



Animal production Level

NTQF Level -II

Learning Guide 53

Unit of Competence: Assist in handling and processing of milk

Module Title: Assisting in handling and Processing of Milk

LG Code: AGR APR2 M16 L01 LG53

TTLM Code: AGR APR2 TTLM 0919v1

LO 1: Undertake milking operation and Preservation



Instruction Sheet	Learning Guide 53
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This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Preparing and using required materials, tools and equipment
- Conducting Milking procedure
- Milk composition and constituents
- Undertaking Milk quality test
- Preservation of milk

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Prepare and use required materials, tools and equipment
- Conduct Milking procedure
- Identify milk composition and constituents
- Undertake Milk quality test
- Preserve of milk

Learning Instructions:

1. Read the specific objectives of this Learning Guide 53.
2. Follow the instructions described in number 1 to 7.
3. Read the information written in the “Information Sheet (1, 2,3,4 and 5) in page **3,5,8,10 and 13** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the “**Self-check 1, Self-check 2, Self-check 3” Self-check 4 and Self-check 5**” in page, **4, 7,9,12 and 16** respectively.
6. If you earned a satisfactory evaluation proceed to “Operation Sheet 1 and 2 in page 17 and 3 and 4 in page 18 respectively.
7. Do the “LAP test” in page 19 (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice you on additional work.

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Information sheet-1	Preparing and using required materials, tools and equipment.
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1.1. Definition of Milk: - is a nutrient rich white liquid food produced by the mammary glands of mammals. It is the primary source of nutrition for young mammals (including human who are breastfed) before they are able to digest other types of food.

1.2. Materials, tools and equipment

- 2. Milking materials and equipment:** milking jar, pail, milk can, weighing scale, towel, rope, strip cup, milk storage tank, sieve, apron, teat cup, milking machine
- 3. Milk cooling equipment:** Cold water container, cooling shed and refrigerator , milk chiller
- 4. Milk boiling equipment:** Boiler, boiling dish,
- 5. Milk processing equipment:** cream separator churner, refrigerator, pasteurizer, homogenizer, , ladle, cooking dish, cooking jar, table, graduated jug.
- 6. Other equipment and materials:** lacto meter, alcohol, spoon, salt, additive/ingredients, other miscellaneous materials.



Self-Check -1	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define milk (5 points)
2. Mention five milking equipment (5 points)

Note: Satisfactory rating - 10points Unsatisfactory - below 10 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

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Information sheet-2	Conducting Milking procedure
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Milking: is the act of removing milk from the mammary gland of mammals. (cow, sheep, goat, camel etc)

There are two types of milking methods, namely

1. Manual (hand milking)
2. Mechanical (machine milking).

Hand milking technique.

There are two methods of hand milking techniques.

1. Hand strip (using finger for small sized teats)
2. Hand squeeze (full hand milking)

The most common milking technique is 'hand strip' milking for the entire milking cycle.

But the second hand squeeze method is more closely mimics the natural calf sucking reflex, which seals the top of teat with the lips and squeezes the teat with the tongue.

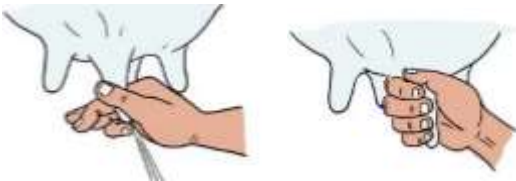


Fig. A. Hand strip

B. Hand squeeze

Steps of Hand milking:

- Prepare all milking materials prior to milking
- Massage and wash teats and udder thoroughly with cloth or piece of towel dipped in warm water; if possible in warm bactericidal (chlorine) solution
- Draw out foremilk in strip cup squeezing a few hand squirts from each teat
- Fore milking stimulates milk flow
- Fore milking helps detect an abnormal milk resulting from a diseased or injured udder
- Before starting milking be sure that milker's hands are clean and dry
- Milking is done carefully without letting any foreign objects or vermin enter the open milking jar



- After finishing milking transfer the milk into a clean container by straining and immediately keep or store the container at a temperature of 35⁰F -40⁰F (2⁰C-4⁰C) or less

Machine milking

Most milking in the developed world is done using milking machine. Teat cups are attached to the cow's teat and then the cups alternate between vacuum and normal air pressure to extract the milk. The milk filtered and cooled before being added to large bulk tank of milk for storage.

Advantages

1. Clean milk/with less contaminants
2. Fast milking/time saving
3. Less man power
4. Complete milking
5. Important for large scale farm
6. More manageable

Disadvantages

1. Machines are expensive
2. Require skilled man power
3. Require facilities(electricity, road, etc
4. Requires maintenance cost.



Self-Check -2	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

3. Mention the two types milking methods (4 points)
4. Mention two methods of hand milking techniques (6 points)

Note: Satisfactory rating - 10points Unsatisfactory - below 10 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date _____

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Information sheet-3	Milk composition and constituents
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1. Milk composition and constituent

Milk is a complete food. It is the most nearly perfect food. The composition of milk is extremely complex, consisting chiefly of water, protein in colloidal suspension, lactose and fats in emulsion, inorganic salts in solution, vitamins, enzymes, gases and other substances.

