RWANDA POLYTECHNIC

TVET LEVEL II

AGRICULTURE

Milk Processing

TRAINEE MANUAL

RWANDA POLYTECHNIC

Approved by: Workforce Development Authority

USAID FROM THE AMERICAN PEOPLE

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MILK PROCESSING

Unit 1: Reception of milk

Unit 2: Processing milk

Unit 1: Reception of milk

Topics

1.1 Preparation of the workplace and equipment

1.2 Reception of raw milk

1.3 Grading and cooling of raw milk

Unit Summary:

This unit describes the knowledge, skills, and attitudes required to receive milk. At the end of this unit, learners will be able to prepare the workplace and equipment, receive, grade, and cool raw milk.

Self-Assessment: Unit 1

1. Look at the illustration above. What do you notice? Based on the photo, what do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this survey. It is for your own use during this course. The trainer will read a skill that is listed in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again.

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify equipment for receiving milk.					
Describe procedures for cleaning and sanitizing the workplace and equipment.					
Depict the equipment adjustment techniques of for receiving milk.					
Prepare equipment for receiving milk.					
Clean and sanitize the workplace and equipment.					
Adjust equipment for receiving milk.					
Determine techniques of controlling raw milk.					
Describe the procedure of filtrating and weighing raw milk.					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Identify techniques for keeping records.					
Control raw milk.					
Filtrate and weigh/measure raw milk.					
Keep records.					
Describe techniques in milk grading.					
Explain degrees of milk in cooling process.					
Grade milk.					
Cool milk.					

Topic 1.1: Preparation of the workplace and equipment

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify equipment for receiving milk.	**1.** Prepare equipment for receiving milk.	**1.** Attention to detail regarding requirements.
2. Describe procedures for cleaning and sanitizing the workplace and equipment.	**2.** Clean and sanitize the workplace and equipment.	**2.** Respecting standards.
3. Depict the adjustment techniques of equipment for receiving milk.	**3.** Adjust equipment for receiving milk.	**3.** Applying protocol.

Getting Started: What do we know and where are we going?

Topic 1.1 Task 1:

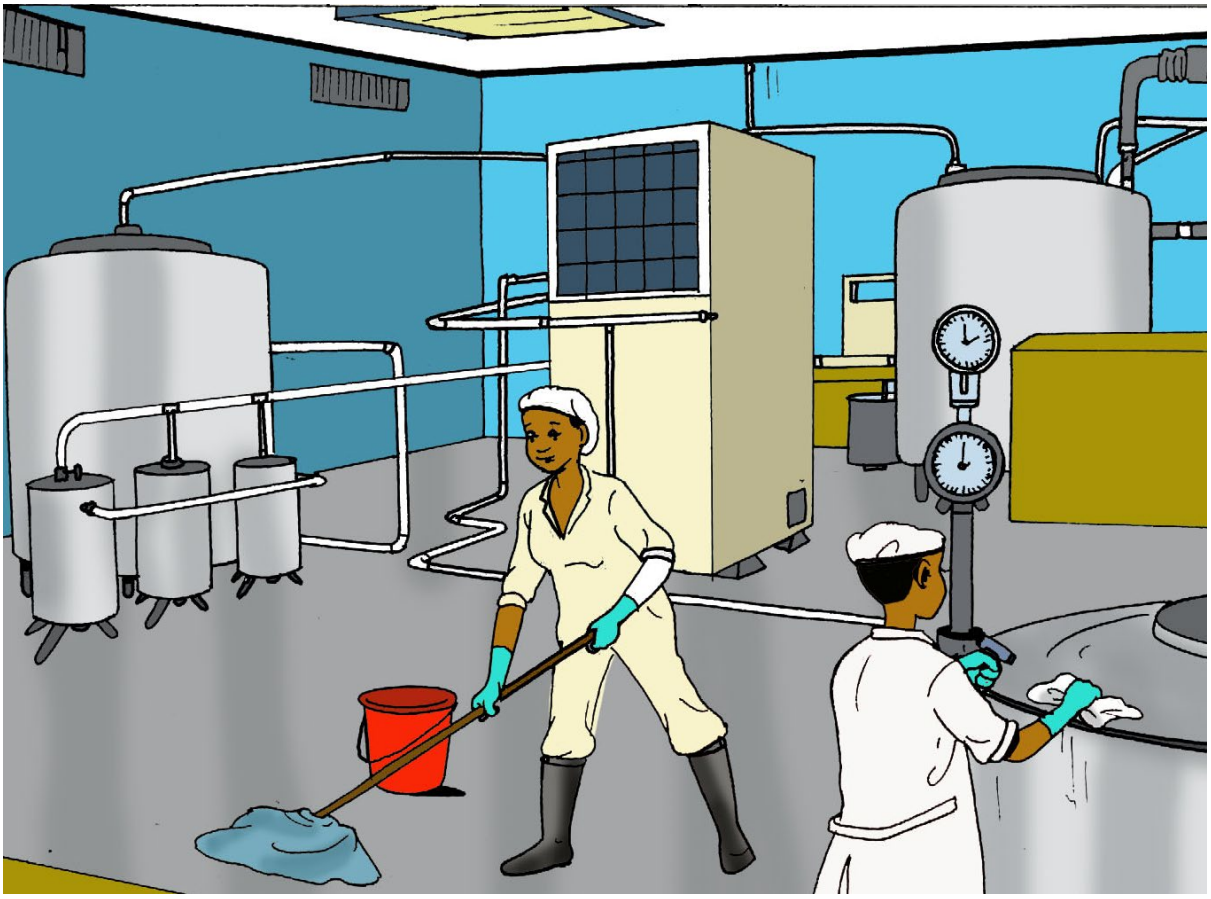
1. In groups of 4-5 people, discuss the following:

