	± 0.1 kg/m³
Protein	From 2.4 to 12%	± 0.15%
Lactose	From 4.0 to 10%	± 0.20%
Adjust Water content	From 0 to 10 %	± 0.5%
Temperature of milk	From 0 to 40 °C	± 1 °C
Freezing point	From -0.400 to -1.700 °C	± 0.005 °C
Salts	From 0.4 to 4%	± 0.05%
pH	From 3.0 to 14	± 0.05%
Conductivity	From 2 to 14 mS/cm	± 0.05 mS/cm
N ₂	From 0 to 100 mg	± 1.0 mg

Lactoscan LA

Parameter	Measuring range	Accuracy
Fat	From 0.01% to 4.0%	± 0.05%
SNF	From 24.0 to 47%	± 0.15 %
Density	From 1020 to 1030 kg/m³	± 0.1 kg/m³
Protein	From 2.4 to 12%	± 0.15%
Lactose	From 4.0 to 10%	± 0.20%
Adjust Water content	From 0 to 10 %	± 0.5%
Temperature of milk	From 0 to 40 °C	± 1 °C
Freezing point	From -0.400 to -1.700 °C	± 0.005 °C
Salts	From 0.4 to 4%	± 0.05%
pH	From 3.0 to 14	± 0.05%
Conductivity	From 2 to 14 mS/cm	± 0.05 mS/cm

Figure 18 different types of Lactoscan with their accessories

Table 3 Chemical composition of milk under laboratory tester (lactoscan)

Parameter	Measuring range	Accuracy
Fat	%45 – 0,01	%0,06±
Solids-non-fat (SNF)	3% – 40%	%0,15±
Density	1160 – 1000 kg/m ³	0,3±kg/m ³
Protein	2% – 15%	%0,15±
Lactose	%20 – %0,01	%0,2±
Added water	%70 – %0	3±
Milk sample temperature	°5C – 40 °C	%1±
Freezing point	–°0,4C to –°0,7C	%0,005±
Solids	%4 – %0,4	%0,05±
PH	14 – 0	%0,05±
Conductivity	14 – 2 [mS/cm]	%0,05±
Weight From	150 – 0 kg	0,10± kg

7.3. Milk Standardization

The fat content of milk varies with species (cow, sheep, goat, and buffalo), animal breed, feed, stage of lactation, and other factors. In order to provide the consumer with a consistent product, most milk in the most countries, is standardized. Milk standardization means adjusting the fat content in milk to the exact percentage required. Different products require different percentages. The percentage can easily be calculated and adjusted.

To achieve standardization, milk is processed through centrifugal separators to create a skim portion and a cream portion of the milk. Separation produces a skim portion that is less than 0.01% fat and a cream portion that is usually 40% fat, although the desired fat content of the cream portion can be controlled by changing settings on the separator. The cream portion is then added back to the skim portion to yield the desired fat content for the product. Common products are whole milk (3.25% fat), 2% and 1% fat milk, and skim milk (< 0.1% fat).

Based on the federal feed and drugs administration of Ethiopia (FDA) before 1998 the milk and milk products standardized and soled with the following aspects

- The Fat content of the Row milk for sale not less than 3.25%
- The Fat content of the milk 0.5-2.0% labelled as “reduced-fat”
- The Fat content of the milk 1 % labelled as “low-fat”
- The Fat content of the milk less than 0.5% is skim milk
- The Fat content in the processed cream 18% labelled as light cream and more than 36% cream labelled as heavy cream.

Pasteurized milk: The fluid milk that boils or pasteurized a high temperature short time (HTST) continuous process of at least 161°F (71.6°C) for 15 seconds. These conditions provide fresh tasting milk that meets the requirements for consumer safety.

8. Summary of Hygienic and Quality Milk Production

The market value of milk for processing depends on the technical quality of the milk delivered. Although the milk price and acceptance often is based on simple common tests, accepted milk is not always of the best possible quality. Even in between the MCC and DPU the quality of milk can change (bacterial growth). Chilling the milk takes time and allows bacteria to multiply and possibly sour the milk. At all places where milk of different suppliers (farms) is mixed, the poorest quality milk delivered deteriorates and makes the quality of the group.



Figure 19 Milk delivery at Dairy processing unit

Farmer must be aware that quality cannot easily be seen with the naked eye. Besides bacterial quality also sanitation level, butterfat and protein content of the milk has influence on the market value. Payment based on milk composition therefore is beneficial for farmers, but it takes time and lab tests to determine correctly. The final quality of dairy products depends on the weakest link in the whole chain from farmer to retail.

Good milk has:

- High fat and protein
- Low number of bacteria per ml.
- No dirt
- No antibiotics residues
- No adulterations
- Low number of somatic cells per ml.
- Produced by healthy cows
- Handled by healthy people

Note

It is important to keep records of all milk that is collected. The goal of these records is to keep track of the quality and quantity of milk that is produced and delivered by the individual members of the MCC or DPU. This information is needed to determine the amount of money each farmer will receive. As a matter of accuracy these records should be kept in a book and not on loose papers. The book should be kept in a safe place.

Records should be kept of:

- The quantity of the milk delivered by each producer;
- The quality of the milk;
- The temperature of the milk
- The hygienic status of the milk and the containers;
- The composition of the milk (results of milk testing);
- The added water or skim milk to the milk.

All efforts made to milk hygiene and quality production destination is to get wholesome product thereby satisfying consumer needs!!

All efforts made to milk hygiene and quality production destination is to get wholesome product thereby satisfying consumer needs!!



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Annex

Annex 1. Sensory evaluation of milk & dairy products

Good quality milk should have a pleasantly sweet and clean flavour with no distinct aftertaste. Because of the perishability of milk and the nature of milk production and handling procedures, the development of off-flavours/odours is not uncommon. To prevent flavour/odour defects in milk, proper milk handling procedures from the farm to the consumer are essential. This guideline will describe the common flavour and odour defects found in milk and their potential causes. These defects may be classified according to the ABC's of off-flavours:

Absorbed/Transmitted

Bacterial/Microbial

Chemical/Enzymatic/Processing

Absorbed -- feedy, barny, cowy, weedy, unclean, lacks freshness, stale, refrigerator/cooler odours.

Raw or pasteurized milk products can absorb flavours during production, storage and distribution. On the farm, off-flavours can be absorbed, or more correctly transmitted, through the bloodstream of the cow from the lungs and/or rumen into the milk in the udder (e.g., onion/garlic, feedy, barny, cowy). Similar off-flavours may be absorbed into the milk during farm storage if ventilation is poor and the milk is not protected. Pasteurized milk can absorb flavours during refrigeration storage, especially in paperboard or low barrier cartons. Examples of off-flavours that might be absorbed include volatile compounds of fruits or vegetables or unclean odours associated with poorly cleaned milk coolers. Absorption of flavours by packaged milk can occur at the plant, in the supermarket or in the consumers' home refrigerators.

