Ethiopian TVET System

Animal Production Level-II

Training Module –Learning Guide 53-55

Based on Version 3 March 2018

Occupational Standard (OS)

Unit of Competence: Assist in handling and processing of milk

UC code: AGR APR2 11 0318

Module Title: Assisting in handling and Processing of Milk

TTLM Code: AGR APR2 TTLM 0919v1

October 2019

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TTLM Code: AGR APR2 TTLM 0919v1

This module includes the following Learning Guides

LG53: Undertake milking operation and Preservation

(LG Code: AGR APR2 M16 L01 LG53

LG54: Process milk into different products.

(LG Code: - AGR APR2 M16 L02 LG54

LG55: Clean up on completion of milk .

(LG Code: AGR APR2 M16 L03 LG55

Instruction Sheet	Learning Guide 53

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.

Information sheet-1	Preparing and using required materials, tools and equipment.

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

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 = _____

Name: _____ Date: _____

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Information sheet-2	Conducting Milking procedure

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.

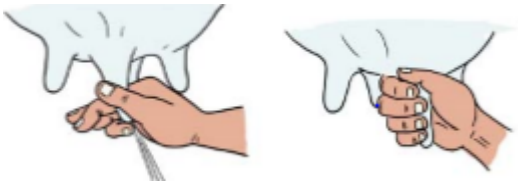

Fig. A. Hand strip B. Hand squeeze

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 35^0F -40^0F (2^0C-4^0C) 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

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 = _____

Name: _____ Date _____

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Information sheet-3	Milk composition and constituents

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

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 = _____

Name: _____ Date _____

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Information sheet-4	Undertaking Milk quality test

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 (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.

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 ºC 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

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 = _____

Name: _____ Date _____

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Information sheet-5	Preservation of milk

5.1. Cooling milk

Since milk is an ideal medium for the multiplication of most disease producing organisms, the milk should be kept at 50^0F 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 10^0C (50^0F).

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 63^0c (145^0 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 71^0c (161^0 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 88^0C (191^0F), held at this temperature for at least one second and then immediately cooled to at least below 10^0C (50^0F).

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 (100^0c or 212^0 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

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 = _____

Name: _____ Date _____

1

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Operation sheet-1	perform hand milking

- 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

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

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**

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

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

Instruction Sheet	Learning Guide 54

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Determining types of Milk products to be processed
- Preparing whole milk and other ingredients
- Processing milk
- Preparing milk processing equipment and materials
- Identifying any OHS hazards and taking appropriate action
- Using Personal Protective Equipment (PPE)
- Observing Sanitary procedure

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 –

- Determine types of Milk products to be processed
- Prepare whole milk and other ingredients
- Process milk
- Prepare milk processing equipment and materials
- Identify OHS hazards and taking appropriate action
- Use Personal Protective Equipment (PPE)
- Observe sanitary procedure

Learning Instructions:

8. Read the specific objectives of this Learning Guide 54.
9. Follow the instructions described in number 1 to 7.

10. Read the information written in the “Information Sheet (**1, 2,3,4,5,6 and 7**) in page **3,5,8,12, 14, 17 and 19** respectively
11. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
12. Accomplish the **“Self-check 1, Self-check 2, Self-check 3” Self-check 4, Self-check 5” Self-check 6 and Self-check 7** in page **4, 7, 11 ,13,16, 18 and 21** respectively.
13. If you earned a satisfactory evaluation proceed to “Operation Sheet 1-2 in page 22 and 3 in page 23 respectively.
14. Do the “LAP test” in page 24 (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.

Information sheet-1	Determining types of Milk products to be processed

Some of the common milk products that are made locally or commercially from whole milk are

- **Cream:** A portion of milk containing not less than 18% milk fat. Cream may be taken from milk by “skimming “or “separating” Skimming is the process of removing manually the cream, which rises to the surface, after milk stands in a container. The remaining part of the milk is called skimmed milk. Separating is the process of removing cream mechanically. The remaining part is called separated milk.
- **Curd/yoghurt:** The coagulated part of milk if milk is stands in a container for sometime at room temperature, it forms clots called curds which are contained in a clear liquid called whey.
- **Whey**: This is the watery part of milk after separation of the curd from the whole milk. It contains protein, lactose, minerals and salts.
- **Cheese**: This is the clotting casein of milk. Cheese is made from separated milk or whole milk. The milk curd, after being removed from the whey, is pressed into solids and through other processes and forms cheese. Genuine cheese must contain no fat other than that obtained from milk.
- **Butter**: This is the solidified milk fat or cream prepared by churning. The cream produced from milk is violently churned up and shaken so that the fat globules are broken up and closed together into pieces of mass called butter.
- **Ghee:** This is butter which has been heated and clarified. Butter is boiled over heat until the water is evaporated. It is then strained and ghee is produced.
- **Ice cream:** This is cream made by mixing milk products with other ingredients and them freezing them into a semi solid state. The principal ingredient of the cream is usually milk or cream flavoring and coloring materials, etc.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down common milk products that are made locally or commercially produced (6pts)