a. Look at the picture—what is happening?

b. Share any experiences and thoughts that you have about the different equipment (tools, utensils and materials) necessary to clean the milk processing area.

c. Why is it important to keep this area clean?

d. List some of the different ways or methods we use to properly clean the area.



Problem Solving Activity

Topic 1.1 Task 2:

1. Read the following:

Mr. Graham, the production manager of Impact Dairies Ltd., knows that keeping the milk processing area clean can be a challenge. He spots Mildred, a new employee, forgetting to use rubber/plastic gloves and using the same cloth to wipe down the equipment as used on the floor. Mr. Graham decides to give all employees a refresher course on the correct tools, utensils and materials necessary to keep the milk processing area clean.

2. Look at the list/drawings of utensils, materials and tools below.

Group of tools, utensils, and materials	Specific examples
Tools and utensils	Brushes, mops, torchons, basins, buckets
Disinfectants	Caustic soda, Nitric Acid
Detergents	Powder Detergent, Liquid soap
Sanitizers	Air driers, chlorine
PPE	Gloves, boots

3. In groups, read and answer the following:
   a. Is this tool, utensil, or material necessary to help clean the milk processing area?
   b. If yes, what is the specific purpose of the tool/utensil/material and where should it be used?

Topic 1.1 Task 3:

1. Read the following:

Mr. Graham, the production manager of Impact Dairies Ltd. knows that most of his employees are familiar with the 4-step process in keeping the milk processing area clean. However, he also knows that sometimes employees may miss a step or get the steps confused. To help the employees follow the different steps in the correct order, he decides to put some posters on the wall. He asks Fred, an employee, to stick the posters on the wall in the correct order of the different stages that must be followed when preparing and cleaning the milk processing area. Fred is eager to help but sees that some of the posters are incomplete, and he also forgets which order the posters should follow as they are not numbered. Can each group help Fred put the posters in the correct order so that employees can follow the 4-step cleaning process?

Step 1:

- Wash with hot water (60 °C) and detergent, disinfectants and sanitizers

Step 2:

- Leave equipment, materials and tools to air dry.

Step 3:

- Treat with very hot, clean, potable water (75 °C) for at least 2 minutes.

Step 4:

- Prepare detergents, sanitizers and disinfectants
- Remove loose dirt and food particles.
- Rinse with warm, potable water.