Table: 1. Percentage composition of milk of different Animals

Source of milk species	Water	Fat	lactose	protein	minerals
Human	87.58	3.74	6.37	2.01	0.30
Cow	87.35	3.75	4.75	3.40	0.75
Sheep	80.25	6.97	4.96	6.72	0.90
Goat	81.04	4.63	4.22	4.35	0.76
Camel	87.10	2.91	5.39	3.90	0.70
Donkey	90.12	1.37	6.25	1.78	0.48

Factors that affect the milk composition and constituents are:

- Age of the animal
- Breed of the animal
- Species of the animal
- Feeding and watering
- Environmental condition/season of the year
- Stage of lactation
- Health condition of the animals



Self-Check -3	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down the composition and constituents of milk? (6 pts)
2. Mention factors that affect the milk composition and constituents (7pts.)

Note: Satisfactory rating – 13 points Unsatisfactory - below 13 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date _____

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Information sheet- 4	Undertaking Milk quality test
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Milk testing and quality control is an essential component of any milk processing industry whether small, medium or large scale. Milk being made up of 87% water is prone to adulteration by unscrupulous middlemen and unfaithful farm workers.

There are various ways and methods of monitoring milk quality, with the key ones described briefly below. Many of the methods are relatively inexpensive, with little needed in the way of equipment. Other methods may require more expensive equipment, but are more accurate and quicker.

Factors affecting Milk quality

- Adulteration,
- Milk Hygiene
- Temperature
- Disease problem (commonly Mastitis)

Common milk quality test

1. Organoleptic (sense) tests

The organoleptic test permits rapid segregation of poor quality milk at the milk receiving platform. No equipment is required, but the milk grader must have good sense of sight, smell and taste. The result of the test is obtained instantly, and the cost of the test are low. Milk which cannot be adequately judged organoleptically must be subjected to other more sensitive and objective tests.

2. Clot on Boiling (C.O.B) Test

The test is quick and simple. It is one of the old tests for too acid milk ($\text{pH} < 5.8$) or abnormal milk (e.g. mastitis milk). If a milk sample fails in the test, the milk must contain many acid or rennet producing microorganisms or the milk has an abnormal high percentage of proteins like colostrums milk. Such milk cannot stand the heat treatment in milk processing and must therefore be rejected.

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3. The Alcohol Test

The test is quick and simple. It is based on instability of the proteins when the levels of acid and/or rennet are increased and acted upon by the alcohol. Also increased levels of albumen (colostrums milk) and salt concentrates (mastitis) results in a positive test.

4. Acidity test

Bacteria that normally develop in raw milk produce more or less of lactic acid. In the acidity test the acid is neutralized with 0.1 N Sodium hydroxide and the amount of alkaline is measured. From this, the percentage of lactic acid can be calculated. Fresh milk contains in this test also "natural acidity" which is due to the natural ability to resist pH changes. The natural acidity of milk is 0.16 - 0.18%. Figures higher than this signifies developed acidity due to the action of bacteria in milk sugar.

5. Lactometer or density test

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 serves as a quick method to determine adulteration of milk by adding water. 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. At 15 °C the normal density of the milk ranges from 1.028 to 1.033 g/ml, whereas water has a density of 1.0 g/ml. So when the lactometer reads a value closer to 1.0, probably water has been added to the milk. If possible the lactometer reading can be combined with the fat test. The density of fat is lower than that of milk. So in case the results of the fat test are low and the found density is still high (e.g. 1.035), then the milk might have been skimmed. If the results of the fat test are low and the density is low (e.g. 1.025), then water might have been added to the milk. Always read the temperature of the milk first; the lactometer reading varies according to temperature.



Self-Check -4	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down common milk quality testing methods (4pts)
2. What are the factors that affect milk quality? (4pts)
3. Write the method of milk quality test which **doesn't not** require equipment (2pts)

Note: Satisfactory rating – 10 points Unsatisfactory - below 10 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date _____

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Information sheet-5	Preservation of milk
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5.1. Cooling milk

Since milk is an ideal medium for the multiplication of most disease producing organisms, the milk should be kept at 50⁰F or below starting immediately after milking. This is very important especially if milk is going to be delivered raw to consumers. This temperature range is essentially needed to arrest the growth of micro-organisms specially brucella organisms.

Cooling methods

- keep the milk in the shade not in the sun
- keep the milk in a well-ventilated place
- use cold water to cool the milk (for example put the milk in a water bath, or in a stream)
- use ice to cool the milk

5.2. Boiling

This is the easiest and most practicable method of making milk safe in every home. As soon as raw milk is produced or delivered it should be boiled. Boiling is raising the temperature of the milk to boiling point and maintaining the milk at this temperature for a few minutes. Then the milk should be immediately cooled. Boiling of milk destroys all microorganisms except the spore formers but it changes the nutritive value of milk, its flavors and palatability appearance and difficult to process on a large scale and is commercially uneconomical.