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

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

Answer Sheet

Score = _____

Name: _____ Date _____

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Information sheet-2.	Preparing whole milk and other ingredients for processing

Poor hygiene introduces additional bacteria that cause the milk to get spoilt very quickly. To ensure that raw milk/whole milk remains fresh for a longer time, good hygiene must be observed during milking and when handling the milk afterwards.

The following factors are important in various milk-harvesting practices to prevent bacterial contamination of milk such as:

1. Health and personal hygiene

2. Environmental hygiene

3. Milking procedures and milk handling

4. Post-milking.

Addition of milk ingredients

Most of the time milk ingredients are added to the whole milk to keep the flavor/ odor and aroma of milk. The most common milk ingredients are:

Salt, garlic, flavoring spices like “Beso bila” etc

Table.1.Key factors and on-farm practices to undertake to produce clean milk on small holder farms

Table 14.1. Key factors and on-farm practices to undertake to produce clean milk on small holder farms

Key factors to produce clean milk	On-farm practices
Prepare the shed	Repair any holes in floor, clean the floor and wash with disinfectant
Personal hygiene	Use clean clothes, carefully wash hands; don't milk if you are sick
Prepare for milking	Have ready the udder cloths, buckets, stool, basket (for dirty udder cloths), strip cup, muslin cloth and milk can to save time; place milk can outside shed
Pre-milking cleanliness	Do not use milk containers for any other purpose, all equipment must be clean, sanitised and dry
Cow comfort	Gentle handling of cows, maybe offer some concentrate, but not roughage
Cow cleanliness	Brush cow to remove dust, wash udder and teats, and dry teats
Cow disinfection	Use one cleaning cloth per cow soaked in hypochlorite (1 teaspoon/5 L water)
Reduce disease transfer	Use one cloth per cow; put used udder cloths into separate basket; don't let milk drip/spill onto floor
Water quality	Only use good-quality water for washing cows and containers
Pre-milk each teat	Strip milk each teat into cup to check for mastitis and remove initial milk
Hand milking	Use fast steady speed, use 'hand squeeze' not 'hand strip' technique; don't use oil, water, milk or spittle as lubricant; use hand cream if necessary
Machine milking	Routinely replace rubber linings, sanitise after use; follow correct maintenance schedule; open tops of milk cans in cooling unit to facilitate heat dissipation
Timeliness of milking	Start milking within 30 seconds of washing udder, cow's let-down lasts 5–7 min
Teat dip	Dip each teat into iodine solution; can use all in cup if solution is still clean
Bulking milk	Quickly strain into milk can through muslin to remove contaminants; put lid on can
Cooling milk	Take milk to a milk collection centre for cooling as soon as possible; handle can gently
Post-milking cleanliness	Rinse all milking utensils in cold water, wash them with detergent and brush in hot water, rinse again in cold water, then rinse in disinfection or very hot water and place upside to drain
Reusing disinfectant	Do not reuse rinsing disinfectant solution for next milking
Drying of equipment	Leave utensils to drain on racks in a well-ventilated, clean, tidy place
Disease treatment	Use indicator paper or California mastitis test to detect sub-clinical mastitis; treat on same day as detected
Clinical mastitis treatment	Empty inflamed teat out every 2 hr, leave antibiotic in teat for 8 hr

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

2. List down the common milk ingredients (6pts)

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

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

Answer Sheet

Score = _____

Name: _____ Date _____

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4._____

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Information sheet-3.	Processing milk and processing methods

3.1. Milk processing

Milk is processed in a number of milk products in the form of concentrated, cultured and dried products, to be reconstituted in to milk as required or mixed with other ingredients to provide mixes such as solid cheeses of various flavors and types, and in condensed or evaporated forms for convenient transportation and longer shelf life.