Bacterial -- acid, bitter, malty, lacks freshness, unclean, fruity/fermented, putrid and rancid.

Bacterial and other microbial (i.e., yeast or moulds) off-flavours result from the growth of microorganisms that are present in milk due to poor sanitation and/or milk handling practices. Bacteria that are able to grow at refrigeration temperatures ($\leq 45^{\circ}\text{F}/7.2^{\circ}\text{C}$), or *psychrotrophic* bacteria, are most often responsible for spoiling refrigerated milks. The type of spoilage (e.g., fruity, rancid, acid) depends on the predominant type(s) of bacteria present and generally occurs when bacterial numbers (i.e., Standard Plate Count) exceed one to ten million per millilitre. The time it takes for bacteria counts to reach spoilage levels depends on the initial numbers of bacteria and the temperature of storage; the warmer the storage temperature, the quicker bacteria grow and produce off-flavours and the shorter the shelf-life. If the raw milk quality is good and post-pasteurization contamination is prevented during processing, the numbers of microorganisms should not reach spoilage levels before 14-21 days when milk is held under proper refrigeration. Bacterial and other microbial defects can occur in raw or pasteurized milk and in other dairy products.

Chemical -- cowy (ketosis), salty, rancid, bitter, oxidized, sunlight, foreign, astringent, medicinal, flat, cooked.

Chemical and enzymatic defects can occur in both raw and pasteurized milk. The cows may be suffering from ketosis (rare) or mastitis, which can affect milk flavour.

Abusive handling of raw milk may result in a rancid flavour from the action of the naturally occurring lipase enzyme, which breaks down butterfat to free fatty acids (i.e., butyric acid is perceived as “rancid”). Oxidized flavours can be induced by heavy metals, particularly copper, or by exposure to sunlight and fluorescent lights. Chemical or foreign off-flavours can also occur due to contamination with cleaning chemicals, sanitizers, medicines, or other substances during production or processing. Processing parameters, if not managed properly, can result in off-flavours including cooked (from high heat) or flat (from added water).

Annex 2. Characteristics of milk off-flavours

Typical Milk No criticism. Very little distinct odour, pleasantly sweet and clean with no aftertaste.

Acid Basic taste sensation. Sour, tart, may cause tingling sensation on tongue. "Cultured milk" or "sour" odour may be present.

Cause - Growth of lactic acid producing organisms such as *Lactococcus lactis*, due to poor refrigeration, especially when temperatures exceed 70°F (21°C). "Malty" milks may be acid also.

Astringent Peculiar mouth-feel, tongue & mouth lining feel shrivelled, puckered, chalky (e.g., cranberry juice).

Cause - Associated with denatured proteins due to high heat treatments or with staleness (e.g., milk powder). May be more pronounced in skim milks and in Ultra High Temperature (UHT) or Ultra-Pasteurized (UP) products. Occasionally occurs with slight rancid, bitter or acid milk.

Barny Unpleasant odour and taste of a poorly maintained barn or unpleasant feed. May be perceived as "unclean." "Cowy" or "cow's-breath" may present a similar defect but generally with an unpleasant medicinal or chemical (i.e., acetone) aftertaste.

Cause - absorbed, transmitted odour/flavour due to cow inhaling barn odours associated with poor ventilation and unclean barn conditions. Similar defect may be due to ketosis in cows, but with more of a medicinal or chemical after taste (see cowy).

Bitter Basic taste sensation. Pure bitter has no odour. Taste sensation is detected on the tongue after expectoration (delayed) and tends to persist. (e.g., hops in beer, coffee may be bitter)

Cause - enzymatic breakdown (microbial or milk enzymes) of milk proteins to short bitter peptides. Certain weeds ingested by cows may also cause bitterness although this is rare.

Cooked Note odour and flavour. Varies in intensity from sweet, pleasant, with slight sulphurous or custard notes, to caramelized or cabbage-like, which may be objectionable. Flavour usually becomes less intense over time but may persist depending on packaging material.

Cause - Higher pasteurization temperatures and/or longer holding times. Intensity depends on the severity of heat treatment. Cooked flavours tend to be more pronounced in batch-pasteurized than HTST milk; most pronounced in Ultra High Temperature (UHT) or Ultra Pasteurized (UP) products.

Cowy Unpleasant odour & flavour; "acetone" or "cow's-breath"; unpleasant medicinal or chemical aftertaste.

Cause - metabolic disorder in cows such as acetonemia or ketosis. Rare in commingled bulk supplies. Similar defect may be transmitted/absorbed odours of poor barn conditions (i.e., barny).

Feed Odour & flavours is characteristic of associated feed; silage, hay, grassy, etc. Can be slightly sweet, generally not unpleasant, although could be unclean when strong or feed quality is poor. Most feed flavours clear up readily after milk is discharged from mouth. Common, though most often slight.

Cause - cows consume particular feed or inhale feedy odours prior to milking; transmitted to the milk. Feeding should be done after milking when practical, barns should be well ventilated.

Flat No odour. Lacks mouth-feel, flavour fullness, and/or sweetness of fresh milk. Watery characteristic.

Cause - adulteration with water or low milk solids content. Older milk may be "flat."

Foreign May have odour and/or flavours that is not commonly associated with milk. Often "chemical" in nature. Depends on causative agent; sanitizers, detergents, exhaust fumes, cow medications, citrus fruits, etc. Chloro-phenol compounds may give "medicinal" or "bandage-like" flavour.

Cause - Contamination of milk with foreign substance. May be direct contamination of the milk (e.g., udder ointment/chemical sanitizers, phenols/chlorine); may be transmitted through the cow or absorbed during raw storage or through retail packages in plant, store or home refrigerators.

Fruity/ Odour and flavour is usually pronounced, similar (*not exact*) to pineapple, apple, strawberry or other **Fermented** fruit (*fruity*); may have more of a sauerkraut or vinegar-like odour or flavour (*fermented*).

Cause - growth of psychrotrophic spoilage bacteria, especially certain psychrotrophic *Pseudomonas* species or some of the spore-forming organisms (e.g., *Bacillus*, *Paenibacillus*).

Garlic/Onion Characteristic pungent odour and flavour. Highly objectionable.

Cause - Animals ingesting wild onion or garlic weed; may also be absorbed through packaging during refrigeration storage with onion or garlic containing foods.