2. In groups, look at the different posters and:

a. Decide what order the posters should go to correctly show the 4-step process for keeping the milk processing area clean.

b. Identify what is missing from the posters – hint: there is 1 thing missing from each poster.

Topic 1.1 Task 4:

1. Answer the following in your notebooks:

a. What could happen if the 4-step process for keeping the milk processing area clean are followed in an incorrect order?

b. What could happen if only 1, 2 or 3 steps of the 4-step process for keeping the milk processing area clean were followed?

c. Why is it important to use the correct tools, utensils and materials for cleaning the milk processing area?

d. What could happen if the milk receiving equipment is not adjusted correctly?

1.1 Key Facts

- **Preparation of the workplace and equipment for milk processing:**[1]
  - A sanitation plan is important in any food processing facility.
  - Cleaning removes food residues that can be sources of contamination.
  - Cleaning methods and implementation vary according to type of food.
  - All items that get into contact with food must be effectively cleaned and sanitized.
  - Cleaning and sanitization is a 4-step process that removes food waste, dirt, grease, and destroys food-borne disease pathogens.

- **Step 1 – Preparation**
  - Remove loose dirt and food particles.
  - Rinse with warm, potable water.

[1] Department of Health. (n.d.). *Cleaning and sanitising food premises and food equipment*. WA Health, Government of Western Australia. Retrieved July 14, 2020, from https://ww2.health.wa.gov.au/Articles/A_E/Cleaning-and-sanitising-food-premises-and-food-equipment

- **Step 2 – Cleaning**
  - Wash with hot water (60 °C) and detergent.
  - Rinse with clean potable water.
- **Step 3 – Sanitizing (bacteria killing stage)**
  - Treat with very hot, clean, potable water (75 °C) for at least 2 minutes.
  - Apply sanitizer as directed on the label.
- **Step 4 – Air drying**
  - Leave equipment, materials, and tools to air dry.

- Application of a cleaning and or/disinfectants should follow four conditions that can be remembered as **TACT** (Temperature, Action, Concentration and Time).[2]
  - The product should be diluted and placed in contact with the utensils in water at a specific **Temperature** (often indicated on the label). The instructions for use need to be noted as a product acts differently in cold and hot water.
  - Soaking equipment, utensils, and tools should be accompanied by **Action** in form of energetic brushing to remove dirt and enable the product to act on all parts.
  - The product should be used at a certain **Concentration**, often indicated on the label.
  - The equipment, utensils, and tools should be left to soak for a given **Time** (as recommended by the manufacturer).

- Adjustment techniques of equipment for receiving milk:
  - Set the milk receiving tank up where it cannot meet dirt.
  - Place the bucket close to the tap of the milk-receiving tank.
  - Put a jag inside the bucket.

Guided Practice Activity

Topic 1.1 Task 5:

1. Review the different tools, utensils and materials in the school workshop:

a. Identify all the different tools, utensils, and materials required and their uses for cleaning the milk processing area.

b. Make a note of any tool, utensil, or material that is different to what has been previously described. Suggest a use for this.

[2] Food and Agriculture Organization of the United Nations. (n.d.). *Hygiene of Food Preparation and Vending Premises and Equipment*. https://www.fao.org/3/a0740e/a0740e02.pdf

c. Look closely at any cleaning fluids/liquids used and carefully read the preparation instructions. Copy and complete the table.

S/N	Name of sanitizer	Concentration of the detergent (%)	Temperature (0C)	Mode of application	Time of exposure (Min)

2. In your groups answer the following:

a. Why is it important to follow the instructions for correctly preparing cleaning agents/disinfectants?

b. What do you think could happen if you do NOT dilute the cleaning agent/disinfectant enough (e.g. it is very strong)?

c. What do you think could happen if you dilute the cleaning agent/disinfectant too much (e.g. it is very weak)?

Application Activity

Topic 1.1 Task 6:

1. Read the following:

Last year, Mr. Graham gave 10 students from the TVET Level 2 milk processing module the opportunity to work for him. He has been very impressed with their commitment to the work and how they are able to follow the instructions and processes for cleaning the milk processing area. He is very happy with how the students work together as a team. Mr. Graham wants to give the same opportunity to 5 new students from this year's TVET course and has asked your group to help this new group when they start. Mr. Graham has asked you to:

a. Develop a 5 minute presentation (it can be a speaking presentation or done by singing, dancing, acting etc!) to show the new group of 5 employees what utensils,

tools, and materials are needed and what their uses are; the 4-step process; and what adjustments to equipment is necessary.