5.3. Pasteurization

It is heating of every particle of milk or milk product to a specific temperature for a specified period of time without allowing recontamination of that milk or milk product during the heat treatment. Pasteurization of milk is a universally known method of rendering raw milk safe through controlled heat treatment. Pasteurization of milk is not sterilization but it is a destruction of all pathogenic micro-organisms.



Pasteurization of milk involves three essential steps:

- Heating raw milk to a predetermined temperature
- Holding at this temperature for a predetermined time
- Immediately cooling down to at least below 10⁰C (50⁰F).

Therefore, the **two** most important variables are pasteurization temperature and the exposure or holding time. At present there are at least three accepted methods of pasteurization of milk:

1. Holding or vat method

The holding or vat method, also known as the low temperature holding time process, is a method of holding the milk in a vat (container) to a temperature of 63⁰c (145⁰ F) for 30 minutes.

2. High temperature-short time method

This is a continuous process by which milk is rapidly brought to a temperature of 71⁰c (161⁰ F) and heated continuously for 15 seconds. During this process the milk has been preheated in the regeneration (heat exchanger) first and then its temperature is brought rapidly up to about 161⁰F and is held there through a holding tube for a period of 15 seconds, after which the milk is returned to the regenerator. The milk is then passed into the cooler and finally to a bottle filling device.

The ultra-high temperature (UHT) method

In this process the milk is heated to at least 88⁰C (191⁰F), held at this temperature for at least one second and then immediately cooled to at least below 10⁰C (50⁰F).

This method has been developed very recently and is used only in a few developed countries because it requires complex equipment and the highest levels of precision and handling.

In developing countries like Ethiopia pasteurization of milk has several limitations:

- It can only be effectively done on a commercial basis
- It requires special and expensive equipment and budget
- It requires skilled technicians to operate



- It requires a centralized collection, processing and distribution management center.

5.4. Sterilization

This refers to the complete elimination of all microorganisms. In this process milk is heated to destroy all micro-organisms including spore forming and can only be done by keeping the milk at a temperature above normal boiling point (100⁰c or 212⁰ F) for at least 20 minutes. If the temperature of the heat treatment is higher and the sterilization effect is greater, there will be a more marked change in the color and taste of the milk.



Self-Check -5	Written Test
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Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write 4 limitations of milk pasteurization in developing countries like Ethiopia (4pts)
2. List down 3 milk preservation method. (2pts)

Note: Satisfactory rating – 6 points Unsatisfactory - below 6 points

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date _____

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2

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Operation sheet-1	perform hand milking
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- Identify all milking material, tools and equipment
- Wear PPE
- Create silent environment
- Clean properly of milking pen.
- Provide concentrate feed to the cow for good milk letdown
- Restrain the cow in number 8 position
- Clean milking utensils (equipment)
- Washing hands
- Clean teats with warm water
- Dry teat by towel
- Check for mastitis using strip cup
- Milk using both hands; squeeze properly the teats with full hand.
- Filter/sieve/ milk
- Record the amount of milk from each cow
- Cool the milk to store in time

Operation sheet-2	Organoleptic (sense) tests
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Procedure:

- Open a can of milk.
- Immediately smell the milk.
- Observe the appearance of the milk.
- If still unable to make a clear judgment, taste the milk, but do not swallow it. Spit the milk sample into a bucket provided for that purpose or into a drain basin, flush with water.
- Look at the can lid and the milk can to check cleanliness.

Judgment:

Abnormal smell and taste may be caused



Operation sheet-3	Clot –on – boiling test
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Apparatus

- One boiling water bath (a 600 ml beaker on a gas or electric heater is adequate)
- Test tubes
- Timer (a watch or clock is adequate).

Procedure

1. Place about 5 ml of milk in a test tube (the exact amount is not critical) and place the test tube in boiling water for 5 minutes.
2. Carefully remove the test tube and examine for precipitate.
The milk is rejected if any curd forms.

Operation sheet-4	Alcohol test
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Apparatus

- Test tubes, e.g. 150 mm long and 16 mm diameter
- Test-tube racks or blocks of wood with holes bored to hold the test tubes.

Reagents

75% alcohol solution. This is usually prepared from 95% alcohol by mixing with distilled water in the proportion of 79 parts of 95% alcohol to 21 parts of distilled water.

Procedure

1. Put equal volumes of milk and 75% alcohol in a test tube.
2. Invert the test tube several times with the thumb held tightly over the open end of the tube.
3. Examine the tube to determine whether the milk has coagulated. If it has, fine particles of curd will be visible.



LAP Test	Practical Demonstration
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Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 8 hours.

Task 1. Perform hand milking

Task 2. Organoleptic (sense) tests

Task 3. Clot –on – boiling test

Task 4. Alcohol test



References

Marshall, R.T. (1992) Standard Methods for the determination of Dairy Products. 16th ed. Publ. American Public Health Association.

Richardson, G.H. (1985) Standard Methods for the examination Dairy Products 15th edition, American Public Health Association, Washington