Lacks- Lacks fine, pleasing flavour. Mild off-flavour that lacks specific characteristic to make identification

Freshness easy. May be "stale" or less sweet (e.g., "flat"). Generally not intense enough to fail product.

Cause - Usually due to age, staleness, residual milk enzymes or initial stage of microbial spoilage (e.g., psychrotrophic bacterial off-flavours such as unclean, bitter and rancid).

Malty Malt-like aroma or taste (like malted milk or Grape-Nuts®). May be similar to feed or cooked odours, but is considered a severe defect as microbial spoilage. Milk often is acid as well.

Cause - Growth of *Lactococcus lactis* var. *maltigenes* (or possibly other organisms) due to poor refrigeration. May be followed by "acid" or "unclean" flavours.

Oxidized / Odour and taste of burnt-protein, burnt-feathers, or medicinal or plastic-like taste. May progress to **Light-Induced** metallic or lipid oxidized type flavour due to fat oxidation.

Cause - exposure of milk to sunlight or fluorescent lights resulting in protein degradation and/or lipid oxidation. Milk in unprotected or transparent milk jugs/bottles is more susceptible although this defect may occur in paper packaging if the light is intense and exposure time is sufficient.

Metallic- Wet cardboard, oily, tallowy, chalky, or fishy flavour. Odour (old veg. oil) is pronounced when defect

Oxidized is intense. May have a lingering greasy or puckery mouth-feel. Sensation comes quickly.

Cause - milk fat oxidation catalysed by copper or certain other metals contacting milk (e.g., copper pipe, white metal, metallic water supply). May be associated with raw milk of cows fed high fat feeds (e.g., soybeans) and/or lack of antioxidants (e.g., vitamin E). Sometimes occurs spontaneously. Raw or cream-line milk is more susceptible than pasteurized homogenized.

Carton/ Plastic-like or wet paper flavour. Subtle, rarely pronounced unless there is evidence of carton

Paperboard burning during the sealing process.

Cause – associated with paper-board packaging with heat used to seal HDPE polymer coating. Generally more apparent in half-pints due to increased package surface area to volume ratio.

Rancid Pungent odour when extreme. Taste soapy, unclean, bitter, blue cheese-like or “baby vomit.” Provolone cheese has a rancid flavour profile. Pronounced lingering aftertaste. Sensitivity varies.

Cause - free fatty acids (e.g., butyric acid) released from milkfat by natural or microbial enzymes (lipase). In raw milk it's associated with excessive agitation, temperature abuse or cow factors (e.g., poor health and/or nutrition). Pasteurization destroys natural enzyme (lipase), but spoilage microorganism may have similar enzymes that cause rancidity.

Salty Basic taste sensation. No odour. Generally easily detected. Clean mouth-feel.

Cause - associated with late lactation or mastitic cows. Would be rare in bulk supplies.

Unclean Unpleasant odour and taste. Mouth fails to clean up after expectorated. Suggestive of mustiness, putrid, “dirty dish-rag” or other “unclean” flavours.

Cause - generally due to growth of spoilage microorganisms in milk or on excessively dirty equipment. Can occur due to milk absorbing odours from dirty coolers or environment.

Annex 3. Ethiopian standards on dairy products

A. Specification Standards:

1. Unprocessed whole milk – ES 548:2005
2. Pasteurized liquid milk – ES 3462:2009
3. Sweetened condensed milk – ES 3463:2009
4. Evaporated milk – ES 3464:2009
5. Milk fat products – ES 3465:2009
6. Butter – ES 3461:2009
7. Pesticide residue limit for milk & milk products – ES 578:2001
8. Yoghurt and sweetened yoghurt – ES 403:2001
9. Flavoured yoghurt – ES 411:2001
10. Whey cheese – ES 509:2001
11. Cream – ES 550:2001
12. Whole milk, partly skimmed milk and skimmed milk powder – ES 3459:2009

B. Density of milk

The specific gravity of milk measured at 15.6 °C shall be within the range of 1.026 to 1.032.

C. Bacteriological grades

Total plate count (ES ISO 6610)

- a) Very good quality less than 50,000 per ml
- b) Good quality 50,000 – 100,000 per ml

NOTE – milk with a total plate count above 100,000 per ml shall not be offered for sale.

Coliforms (ES ISO 5541-1, ES ISO 5541-2)

- a) Faecal coliforms nil per ml
- b) Non faecal coliforms not more than 10 per ml

Annex 4. Multipurpose uses of Mazzi can

የማዚ ኃን አያያዝና አጠቃቀም

ማዚ ኃን

- ዕቃው የተሰራበት ግብንት ወተቱን የማይበክል ማጠራቀሚያ ነው
- ጠንካራና ቀላል ነው
- እፅ ሰፊ በመሆኑ ውስጡን ሙሉ በሙሉ በቀላሉ ማጽዳት ይቻላል
- በማለብም ሆኖ በማንኛው ወቅት ፍላጎት እያኖርም ስለዚህ ብክነትን ይከላከላል፤ ንጽህናንም ይጠብቃል
- በቀላሉ ሊታይ የሚችል የመስፈሪያ ልኬት አለው
- በማንባበር ማንኛውን ይቻላል

ማጥለያ

- በቀለሙ ጥቁር ነው
- ከጡት ቁስሎች ውስጥ የሚመነጩ የቆሻሻ ጠብቃዎችን በቀላሉ ሊያሳይ የሚችል ነው
- የማጥለል ብቃቱ የወተት ጥራትን ያሻሽላል
- በማለብ ወቅት ፍላጎት የመቆጣጠር ብቃት አለው

የንጽህና መመሪያ

- በተለመደ የንፅህና መጠበቂያ መንገድ መጠቀም
- በንጹህ ውሃ በጥራት ማለቅለቅ



የማዚ ኃን ማጥለያ እንዳለዎ ያረጋግጡ



ለማለብ መጀመሪያ ማጥለያውን በማለቢያው እፍ ላይ በማድረግ ወደ ቀኝ ማዞርና መግጠም





ማጣሪያው የተገጠመለትን ማዚ ኃን ወደ ላሟ ጡት ስር በማቅረብ ማለብ



አለባው ከተጠናቀቀ በኋላ ማጥለያውን በጥንቃቄ በመፍታትና የወተት ማጠራቀሚያውን በደንብ በመክደን ወደ ተፈለገው ቦታ ማንኛውን

በማዚ ኃን ወተትን (በእጅ፣ በጋሪና በአህያ) ማንኛውን በቀላሉ ፍላጎትና ብክለትን ይቀንሳል






Tel: +251(0) 11 126 21 00 P.O.Box 40675
Web: www.snvworld.org





CAF P.P. 0911 644 726

Hygienic and Quality Milk Production Training Guideline for Dairy Extension workers



II. Hygienic and Quality Milk Production Training Guideline

A. Module Book

Introduction

The module Hygienic Milk Production is part of the Working Package “Business Management” introduced By SNV Ethiopia as part of the EDGET Project. One of the EDGET project objectives is to make small holders dairy farmers more aware about “commercial farming”. The Module Hygienic Milk Production will help the extension workers to acquire the knowledge and skills to make basic decisions which will enable them to improve the performance on Milk quality at holder farms. Hygienic Milk Production is the basis for safe milk of a high Quality standard to be sold for the best possible price.