Points to Remember

- Avoid cleaning and disinfecting the floors in dry state.
- Clean, disinfect, and thoroughly rinse the equipment, tools and utensils, and work surfaces with running water and put everything away, clean and protected from dust.
- Empty the dust bins into the appropriate facility and then wash and disinfect.

Formative Assessment

Ask the trainees to choose the right answer to the questions below.

1. Sanitizing is the first step in creating a safe food contact surface.
- **a.** No
- **b.** Not sure
- **c.** Usually
- **d.** Yes

2. After sanitizing, equipment, utensils and tools should always be _____dried.
- **a.** Air
- **b.** Vacuum
- **c.** Towel
- **d.** Speedy

3. The only way to correctly sanitize surfaces and equipment in a milk processing establishment are with _____and _____.
- **a.** Soap and water
- **b.** Hot and cold water
- **c.** Disinfectant/cleaning fluids and heat
- **d.** Heat and water

4. To prevent _____of food, cleaning supplies, equipment, and chemicals should be stored separately and well away from food contact surfaces.
- **a.** Freezing

b. Burning
c. Rotting
d. Contamination

5. Which of the following are approved for sanitizing food contact surfaces and equipment?
a. Chlorine
b. All of those
c. Mercury
d. Zink

6. Proper three compartment sink cleaning procedures are_____.
a. Pre-wash, rinse, sanitize, towel dry.
b. Wash, rinse, sanitize, towel dry.
c. Wash, rinse, air dry
d. Pre-wash, wash, rinse, sanitize and air dry

Topic 1.2: Reception of raw milk

Key Competencies:

Knowledge	Skills	Attitudes
1. Determine techniques of controlling raw milk.	**1.** Control raw milk.	**1.** Safety oriented awareness
2. Describe the procedure of filtrating and weighing raw milk.	**2.** Filtrate and weigh of raw milk.	**2.** Attention to detail
3. Identify the techniques of keeping records.	**3.** Keep records.	**3.** Diligence

Getting Started: What do we know and where are we going?

Topic 1.2 Task 1:

1. Brainstorm responses to the following:

a. The milk arrives at the dairy. What happens next and why is this important?

2. Look at the picture above and answer the following:

a. What do you think is happening in the picture?

Problem Solving Activity

Topic 1.2 Task 2:

1. Look at the instructions below for milk sampling. This is the process that first occurs when the milk arrives in the dairy. The instructions are not in the correct order. Show with numbers 1-6 the correct order for sampling milk. The first one has been done for you.

Instruction for sampling milk	Correct ordering of sampling
Mix milk at least 5 minutes.	
Wash and dry hands; keep hands clean during sampling operation.	1
Seal the sample container immediately after filling.	
Rinse equipment used for sampling after use	
Take the sample as soon as possible after mixing	
Label the sample with the necessary information	

Topic 1.2 Task 3:

1. Read the following:

a. After a sample of milk has been taken, there are different tests and observations that must be completed. One test is to observe what the milk looks like.

b. The following statements show some observations that a dairy man has made of 5 different samples of milk. Write the statements and fill in the missing spaces using the words in the box. Each word can only be used **ONCE**.

i. The colour of cow milk should be slightly _____; a different colour may indicate milk which is unsuitable for processing.

ii. Reddish milk could indicate that there is _____in the milk.

iii. A “blue thin” colour and a thin and watery appearance can indicate that the milk contains added _____ or skimming (fat removal).

iv. Large _____ can indicate sour milk or mastitis milk.

v. Small white clots or grains can indicate either Mastitis milk or milk adulterated with _____and / or skim milk powder

Blood	**Flour**	**Water**	**Clots**	**Yellowish-white**

Topic 1.2 Task 4:

1. Review the following table that is about the different tastes and flavours of milk. Match up the statements on the left with the statements on the right. The first two have already been done for you.