Basically milk is processed to increase deliciousness of milk products and their shelf life. It is processed in different ways in to different products; traditional or industrially. The types of products to be processed are determined based on the enterprise requirements. Raw milk can be processed in to the following products include: Cream, yoghurt, butter, cheese, Whey and other special products.

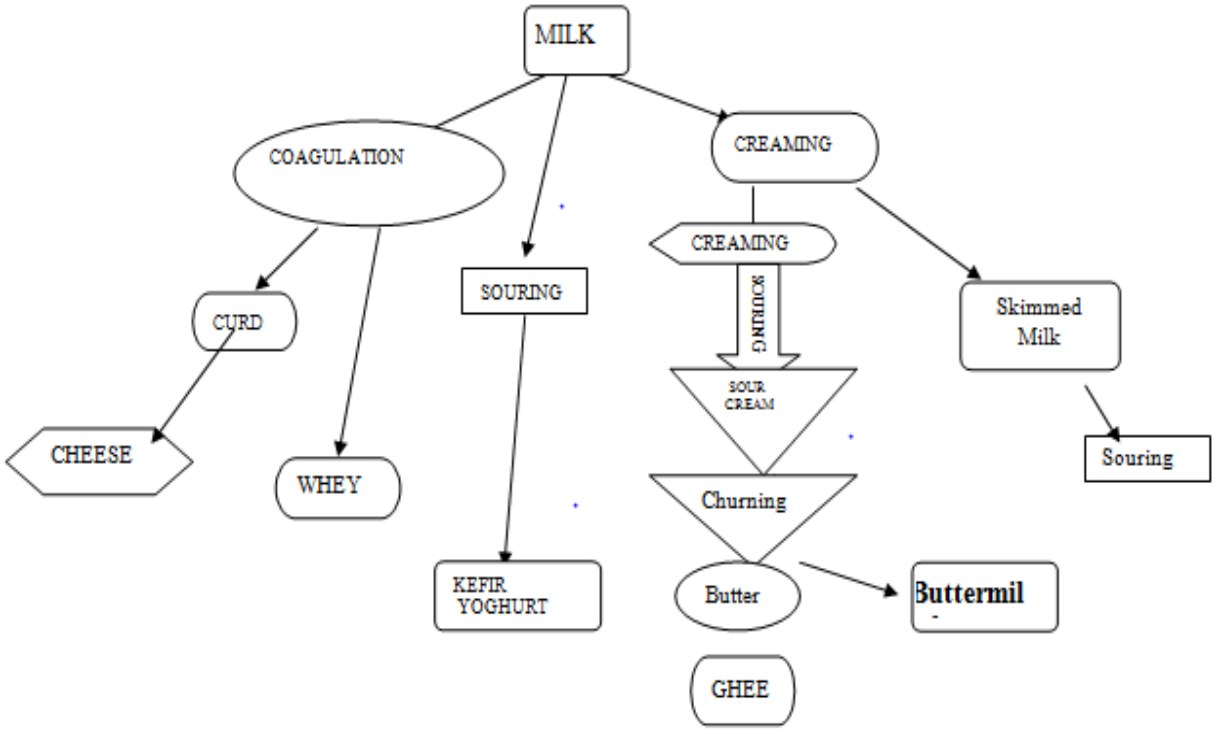

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Diagram. 1. Different products of milk

3.2. Milk processing method

Cream separation method

1. **Gravitational separation** :Gravity separation is slow and inefficient

Cream can be separated from milk by allowing the milk to stand in a setting pan in a cool place. This can be done in either of two ways

- **Shallow pan method-** Milk, preferably fresh from the cow, is poured into a shallow pan 40 to 60 cm in diameter and about 10 cm deep. The pan should be in a cool place. After 36 hours practically all of the fat capable of rising by this method will have come to the surface, and the cream is skimmed off with a spoon or ladle. The skim milk usually contains about 0.5 to 0.6% butter fat.
- **Deep setting methods –** Milk preferably fresh from the cow, is poured into a deep can of small diameter. The can is placed in cold water and kept as cool as

possible. After 24 hours the separation is usually as complete as it is possible to secure by this method. The skim milk is removed through a tap at the bottom of the can.