Professional situation

As an extension worker you usually have to advise small holder farmers on how to manage their livestock in the most optimal way. As an extension worker, you should be able to clearly identify which kind of practices at farm level will lead to the best possible results, not only in quantity but also in quality.

Dairy farms depend for their milk price and sales on the ‘processing value’ of milk. Hygiene during milking, milk storage and transport is a major link in quality assurance. Side effect of hygiene at farm level is the effect of it at collection point (centre) level. Poor quality milk of one farm which is mixed with milk of good quality of others can spoil the quality of a whole batch at factory level.

Hygienic Milk Production is an important and serious activity to be executed frequently. If mistakes are made correcting of the negative effects is often impossible. Therefore awareness, knowledge and correct procedures at farm level are essential.

As an extension worker, you have the knowledge and skills to convince small holder farmers to improve on their Milk hygiene practices. You have access to key information about constraints that occur in milk quality and you support farmers to find a solution.

As an extension workers, you are able to recognize signs good practices during milking, milk storage and milk transport, and you are able to advice on cleaning and storage practices off all milking utensils.

As an extension worker, you are also able to explain the effect of personal hygiene, and personal health on Hygienical milk quality.

But you (and the owner) have other responsibilities as well; how to deal with environmental and social issues. In the end any business is only really sustainable if it is taking into account the three P’s; People, Planet & Profit.

Required entry qualification

To take part in this module on Management you should comply with the following entry requirements:

- Competent in the English language.
- Competent in skills on hand milking, cleaning of milk equipment.
- Competent to recognize a hygienic way of milking milk storage and storage of utensils
- Have basic insight/experience in Milk handling at small holder dairy farms.

Specific objectives and related topics

- a. At the end of the course participants are able to recognize good milking practices, to execute cleaning and disinfection of milking utensils. They can monitor storage, transport of milk to DPU or MCC. They can motivate personal hygiene and health as an assurance for safety for human health. They are able to advice on materials used for milking and the way they should be store in between milking times.

Related topics are:

- Clean cow management
 - Milking of a cow, checking milk
 - Cleaning and disinfection of utensils
 - Storage of milk and milking utensils
 - Transport of milk
 - Personal hygiene
- b. At the end of the course participants can milk a cow in the proper way, they can clean and disinfect utensils and store properly. They know the relation between hygiene, bacteria and multiplication of bacteria as well as the effect of time and temperature to total bacteria count in milk.

Related topics are:

- Practical milking
- Milk hygiene
- Bacteria, temperature and multiplication

Assessment

During the course, some assessments will be conducted to measure the competence level of the participants. The assessments will be individual and a group assignment. The group (maximum 4 persons) will have to visit an assigned small holder farm and implement the following tasks:

- Report present milking practices, personal hygiene and used utensils
- Report present hygiene based on cleaning and disinfection practices
- Report milk storage and transport
- Storage of utensils in between milking
- Write an advise to the farmer (how to improve)

Activities

Below an overview of all activities related to this module are presented:

Day	Time	Subject
Mon	1 st	All activities of this module are done in a real farm environment having lactation Cows milking equipment as well as a classroom available. Introduction Module/ participants/ trainer and introduction into rearing replacement stock
	2 nd	Theory on milking, good milking practices. Utensils, preparation, milk let down, hygienic milking, storage transport, cleaning and disinfection.
	3 rd	Practices on milking, good milking practices. (artificial udder) ALL STUDENTS PRACTICE THE WHOLE MILKING PROCES AT FARM LEVEL! Utensils, preparation, milk let down, hygienic milking, storage transport, cleaning and disinfection.
	4 th	Instruction of milking on real cows by the whole group. All participants practice for themselves under super vision of a trainer. Trainer makes photographs of good and bad examples that occur in the process to be used for training next day.
Tue	1 st	Instruction on good and bad practices seen by trainer supported by photographs of previous lesson,
	2 nd	InterVision by the participants of milking practices and milk hygiene. Important skills to be trained for themselves: Summary on wall paper
	3 rd	Theory general milk Hygiene; (clean vs dirty, bacterial growth, cleaning, storage)
	4 th	Introduction to the assessments: Individual milking assessment, group assessment approach of individual farmers
<p>Participants have two weeks to practice their individual skills on milking and milk hygiene. Competence on Hygienic milk production is essential to continue the module Program continuation is as follows:</p>		
Mon	1 st	InterVision by the participants of milking practices and milk hygiene including assessment results. How to train farmers in the important skills to be trained? : Summary on wall paper
	2 nd	Interaction trainer / Working out assessment
	3 rd	Working out assessment
	4 th	Preparation of farmers training material "Hygienic milk production"
Tue	1 st	Micro teaching from group to group (each group takes one aspect like; milking the cow / cleaning and disinfection / milk storage and transport)
	2 nd	Micro teaching from group to group continued
	3 rd	Interaction Trainer / Participants at group level Participants react on observations. And can ask questions
	4 th	Overview module "The influence of hygienic milk production on food safety"

B. Hygienic Milk Production Lesson matrices and trainer guides

Lesson Matrix	
Topic / Serial #	
Practical Lesson	Lesson 1 Hygienic Milk Production
Date	
Venue	
Duration	1 day/ Day 1 of the Course
Type of students	Extension Workers
Suggested number of students	8
Starting situation	Students have very little or no experience with Hygienic Milk Production
<u>Outcomes</u>	The student is able to:
Skills	<ul style="list-style-type: none"> -Recognize and select all needed utensils for Hygienic Milk Production -Prepare milking place and utensils in advance of a milking session -Recognize personal hygiene criteria -Handle cows to be milked -Handle milk hygienically
Knowledge	<ul style="list-style-type: none"> -Explain the important of hygienical milk handling -Explain how to use the different utensils needed for Hygienic Milk Production -Explain personal hygiene measures to be taken -Explain the essence of preparation and milk let-down -Explain the essence of proper milking method -Explain the essence of a good milking method in relation to the hygienical quality of milk
Attitude	Convince farmers that for Hygienic Milk Production the milkers need to have specific skills