Statement	**Statement**
• Acid flavours are easily detected by smell and taste.	beets, poorly made silage, certain plants and pastures can cause off-flavours to milk
• Rancid and bitter flavours: a pure bitter flavour can be detected by taste only.	The flavour is caused by the growth of acid-producing bacteria that reduce lactose to lactic acid.
• Feed flavours like garlic, onion.	A very slight oxidized flavour suggests flat flavour as well as low solids and/or low-fat milk.
• Flat flavours are quite easy to detect.	The rancid flavour can be detected by both the senses of smell and taste and is caused by lipolysis (deterioration) of fat.
• Other flavours such as drugs, disinfectants and	detergents can also be causes bad smell and flavour.
• Unclean flavours suggest mustiness, staleness and foul stable air.	It is caused by an increase in chlorine and decrease in lactose content
• Salty flavours are easy to detect; and often associated with milk from cows in an advanced stage of lactation or mastitis milk.	The oxidized flavour is characterized by a quick taste reaction.
• Oxidized flavours are sometimes described in such terms as “oily”, “stale”, “	The flavour is caused by the growth of the bacteria Streptococcus lactis var. maltigenes.

Topic 1.2 Task 5:

1. Answer the following questions:

a. What do you understand by the term density?

b. Mr. Graham is asking for help. He thinks that a recent delivery of milk has been 'thinned' by the farmer by adding water to it. In pairs, think of how Mr. Graham could find out if his suspicions are true.

c. Mr. Graham has another inventory of milk from a different farmer. This milk looks like it has some unwanted material in it. How could the unwanted material be removed and what procedures should be followed?

d. Mr. Graham has asked for our support. He wants us to explain to his new employees what records to keep about the milk. In groups of 4, record all the different things about the milk that should be recorded.

1.2 Key Facts

- **Control of raw milk**
  - ✓ *Milk sampling*
    - Wash and dry hands; keep hands clean during sampling operation.
    - Mix milk at least 5 minutes with stainless stirrer.
    - Take the sample (500ml) as soon as possible after mixing.
    - Cover sample with aluminium foil.
    - Seal the sample container immediately after filling.
    - Label the sample with the necessary information.
    - Rinse equipment used for sampling after use.

  - ✓ *Organoleptic quality testing (taste, smell, and visual observation)*[3]
    - The colour of cow milk should be slightly yellowish white; a different colour may indicate milk which is unsuitable for processing.
    - Reddish milk could indicate that there is blood in the milk.
    - A "blue thin" colour and a thin and watery appearance can indicate that the milk contains added water or skimming (fat removal).
    - Large clots can indicate sour milk or mastitis milk.
    - Small white clots or grains can indicate either Mastitis milk or milk adulterated with flour and / or skim milk powder
    - Acid flavours are easily detected by smell and taste. The flavour is caused by the growth of acid-producing bacteria that reduces lactose to lactic acid.

[3] Alsandaqchi, A. (n.d.). *Milk Hygiene/Practical Lecture*. University of Basrah. https://un.uobasrah.edu.iq/lectures/7575.pdf

- Rancid and bitter flavours: a pure, bitter flavour can be detected by taste only. The rancid flavour can be detected by both the sense of smell and taste and is caused by lipolysis (deterioration) of fat.
- Feed flavours like garlic, onion, beets, poorly made silage, certain plants, and pastures can cause off-flavours to milk.
- Flat flavours are quite easy to detect. A very slight oxidized flavour suggests flat flavour as well as low solids and/or low-fat milk.
- Malty flavours are very suggestive of malt. The flavour is caused by the growth of the bacteria Streptococcus lactis var. maltigenes.
- Oxidized flavours are sometimes described in such terms as "oily," "stale," "tallowy, "cardboard," or "sunshine". The oxidized flavour is characterized by a quick taste reaction.
- Salty flavours are easy to detect, and often associated with milk from cows in an advanced stage of lactation or mastitis milk. It is caused by an increase in chlorine and decrease in lactose content.
- Unclean flavours suggest mustiness, staleness and foul stable air.
- Other flavours such as drugs, disinfectants, and detergents can also cause bad smells and flavours.