2. Centrifugal separation – Centrifugal separation is quicker and more efficient leaving less than 0.1% fat in the separated milk compared with 0.5--0.6% after gravity separation. It also allowed removal of cream and recovery of the skim milk in a fresh state.

Factors affecting efficiency of cream separation:

- Mechanical condition of machine
- Temperature of the milk
- Los speed of bowl
- High rate of inflow
- Clogging of bowl Acidity of the milk

Churning: is the process of shaking up whole milk or cream to make butter. Butter production (changing whole milk to butter) is a process of transforming a fat-in-water emulsion (milk) to a water-in-fat emulsion (butter).The process can be summarized in 3 steps:

- Churning physically agitates the cream until it ruptures the fragile membranes surrounding the milk fat. Once broken, the fat droplets can join with each other and form clumps of fat, or butter grains.

- As churning continues, larger clusters of fat collect until they begin to forma network with the air bubbles that are generated by the churning; this traps the liquid and produces foam.
- The cream separates in to butter and buttermilk. The buttermilk is drained off, and the remaining butter is needed to form a network of fat crystals that becomes the continues phase, or dispersion medium, of a water-in-fat emulsion.

Factors affecting butter churning

- Milk acidity
- Churning temperature
- Degree of agitation, and
- Extent of filling the churn

Self-Check - 3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define churning? (3 points)
2. What are the factors that affect butter churning ? (7 points)

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

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

Answer Sheet

Score = _____

Name: _____ Date _____

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Information sheet-4	preparing milk processing equipment and materials

After collecting whole milk from different sources, the milk should pass through different steps for processing. In each step different materials and equipment are required. The materials and equipments must be cleaned and disinfected properly. The following are materials and equipment used for the processing of milk.

		
Cream separator	Churner	churner
Milk cooling tanks 		Milking machine 

1. Bucket
2. Ladle /Spoon
3. Sieve/filter
4. Milk jars
5. Milking can
6. Lactometer
7. Refrigerator
8. Weighing scale
9. Cooking dish
10. Homogenizer
11. Pasteurizer and the others should be prepared accordingly kali

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down the five materials, tools and equipment used in milk processing (5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

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

Answer Sheet

Score = _____

Name: _____ Date _____

1

- _____
- _____
- _____
-

Information sheet-5	Identifying any OHS hazards and taking appropriate action

According to the International Labor Organization (ILO) OHS Hazard can be categorized into physical, chemical or biological nature. Proper management is needed to avoid accidents and to keep the staff motivated.

Physical

- Exposure to high levels of noise.
- Injuries of teats, udder
- Long-time exposure to heat and cold.
- Skeletal problems resulting from lifting and moving of animals, feed bins (bags)

Chemical

- Respiratory problems resulting from exposure to dust, which is composed of feathers, dander, micro-organisms, etc.
- Respiratory, skin, and eye diseases due to exposure to gaseous chemicals.(e.g. NH3, H2S, CO2, CO, and CH4.
- Exposure to disinfectants, detergents, formaldehyde and pesticides.

Biological

- Zoonotic infections. These diseases are transmitted between animals and humans & they also are transmitted from animals to humans and include bacterial, viral, fungal, and parasitic diseases. tuberculosis,

OHS requirements

Work task is provided according to Occupational Health and Safety (OHS) requirements. This may include:

- Using of relevant protective clothing and equipment,
- Use of tooling and equipment,
- Creating conducive working environment and safety handling of material,
- Using First aid kit to provide aid services
- Hazard control and hazardous materials and substances.etc,
- Following Occupational health and safety procedure designated for the task
- Checking and fulfilling required safety devices before starting operation

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

2. List down the three types of hazards (3pts)
3. Write the Occupational Health and Safety (OHS) requirements in work place. (7pts)

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

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

Answer Sheet

Score = _____

Name: _____ Date _____

1

- _____
- _____

2

- _____
- _____
- _____
- _____

Information sheet-6	**Using personal protective equipment (PPE)**

Select suitable personal protective equipment.

There are different types of materials, tools and equipments and supplies to perform different activities in milk handling. Therefore, identifying, selecting, using and preparing facilities, supplies according to the working activity are very important aspect in work.