Time in minutes	Brief Content	Role trainer /didactical methods	Teaching aids	Role/activities Participants
30	-Opening of the Course, getting acquainted with each other, explanation Module Book and Course Objectives	-Explaining/ guiding/ making trainees feel at ease	-Module Book	-Listening, introduction of themselves, asking questions, answering questions
30	-Sharing experiences with Hygienic Milk Production -Introduction into Hygienic Milk Production -Distribution lesson materials.	-Asking for experiences to get an idea about student level	-Example Farm - Hygienic Milk Production manual	-Sharing experiences -Participate in example explanation -Check contents of Manual
60	-Explanation 'Hygienic Milk Production'	-Explaining theory + assignments	-Manual -Exercise	-Observing theory -Checking practical examples -Asking questions -Study theory
20	Break			
120	-Explanation of the whole milking process Utensils, preparation, milk let down, hygienic milking, storage transport, cleaning and disinfection.	-Explaining theory	-Real utensils available in classroom -PPT -Worksheet -Manual	-Classroom session -Study theory -Asking questions -Fill out worksheet
60	Lunch			
120	-Practical on Hygienic Milk Production -Students practice the whole process using artificial udders -preparation, animal handling, used milking technique, caretaking of milk, cleaning, disinfection and storage of milk	-Explaining how to organize milking process -coaching / correction	-Real farm situation. -all needed utensils Artificial udders (1 per 2 students)	-Practice all activities and handling of milk -Practice skills -Asking questions -Fill out exercise 1
20	Break			
120	-Practical milking at farm	-Demonstration -Coaching -photographing key situations for next day use	-Real farm situation -All materials needed for good practices	-Prepare milking -Handling animals -Milking cows under supervision -Handling milk -transport to CC / CP -Asking questions -Practice skills

LESSON Day 1:

Harvesting and handling of milk from cow to collection centre.

Required materials:

- Manual - Hygienic Milk Production
- Exercise
- Classroom
- Practical dairy farm environment suitable for students to practice real milking
- Artificial udders (4)
- All needed utensils for milking for at least 4 persons milking at the same time

1. Sharing experiences with Hygienic Milk Production

2. Introduction

- Distribute and discuss course plan
- Distribute book "Hygienic Milk Production"
- Discussion on Hygienic Milk Production practices and constraints to be tackled

3. Lecturing the manual:

- Introduce topic "Hygienic Milk Production" according to the handout

1. Utensils

2. Hygiene and udder preparation

3. Hand milking

4. After milking and recording

5. Storage and transport

6. Cleaning of equipment

- Explanation of the different processes according to the manual

4. Practical exercise of milking

a. Artificial udder

- Total simulation of milking process
- Practices on cleaning process hygiene security

b. Real milking

- First practice of milking
- Delivery at Milk collection centre

5. End of day 1

Lesson Matrix	
Topic / Serial #	
Practical Lesson	Lesson 2 Hygienic Milk Production
Date	
Venue	
Duration	1 day/ Day 2 of the Course
Type of students	EDGET Extension Workers
Suggested number of students	8
Starting situation	Students have very little or no experience with Hygienic Milk Production
<u>Outcomes</u>	The student is able to:
Skills	<ul style="list-style-type: none"> -Recognize and select all needed utensils for Hygienic Milk Production -Prepare milking place and utensils in advance of a milking session -Recognize good milk handling practices from preparation of utensils to delivery of milk -Recognize good milking method and cow treatment during milking -Recognize good cleaning and storage practices of utensils
Knowledge	<ul style="list-style-type: none"> -Explain the important of hygienical milk handling -Explain how to use the different utensils needed for Hygienic Milk Production -Explain personal hygiene measures to be taken -Explain the essence of preparation and milk let-down -Explain the essence of proper milking method -Explain the essence of a good milking method in relation to milk hygienical quality
Attitude	Convince farmers that well trained milkers, having the right skills and knowledge on Hygienic Milk Production is essential to produce high quality milk.

Time in minutes	Brief Content	Role trainer / didactical methods	Teaching aids	Role/activities Participants
10	-Recap day one	- guiding making trainees feel at ease	-	-Listening, asking questions, answering questions
60	-Feedback on first hand milking lesson.	-Asking for experiences -show photographs made of critical aspects in milking lesson	-Hygienic Milk Production manual -WB / BB -Photographs by beamer	-Sharing experiences -Discussion -Participate in example explanation
60	-group discussion on exercise 1	-coaching -feed discussion	-Hygienic Milk Production manual -Filled out papers of exercise 1	-Sharing experiences -Discussion -Participate in example explanation
30	Break			
120	-InterVision by participants -Important skills to be trained -Essential knowledge to execute skills	-stimulate discussion the group -stimulate on using available own experience	-Flip over / markers to make wall paper -Worksheets -Manual	-Discussion -Fill out wall paper -Reflect on own experience
60	Lunch			
180	-Explanation on how to monitor general Hygiene at the farm. - Explain the value of good housing in milk hygiene. -Explain bacterial growth / cleaning / disinfection -Explain effect of chilling / storage and transport.	-Explaining theory + assignment	-PPT -Manual -assignment	-Study theory -Study examples -Asking questions
60	-Introduction to assessments. -Explanation of program -Explanation of examination standards	-Explaining process -Explaining program -distributing forms	-white board -ppt -Exercise 2 (to be filled out during practical's later) -assignment	-Answering and asking questions. -Planning agenda

LESSON Day 2:

Reflexion on own experiences, translate experiences to needed skill development on Hygienic Milk Production.

Study on background of Milk and Farm Hygiene to be able to understand. Planning of practical assessment and examination as a preparation for 2nd part of module

Required materials:

- Manual Hygienic Milk Production
- Exercises
- Classroom
- Photographs
- Assessment forms

1. Sharing experiences of previous day on Hygienic Milk Production practicals

2. Introduction

- Feedback by trainer on good and bad practices observed supported by photographs made
- - Discussion in the group about essential skills to develop (incl. Exercise 1).

3. Lecturing the manuals' background:

- - InterVision by the group of milking practical's and milk hygiene "what to be trained"

To train a farmer the extension worker must be able to demonstrate the best practices him/her self!!

- Introduce topic "Milk Hygiene, factors influencing the hygienical quality of milk". Background to be understood by extension workers to give farmers the right instructions.
- Introduce the milking assessment and planning
- Introduce exercise 2

4. Evaluation:

- Summary of the lessons, any questions?
- Home work
- Milking lessons and assessment to be finished coming two weeks

5. End of day 2

A participant can attend day three and four only after passing the individual assessments on hand milking and the skills list.