✓ *Milk density determination*[4]

- With a lactometer, the specific density of milk is measured. The specific density of the milk varies according to the proportions of fat, SNF (casein, lactose, vitamins and minerals) and water. At 15 °C, the normal density of the milk ranges from 1.028 to 1.034 g/ml, whereas water has a density of 1.0 g/ml.

➢ **Filtration and weighing of raw milk[5]**

- A better method to weigh the milk would be to use a good quality bench weighing scale or a platform weighing scale.
- Filter milk through a linen cotton disc.

➢ **Keeping records[6]**

The record paper should include the following items:

- identification of the product
- nature of the product
- identification number

[4] Food and Agriculture Organization of the United Nations. (n.d.). *Chapter 3: Developing Groups*. Milk Manual. https://www.fao.org/tempref/docrep/fao/007/y3548e/y3548e02.pdf

[5] Food and Agriculture Organization of the United Nations. (n.d.). *Milk Testing and Payment Systems: Resource Book*. https://www.fao.org/3/a-i0980e.pdf

[6] Food and Agriculture Organization of the United Nations. (n.d.). *Milk Testing and Payment Systems: Resource Book*. https://www.fao.org/3/a-i0980e.pdf

- name / signature of the person who took records
- milk quality test results

Guided Practice Activity

Topic 1.2 Task 6:

1. Read the following**:**

The president of Terimbere Milk Collection Centre has received a notice from the head of Rwanda Energy Group informing him of the likelihood of power disturbances on Saturday. The collection centre has 5000 litres of raw milk in the cooling tank. He asked the Impact Dairies Ltd. production manager to help him and receive this quantity of milk to prevent spoilage.

2. In groups of 4:

a. Think of the impact of power disturbances if the milk is not moved.

b. Develop a plan for receiving the milk, after identifying clear roles and responsibilities for each group member.

c. Determine what tests should be done on the milk.

d. Conduct the different tests etc. on the sample of milk provided, ensuring that the plan is followed.

e. Record results.

3. Think of the following questions:

a. What did you find easy with the different procedures?

b. What did you find difficult with the different procedures?

c. What if anything and why would you change your plan?

Application Activity

Topic 1.2 Task 7:

1. Each group of 4 will be given 3-4 milk samples. In groups, determine which sample out of the 3-4 provided is “good” milk and could be consumed.

2. Craft a report, including recommendations on what milk is suitable for consumption. The following table can be used within the report if helpful.

Record sheet for sample milk testing

Sample No	smell	sight	alcohol	Lactometer
1				
2				
3				

Points to Remember

- Milk that already has many bacteria will not keep as long even once cooled.
- Proper hygiene practice in milk production and handling is key to a longer shelf life for milk.
- Cooling of milk will slow down the multiplication of bacteria and prolong shelf life.

Formative Assessment

Ask trainees to choose the correct answer.

1. How can the quality of milk be assessed?
- **a.** Taste of the milk
- **b.** Taste, density and smell of the milk
- **c.** Taste and colour of the milk
- **d.** Taste, smell, colour and density

2. What does the word density mean?
- **a.** The weight of a substance in a given volume
- **b.** The weight of a substance
- **c.** The mass of a substance in a given volume
- **d.** The mass of a substance

3. The density of milk can be measured by:
- **a.** A Lactometer
- **b.** Weighing scales
- **c.** A butyrometer
- **d.** A pipette

4. A red or pinkish tinge to the milk may indicate:
- **a.** Red clay in the milk
- **b.** Blood in the milk
- **c.** Carrot or beet in the milk
- **d.** Water in the milk

Topic 1.3: Raw milk grading and cooling

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe milk grading techniques.	**1.** Grade milk.	**1.** Thorough
2. Explain optimal milk cooling temperature range.	**2.** Cool milk.	**2.** Attention to detail

Getting Started: What do we know and where are we going?