Personal protective equipment include

- Overalls
- Gloves
- plastic boots/shoes
- Respiratory musk
- Aprons,
- Hair cover

Protective clothing should be selected to prevent skin contact with contaminated materials or environments. Consideration should be given to the type of work being performed by the worker when selecting personal protective clothing.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down PPE used in processing of milk (6pts)

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

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

Answer Sheet

Score = _____

Name: _____ Date _____

1

- _____
- _____
- _____

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Information sheet-7	Observing Sanitary procedure

When all cows have been milked, the shed and all milking equipment must be thoroughly cleaned. There are many dairy detergents and chemical sterilizes available, but misuse could lead to ineffective cleaning and sterilizing, or residues appearing in milk.

Good cleaning practice includes:

- Dry clean and remove all loose dirt and debris from the shade and yards
- Rinse or wet the surface, using cold or warm (not hot) water
- Hot wash using a detergent solution that holds contaminants (or soils) in suspension for a short time
- Rinse with cold water and drain
- Apply sanitizer to contact surfaces and allow to dry.

7.1. Milking barn or cowshed

Everything within the milking barn, stable or cowshed should be kept clean and tidy. These rooms should be free of dirt and animal droppings. They should be kept free of dust and the floor should be dry, clean and fly and rodent proof. The interior and the surroundings of the barn, stable or cowshed should be kept clean and tidy. The walls, ceilings, windows and equipment should be free of filth, litter and vermin. Animal droppings and manure should be collected and disposed of properly.

7.2. Utensils and Equipment

General guide lines used to clean milk utensils and equipment should include:

- Be cleaned after each usage
- Be washed thoroughly after each usage

- Be sanitized before each usage
- Be protected from contamination and mishandling prior its usage
- Be stored free from flies and other vermin when not in use.

7.3. Milk handlers

- Keeping the milk handler level of personal hygiene high
- Washing of hands with detergents before handling milk
- The milk handler should always wear clean garments (PPE) while milking, transporting, storing and processing milk.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down the general guide used in cleaning of milk equipment (5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

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

Answer Sheet

Score = _____

Name: _____ Date _____

i. _____

ii. _____

iii. _____

iv. _____

0pration sheet -1	**Cream separation**

Procedure

1. Set bow, fit the skim milk spout and the cream spout.
2. Fit the regulating chamber on top of the bowl.
3. Put the float in the regulating chamber.
4. Put the supply can in position, making sure that the tap is directly above and at the centre of the float.
5. Pour warm (body temperature) water into the supply can.
6. Turn the crank handle, increasing speed slowly until the operating speed is reached.
7. Open the tap and allow warm water to flow into the bowl.
8. Pour warm milk (37--40°C) into the supply can. Repeat steps 6 and 7 above and collect the skim milk and cream separately.
9. When all the milk is used up and the flow of cream stops, pour about 3 liters of the separated milk in to the supply can to recover residual cream trapped between the discs.
10. Continue turning the crank handle and flush the separator with warm water.

0pration sheet -2	**Butter making**

Procedure

1. Clarify or filtrates the milk as soon as it is milked & cool it.
2. Wash & dry the charner.
3. Sour the cream 2-3 days or add sweet cream to the churn after measuring the volume of cream to churn. The ideal volume of cream to be churned should not exceed one half the volumetric capacity of the churn.
4. Churn the cream in cool temperature (morning or evening).
5. When the butter grains appear, it may be necessary to add water ($2c^0$ below the churning temperature) to maintain butter grain butter grain of required size.
6. Churning should cease when the butter grains & are the size of small wheat grains.
7. Drain off the buttermilk or collect the butter grains & wash the butter with water several times. Adding only as much water as is needed to float butter in the container or churn does each washing.
8. Add dry & evenly ground & of best quality salt available at a rate of 16 salts per kg of butter or according to the test & wash it.
9. Roll out the 8 to 10 times or ridge with spatulas to remove excessive moisture.
10. Take weight & pack it in container.

0pration sheet -3	**Cheese making**

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URE

1. Standardized the milk
2. Heat to 83 $c^0$for 20 minutes
3. Acid is added example Lemon juice or Lactic acids Acetic acid or Acid whey
4. Stirring for 2minutes
5. Coagulation to casein in denatured serum proteins, fat is incorporated
6. Precipitation to settle the curd 15min
7. Filtering
8. Adding of salt 3-10g/l used milk
9. Cooling
10. Filling packs/ moulds & pressing
11. Wrapping

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 5 hours.