Lesson Matrix	
Topic / Serial #	
Practical Lesson	Day 3 Hygienic Milk Production
Date	
Venue	
Duration	1 day/ day 3 of the Course
Type of students	Extension Workers
Suggested number of students	8
Starting situation	Students have very little or no experience with Hygienic Milk Production
<u>Outcomes</u>	The student is able to:
Skills	<ul style="list-style-type: none"> -Prepare an advise to farmers how to improve on Hygienic Milk Production based on personal practical experiences. -Prepare to present a training on Hygienic Milk Production. -Use handouts to support understanding of an aspect trained. -Demonstrate the correct example of good hygiene practices.
Knowledge	<ul style="list-style-type: none"> -Explain the value of good quality milk -Explain the factors influencing milk hygiene -Explain the risk of pathogenic bacteria -Explain how farm (value)output will improve due to Hygienic Milk Production
Attitude	Convince farmers that for commercialization of their small holder farms Hygienic Milk Production is an essential part of farm management.

Time in minutes	Brief Content	Role trainer / didactical methods	Teaching aids	Role/activities Participants
80	- InterVision of the assessment and its value for the farmers.	-Guidance and coaching	-Flip over -WB - filled out versions of Exercise 2	-Discussion -Questioning each other -Collection of information -making wall paper
40	-Interaction with trainer about presented wallpapers	-leading discussion -advise on assignment for assessment	-WB -Presented wallpapers	-Listening -Making notes
30	Break			
120	Students work out group assessment	Guiding and coaching	Wallpapers Exercise 2	Work out training method and materials
60	Lunch			
120	Students work out group assessment	Guiding and coaching	-Wallpapers -Exercise 2 -Photographs day 2	Work out training method and materials
30	break			
120	Students prepare for micro teaching next day	-Guidance and coaching	-trainees make sure needed materials will be available at the training farm -utensils to do instruction	-Preparing -divide tasks -Prepare handouts -agree / adjust with other group the aspect of training

Lesson Matrix	
Topic / Serial #	
Practical Lesson	Day 4 Hygienic Milk Production
Date	
Venue	
Duration	1 day/ Day 4 of the Course
Type of students	Extension Workers
Suggested number of students	8
Starting situation	Students have very little or no experience with Hygienic Milk Production
<u>Outcomes</u>	The student is able to:
Skills	<ul style="list-style-type: none"> -Advise farmers to improve on Hygienic Milk Production. -Present a training on Hygienic Milk Production. -Use handouts to support understanding of an aspect trained. -Demonstrate the correct example of good hygiene practices.
Knowledge	<ul style="list-style-type: none"> -Explain the value of good quality milk -Explain the factors influencing milk hygiene -Explain the risk of pathogenic bacteria -Explain how farm (value)output will improve due to Hygienic Milk Production
Attitude	Convince farmers that for commercialization of their small holder farms Hygienic Milk Production is an essential part of farm management.

Time in minutes	Brief Content	Role trainer / didactical methods	Teaching aids	Role/activities Participants
60	Students do the final preparation of micro teaching session	Guidance and coaching	<ul style="list-style-type: none"> -classroom -farm situation -milking utensils -artificial udders 	<ul style="list-style-type: none"> - Formulate lesson session - Formulate handouts
60	Micro teaching session 1	Guidance coaching and feedback -prepare assessment forms and feedback	Group to decide	<ul style="list-style-type: none"> -one group teaching -other groups are trainees -give feedback after session / exchange experiences
30	Break			
120	Micro teaching session 2 and 3	Guidance coaching and feedback -prepare assessment forms and feedback	Group to decide	<ul style="list-style-type: none"> -one group teaching -other groups are trainees -give feedback after session / exchange experiences
60	Lunch			
120	Trainer and students discuss the observations of micro teaching sessions. Students work out the final handout versions, and training method to farmers	<ul style="list-style-type: none"> -give feedback and advise -Guidance and coaching 	<ul style="list-style-type: none"> -classroom -WB 	<ul style="list-style-type: none"> -Preparing final version handout -preparing training scheme -list the training materials needed
120	Different groups come to one shared approach on Hygienic Milk Production	Guiding and coaching	-group discussion	<ul style="list-style-type: none"> -common message to farmers supported by Handouts for different aspects of good hygienic Milk Production

C. Skills list–practical milking

Name Participant:

No	Skills that are judged ¹	Description of the skill (participant is able to)	Signature (only if skill is shown correctly)
1	Preparation for milking	a. Maintain personal hygiene b. Collect all needed utensils c. Prepare the milking place	a. _____ b. _____ c. _____
2	Organize the milking place	d. Bring the cow to the milking place and tie it up e. Change cows after milking and maintain hygiene f. Secure utensils while changing cows	d. _____ e. _____ f. _____
3	Care taking of animals	g. Restrain the cow during milking and keep it quiet h. Feed concentrates during milking i. Take hygiene measures on the animal in advance of milking it	g. _____ h. _____ i. _____
4	Organize cleaning and disinfection	j. Separate utensils in the right groups for cleaning k. Prepare the troughs and needed materials for the cleaning procedure l. Take the right measures of rinsing milking utensils in advance of cleaning m. Execute the cleaning and disinfection procedure / good hygiene practices n. Store utensils correctly. o. Make sure detergent and disinfectant is available for next time / top up / order it	j. _____ k. _____ l. _____ m. _____ n. _____ o. _____
5	Cleaning of the milking place	p. Take care of cleaning the milking place q. Make sure all materials are there for next milking time / top up / order it	p. _____ q. _____
6	Organize transport of milk to CC or CP	r. Make cans ready for transport s. Take care that milk will arrive in time at CC or CP	r. _____ s. _____

At least 16 out of the 19 skills must be assessed.

All assessed skills must be sufficient!

If an assessed skill is not shown sufficient, it will be re-assessed once only!

D. Exercise

Exercise 1: Hygienic and quality milk production

Taking the whole 'milk line' in consideration between cow until the urban consumer milk has follow a long route. Milk is a very sensitive, high nutritious food and it must arrive at the consumers place safely for human consumption.

Mention at least 5 aspects influencing milk quality in the whole line.

Dairy farmers stand at the beginning of the milk line. They have great influence on the quality of milk delivered at the collection point. The cow, the milker, the milking utensils and the transport means are involved.

Give a summary were you describe the important values, processes and needed skills for "Hygienic Milk Production" at farm level.