Task 1. Cream separation

Task 2. Butter making

Task 3. Cheese making

Instruction Sheet	Learning Guide 55

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Storing the processed milk and milk by products properly
- Returning/Disposing off materials
- Cleaning, maintaining and storing tools and equipment
- Reporting Work outcomes

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 –

- Store the processed milk and milk by products properly
- Return/Dispose off waste materials
- Clean, maintain and store tools and equipment
- Report Work outcomes

Learning Instructions:

15. Read the specific objectives of this Learning Guide.
16. Follow the instructions described in number 1 to 6.
17. Read the information written in the "Information Sheet (**1, 2,3, and 4**) in page **2,5,7 and 9** respectively
18. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
19. Accomplish the **"Self-check 1, Self-check 2, Self-check 3" and Self-check 4** in page**, 4, 6,8 and 10** respectively.

20. If you earned a satisfactory evaluation proceed to “the next topic”. However, if your rating is unsatisfactory, see your teacher for further instructions or read back the Learning guide information sheets **1-4**. Submit your accomplished Self-check. This will form part of your training portfolio.

Information sheet-1	1.1. Storing the processed milk and milk by products properly

The processed milk and milk by products are properly stored until transporting. All dairy products have a shelf life that varies according to how an item is processed, packaged, stored, how long a product has been allowed to stand unrefrigerated on a counter or the type of container used can alter the freshness period. Most milk, yogurt, sour cream and similar products are sold in date-coded cartons that indicate a product's peak freshness. The shelf life of cheese depends on its type (hard or soft) and its form (cut or wax-coated). Milk products should be labeled.

Important points to be considered in storing of milk and processed milk product:

- Avoid heat shock; do not leave milk out of refrigeration for a prolonged period of time.
- Try to keep the refrigerator door closed as much as possible,
- Keep the temperature steady.
- It is recommended that milk or dairy products be placed on refrigerator shelves and not on the door.
- Check the temperature of your refrigerator often.

Table : 1 Recommended dairy product storage guidelines

Product	Shelf life	
	After opening T^o/Time	Un opened T^o/Time
Milk	35^o 1 week	35^o 10-14 days
Cream	35^o 1 week	35^o 2 weeks
Butter	35^o 2weeks	35^o 4 weeks

Processed cheese	35^{o} 5 weeks	35^{o} 24 weeks
Yogurt	35^{o} 3 weeks	35^{o} 4 weeks

Table: 2: recommended storage time and temperature

Recommended Storage Times and Temperatures for Milk and Other Milk Products

Dairy Food	How To Store	Safe Storage Time: On Refrigerator Shelves 35 - 40°F (2 - 4°C)	Safe Storage Time: In Freezer 0 °F (-18°C) or below, properly packaged
Pasteurized Fresh Whole or Skimmed Milk, Sweet Cream, Flavored Milk Drinks	Refrigerate immediately in original container. Keep container closed.	Unopened cartons for 30 days. Opened for 1 week. Check code date.	Do not freeze. (Change of texture, body appearance. Separation of fat.)
Sweetened & Condensed Milk (opened)	Keep covered.	1 week.	Do not freeze.
Whipped Topping	Keep covered.	3 months in aerosol can. 3 days prepared from mix. 2 weeks bought frozen (once thawed).	Do not freeze.
Yogurt	Keep covered.	7 - 10 days.	Do not freeze.
Sour Cream, Butter, Milk, Cultured Milk	Refrigerate immediately in original container. Keep container closed.	2 weeks. Up to 2 months for salted butter (2 weeks for unsalted butter)	6 to 9 months for salted butter; up to 5 months for unsalted butter. Do not freeze others.
Soft Custards, Milk Puddings, Cream and Custard Fillings for Cakes and Pies	Cool cooked dishes quickly and refrigerate within 2 hours. Refrigerate cold dishes immediately after preparation.	5 - 6 days.	Do not freeze.
Ice Cream	Store in original container in freezer or transfer to a moisture-vapor-proof container.	Do not store here.	2 - 3 weeks.
Natural Hard Cheese and Semi-Hard Cheese and Processed (Cheddar, Swiss, Parmesan, Brick, Bleu, etc.)	Refrigerate in original package and over wrap tightly in aluminum foil, plastic wrap or plastic bag tightly closed to avoid drying.	1 month. If mold forms, cut off.	Freezing affects texture (makes it crumbly). Still suitable for cooking. Thaw in refrigerator. Do not freeze soft cheeses.
Soft Cheese (cream, cottage, limburger, camembert)	Refrigerate tightly covered.	1 week.	Do not freeze (Can freeze cream cheese. Texture may change.)
Cheese Spreads	Refrigerate tightly covered.	1 month.	Do not freeze.
Evaporated Milk (opened)	Refrigerate tightly covered.	1 week.	Do not freeze.
Homogenized, Reconstituted Dry Nonfat and Skimmed	Keep containers tightly closed. Do not return unused milk to original containers.	1 week.	Do not freeze.

From the National Food Safety Database: http://www.foodsafety.org/he/he517b.htm

Self-Check -1	Written Test

Directions:

Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List down factors that make shelf life of dairy products to vary (5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

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

Answer Sheet

Score = _____

Name: _____ Date _____

1. _____
2. _____
3. _____
4. _____
5. _____

Information sheet-2	Returning/Disposing off materials	Handling Waste

materials produced during work

There are different waste materials or product which will be produced in work place but the common waste material which produced during handling and processing of milk are the following

- Animal dung
- Plant debris
- Plastic,
- Metal and paper-based
- Dusty feeds or bedding materials
- Contaminated milk/Adulterated milk

These waste materials which are produced during handling and processing of milk have to be removed from the site on regular manner/ properly;

Disposable materials properly buried in deep enough trench and should be covered with quicklime and then with soil or use Burning. But Burning is the most difficult because the Fumes and smoke may be a problem to the surrounding environment. Mud holes should be frequently filled or exclude the animals away from it quickly.

- **N.B. Never dispose waste materials everywhere.**

Important points in handling and disposal of waste materials in dairy farm

- Treating, reusing, and disposing of waste water using different methods
- Safe and proper disposal of non-hazardous farm waste
- Handle, collect, segregate, store, label and dispose of Human waste
- Preventing the contingency site from being polluted
- Storing, segregating, treating, disposing of farm waste

- Store, secure, utilize and dispose of pesticides/equipment
- Spill prevention, response, containment, and cleanup

Self-Check -2	Written Test

Directions:

Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the waste materials produced during handling and processing of milk.(5pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

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

Answer Sheet

Score = _____

Name: _____ Date _____

1. _____
2. _____
3. _____
4. _____
5. _____

Information sheet-3	Cleaning, maintaining and storing tools and equipment

3.1. Cleaning materials, tools and equipment

After each step during handling and processing of milk and by products the materials should be thoroughly washed and cleaned. If not thoroughly washed they becomes a source of microbial contamination and shorten the life span of the materials.

Materials used in milk handling and processing have to be handled and transported safely. Any milk handler and processer have to do this task safely because any damage will create inconvenience on the next use of the equipment, and also it will cause damage on the products.

The routine cleaning process of all this equipment is as follows: -

- Rinse with cold water; -
- Wash and brush in hot water containing a detergent in an 1% solution, e.g. washing soda or teepol; -
- Rinse in hot distilled water and examine for cleanliness; -
- Allow to dry upside down in a dust-free surrounding;
- After use pipettes should be placed vertically in a cylinder, which contains a mild solution of hypochlorite in a concentration of 1.5 ml per liter water.
- This eases cleaning and minimizes the risk of contamination.

3.2. Separator maintenance

- The gears must be well lubricated. Follow the directions of the manufacturer.
- The level of the lubricant must be kept constant; observe the oil level through the sight glass.
- The bowl must be perfectly balanced.

The bowl should be cleaned thoroughly immediately after use to ensure proper functioning of the separator and for hygiene

Self-Check -3	Written Test	Directions:

Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the advantages of cleaning and maintaining materials, tools and equipment.(4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

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

Answer Sheet

Score = _____

Name: _____ Date _____

1. _____
2. _____
3. _____

Information sheet-4	Reporting Work outcomes

There are many work outcomes in dairy farm while handling and processing of milk and milk products. The work out comes should be reported to the supervisor.

Some of them are:

- The amount of product produced. e.g milk yield, composition and quality
- Disease out breaks/ disease transmission
- Human labor attendance
- Mastitis
- Insufficiency of working facilities eg. electricity
- Contaminations (feed, water and feeding and watering trough)
- Malfunctions of machines and equipment like cream separator, churner, milking machine etc
- Suspected and dead animals and the others should be properly reported.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention 4 points that are reported to the supervisor (4pts)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

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

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

1. _____
2. _____
3. _____
4. _____

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