Exercise 2 milk hygiene

False or True

1. A dirty cow produces milk with a too high bacterial count. False / True
2. The milker has no influence on the purity of milk. False / True
3. The most suitable material for a milk bucket is stainless steel False / True
4. Colostrum can be delivered to the factory without any problem False / True
5. Milk rests in utensils must be removed by rinsing before cleaning False / True
6. Good housing helps to maintain good purity of milk False / True
7. Most bacteria found in milk after milking have entered by utensils False / True
8. A strip cup helps to find cows suffering from mastitis False / True
9. It is good to use milk with antibiotics for family consumption False / True
10. A jerry can is a hygienical means of storage and transport of milk False / True
11. Never store your cleaned utensils in the sun, it is unhygienic False / True
12. If you are in a hurry, cleaning is less important if you disinfect well False / True
13. MTS (Mazzi can) is used only for milking False/True

Exercise 3: Hygienic and quality milk production

Farm checklist

Make a personal overview the different aspects mentioned on the skills list.

Describe how and what to do during each step.

Add some photographs representing good examples of each step.

The different steps are:

- How to prepare for milking
- How to organize the milking place
- How to take care of animals during milking
- How to organize cleaning, disinfection and storage of utensils
- How to organize cleaning of the milking place
- How to organize storage and transport to MCC or DPU

Use your personal overview during "day three and four" of the course as part of the input for message sheets and microteaching assessment

E. Assignment - Hygienic Milk Production

During the course two assessments will be conducted to measure the competence level of the participants to advise a small holder farm on Hygienic Milk Production, and the ability to show and instruct farmers the right example him-/herself. The assessment of milking will be individual. The advising assessment will be a group assignment. The groups (5 persons) will have to implement the following tasks:

Day one and two (training in advance of individual assessment)

Presentation, discussion, exercises, knowledge exchange, setting of hygienic standards according to the utensils at farm level.

Trainer – student interaction leading to set: “Good practices for Hygienic Milk Production”

Groups of 5 - 6 persons have been formed, in cooperation with the trainer you practice the whole milking process from preparation of the utensils up to the final cleaning process and storage of the cleaned equipment. The first practice will be done on live animal udder and under conditioned circumstances but in a real farm setting.

At milking time the group will milk (part of) the farm herd to experience all aspects of milking and get familiar to its difficulties. The trainer observes corrects and is making photographs to be used for training next day.

Day two starts with feedback from the trainer on the milking of previous evening, supported by the photographs made.

The participant groups will do an InterVision to find out which skills are important to be trained, for themselves and for the farmers. And a summary is made by using the wall paper model, the groups present the wall papers to one and other briefly.

Before introducing the assessments, the trainer presents a lecture in which Milk Hygiene and the important of it in the milk line ‘from farm to consumer’ is explained. He focuses on and highlights the influence of farm practices to this issue.

F. Individual milking assessment:

Starting from here students have 4 days to practice milking every day under supervision of a trainer. After two weeks, the practices will be assessed according to the assessment from “Hand milking”.

Motivation: An extension worker must be able to show the correct example, and know the difficulties from own experiences.

The assessment includes a skills list to be signed by the trainer, and monitored by the participant

- How to prepare for milking
- How to organize the milking place
- How to take care of animals during milking
- How to organize cleaning, disinfection and storage of utensils
- How to organize cleaning of the milking place
- How to organize storage and transport to MCC or DPU
- Introduction of group assessment (brief introduction)

The groups are informed about the central question in the group assessment:

“What do farmers need to know, and how do they have to act, to assure milk will be harvested, transported and delivered under hygienic, healthy and safe circumstances.”

To support the awareness of all aspects involved it is a must that the individual assessment is done (and passed) in advance of the group assessment

The group assessment is part of the second training session that will take place some (2) weeks after the first session, and will take two days

Day three and four (training after passing the individual assessment)

Presentation, discussion, exercises, knowledge exchange, setting of hygienic standards according to the whole milking process, transport and delivery.

To respond on the central question of the group assessment the outcome must be a clear message to the farmers.

The assessment objectives are:

1. Define a clear message to farmers on Hygienic milk production, and prepare a handout.
2. Prepare a farm check list on Hygienic milk production to monitor the farm situation, and to be able to advice on improvements.
3. Formulate your message for at least two possible improvement situations. (Possible improvements on for instance: better utensils, proper cleaning, better storage, transport means, simple chilling etc.)
4. Prepare a hardware list of needed utensils and materials for the whole milking process, and where to get them locally.

InterVision:

Based on their own experiences during the individual assessment the groups make list of.

- Essential knowledge for hygienic milk handling
- Essential skills for milkers
- How to exchange the knowledge
- How to train the skills
- Which utensils (available on the local market) to use
- Detergents and disinfectants (available on the local market) to use

Make a wall paper of the list and present briefly to the other groups.

The trainer will interact and coach during the process.

Assignment to work out assessment:

- Discuss with your group members the assignment and divide tasks among the members
- Decide upon the necessary observations, and checks to be done on the small holder farm, and the way to write down the information (checklist).
- Decide upon the additional information to be given by the small holder farmer about hygienic milk production related issues.(clear message)
- Prepare a questionnaire checklist for collecting relevant information you think is necessary for being able analyze present milk hygiene performance.
- Prepare a manual "Hygienic Milk Production"
- Make a list of utensils and materials locally available (+ pricelist)

Assignment for micro teaching

- Decide as different groups upon witch milk hygiene related message you want to test in a micro teaching setting (all groups different messages)
- Test your message group to the other groups (they take the role of farmer) and make sure all your group members contribute in teaching.

Feedback and overview

- Groups give feedback to one and other first (tips / tops)
- Trainer interacts
- Finish the module by submitting your group assessment files to be judged
- Overview the result as one group and receive final feedback.

Assessment:

- Each group receives a group score for their microteaching practices and message sheets.
- Each group member receives an individual score for their individual contribution in microteaching.
- Assessment results will be discussed with the groups the same day.

Assessment forms for hygienic and quality milk production

Assessment form Micro teaching (Group score)

Group members:

Subject / Title:

Group Score

(out of 20, each item can score from 1 to 5 points, 5 = excellent / 1 = very poor)

Activities	Excellent	Good	Average	Poor	Very poor
1. Introduction <ul style="list-style-type: none"> - Group members and "message subject" is given - The important of the message is given 					
2. Objective of the message (explanation of...) <ul style="list-style-type: none"> - Value for farmers - Benefits for Hygienic Milk Production 					
3. Training method <ul style="list-style-type: none"> - Suitability / usefulness of method - Fits to target group level - Used training aids 					
4. Handout material <ul style="list-style-type: none"> - Summary of message - Illustrations / photographs 					

Assessment is passed with a score of minimum 12 points

Assessment form for observation of student during presentation (Individual score)

Name trainer:

Enterprise presented:

Observer:

Date:

Behaviour criteria; The participant:	Remarks and score by observer (range from 0 (insufficient) to 5 (very good))
1. Has prepared the correct and required teaching aids	
2. Instruction can be followed by all, the level fits to farmers' level	
3. Instruction follows a logical path and is divided in clear steps if required	
4. Links the level of knowledge and skills instructed to the level of the farmers	
5. Can execute all skills required for the lesson	
6. Speaks clearly and is pleasant to listen to	
7. Makes contact with the group and keeps this momentum during the lesson	
8. Stimulates interaction with the participants	
9. Provides for feedback during the instruction to check if message comes through	
10. Can describe to which extend outcome was realised	
Further Remarks and final score:	

Minimum score for passing the assessment will be 30.

Assessment form Micro teaching (Group score)

Group members:

Subject / Title:

Group Score ...(out of 20, each item can score from 1 to 5 points, 5 = excellent / 1 = very poor)

	Excellent	Good	Average	Poor	Very poor
1. Introduction <ul style="list-style-type: none"> - Group members and "message subject" is given - The important of the message is given 					
2. Objective of the message (explanation of...) <ul style="list-style-type: none"> - Value for farmers - Benefits for Hygienic Milk Production 					
3. Training method <ul style="list-style-type: none"> - Suitability / usefulness of method - Fits to target group level - Used training aids 					
4. Handout material <ul style="list-style-type: none"> - Summary of message - Illustrations / photographs 					

Assessment is passed with a score of minimum 12 points

Assessment form for observation of student during presentation (Individual score)

Name trainer:	
Enterprise presented:	
Observer:	
Date:	
Behaviour criteria; The participant:	Remarks and score by observer (range from 0 (insufficient) to 5 (very good))
11. Has prepared the correct and required teaching aids	
12. Instruction can be followed by all, the level fits to farmers' level	
13. Instruction follows a logical path and is divided in clear steps if required	
14. Links the level of knowledge and skills instructed to the level of the farmers	
15. Can execute all skills required for the lesson	
16. Speaks clearly and is pleasant to listen to	
17. Makes contact with the group and keeps this momentum during the lesson	
18. Stimulates interaction with the participants	
19. Provides for feedback during the instruction to check if message comes through	
20. Can describe to which extend outcome was realized	
Further Remarks and final score:	

Minimum score for passing the assessment will be 30.

Practical Test on Hand Milking

Detailed Judgement	insufficient	weak	sufficient	good	
A. The cleanliness of the hands, clothing and milk equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Judgement card of: Mr. / Mrs.: _____ From: _____
B. Tying of the legs, preparing and stimulation of the udder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
C. Method of sitting and position of the bucket	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
D. Method of milking and setting of the fingers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
E. Regular, powerful milking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
F. Method and result of stripping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
G. Time needed for milking *	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	start: _____ completed: _____ kg milk: _____
H. Leaving of the cow, cleanliness of the milk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
I. Cleaning of equipment, methods and results	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

*Capacity has to be judged as follows:

Insufficient < 0.3 kg milk/minute
Weak 0.3 – 0.6 kg milk/minute
Sufficient 0.6 – 0.9 kg milk/minute
Good > 0.9 milk/minute

Date: _____

Assessor: _____

Final Result

- ☐ very good (9)
- ☐ good (8)
- ☐ fair (7)
- ☐ sufficient (5)
- ☐ insufficient (<5)

Guidelines for the assessor for scoring the “final result”

To pass with the final result:

Very good;

Maximum one time the score “sufficient” is awarded. All the other judgement criteria must be judged with “good”

Good

At least 5 times the score “good”. The other items must be judged “sufficient”

Fair

At least 3 times the score “good”. The other items must be judged “Sufficient” or just one time “weak” is allowed.

Sufficient

None of the detailed judgements is insufficient and *maximum 2 times* the judgement “weak” is awarded.

If the score does not meet one of these criteria the assessor will mark the assessment result ‘Insufficient’

G. Answer sheet "Exercise False / true"

1. A dirty cow produces milk with a too high bacterial count. False / ~~True~~

The milk produced by a cow being dirty is *not different!* A dirty cow is still a *possible source* of dirt and bacteria entering milk. Because of this dirt the cow is risky for hygienical milk production. Only if the *milker corrects the effect by cleaning the cow and practicing a hygienical milking method* the milk as such is still okay.

2. The milker has no influence on the purity of milk. False / ~~True~~

The milker has *great influence* on the purity of milk.

3. The most suitable material for a milk bucket is stainless steel False- / True

Stainless steel is easy to clean, it is strong, it does not absorb smells, it is not corrosive and resists detergents.

4. Colostrum can be delivered to the factory without any problem False / ~~True~~

Milk of a just calved cow is of different composition and will give problems during processing (protein will coagulate)

5. Milk rests in utensils must be removed by rinsing before cleaning False- / True

Immediate rinsing after use prevents milk drying on the surface of the utensils. When most of the milk rests are removed in advance, cleaning will be more effective.

6. Good housing helps to maintain good purity of milk False- / True

It really helps, and it saves the milker a lot of work. Clean cows reduce the risk of problems with purity as well as infection of milk with dirt related bacteria. (see statement 1)

7. Most bacteria found in milk after milking have entered by utensils False- / True

Talking about *numbers of bacteria* found in milk come from all the different utensils mainly. Still hygiene around the animal and executed by the milker is important. These sources influence the presence of some types of pathogenic bacteria or bacteria dangerous for processing. (*Types of bacteria*)

8. A strip cup helps to find cows suffering from mastitis False / True

Using a strip cup makes it easy to find abnormal milk. Abnormal milk is a sign of clinical mastitis.

9. It is good to use milk with antibiotics for family consumption False / ~~True~~

Milk containing antibiotics (from a treated animal) is dangerous for your personal health. It can lead to resistance of bacteria for this medicine.

10. A jerrycan is a hygienic means of storage and transport of milk False / ~~True~~

Jerrycans are difficult (impossible) to clean. Milk cans made of aluminum or stainless steel are the only acceptable mean of milk storage and transport.

11. Never store your cleaned utensils in the sun, it is unhygienic False / ~~True~~

For properly cleaned utensils the sun is the cheapest disinfectant. Well cleaned and dried utensils stored in direct sunlight contain very low numbers of bacteria. Remember bacteria hate drought, hunger and sunlight.

12. If you are in a hurry, cleaning is less important if you disinfect well False / ~~True~~

Disinfection leads to killing of bacteria in the moment, improper cleaning will lead to new bacterial growth. For the simple reason, there is still food (dirt) to multiply in.

(Footnotes)

¹ *If one of the skills cannot be demonstrated, it will be left out and will not be a part of the final judgement.*



Designed & Printed by

☎ አራት ኪሎ :: +251 111 557 788 ገርጂ :: +251 116 298 777
✉ 31362 አዲስ አበባ ኢትዮጵያ

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