Topic 1.3 Task 1:

1. Brainstorm as a class:
   a. Describe what you see in the picture.

b. What do you think the words 'grading milk' mean and why do you think this is important?

c. Do you know what tests can be done to measure fat and protein content, density of milk, and the amount of bacteria present in the milk?

d. Does anyone know the process for cooling milk?

Problem Solving Activity

Topic 1.3 Task 2:

1. Read the following:

One day, Jean de Dieu, an employee of Impact Dairies Ltd. Arrived to work late. He knew that there were deliveries of milk that needed to be completed immediately as customers were waiting. Jean de Dieu decided the best way to keep his customers happy was not to grade the milk as it was all fresh in and looked and smelt fine.

a. What are the risks in this approach?

b. Do you think the employee made the right decision to get the deliveries out so that customers did not have to wait for their milk?

c. What advice would you give the employee for the future?

2. Your group will be given one task that helps to grade milk (e.g., measuring **fat content**, measuring **protein content**, checking the **bacteria count** and measuring the **density)**. Using the information in **1.3 Key Facts** below, your group must:

a. Create a presentation for the other groups that explains how to correctly perform your assigned task.

b. Show and explain the equipment/materials (made available by the trainer) you need in order to correctly perform the task.

c. Afterwards, observe the trainer demonstrate the tasks needed to grade milk and ask any question about the different processes.

1.3 Key Facts

Cooling milk[7]

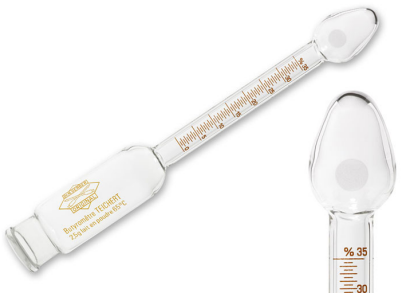
- After agitation or mixing the milk to prevent butterfat from forming globules/layer on top, the milk should be cooled to 20°C in a refrigerator, after which the tests below are carried out for grading. Testing should start as soon as possible after this pre-treatment.

Grading or classification of milk

Grade	Minimum Protein	Minimum Fat
A	3.1 %	3.5
B	2.5	3

Milk is **graded** by checking the:

- **Fat content**[8]
  - ✓ This is done by separating the fat from the milk. An acid called sulphuric acid is used to dissolve the membrane (a thin layer) of protein that surrounds the fat globules. Amyl alcohol is then added to help improve the separation of the fat from other solids.
  - ✓ The detailed process is as follows:[9]
    1. Use the 10 ml pipette to transfer 10 ml of sulphuric acid into the butyrometer.



    2. Fill the 10.75 ml pipette with milk and deliver the sample into butyrometer.

[7] Food and Agriculture Organization of the United Nations. (n.d.). *Milk Testing and Payment Systems: Resource Book*. https://www.fao.org/3/a-i0980e.pdf

[8] Wikipedia. (2008, September 5). *Gerber method*. Wikipedia, the free encyclopedia. Retrieved 2019, from https://en.wikipedia.org/wiki/Gerber_method

[9] *Determination of fat in milk by Gerber method*. (2015, November 28). AgriMoon. https://agrimoon.com/determination-of-fat-in-milk/

3. Add 1 ml of amyl alcohol using the 1 ml pipette. Close the butyrometer. Shake the butyrometer in the shaker stand until no white particles are seen and invert (tip it upside down) a few times.
4. Put the butyrometer in the water bath (temperature of 65^{o}C) for 5 min.
5. Take out the butyrometer and dry with a cloth, put it in the centrifuge, placing two butyrometers diametrically opposite, centrifuge at maximum speed for 4 minutes.
6. Transfer the butyrometers, stoppers downwards into water bath for 3-10 minutes.
7. Bring the lower end of the fat column onto a main graduation mark by slightly withdrawing stopper; the colour of the fat should be straw yellow; the ends of the fat column should be clear and sharply defined; the fat column should be free from specks and sediment; the water just below the fat column should be perfectly clear; the fat should be within the graduation.

- **Protein content**
  - ✓ When formaldehyde is added to milk, the free amino groups of the protein react with the carbonyl groups of formaldehyde causing the milk to become acidic. The acidity developed is related to the amount of protein present, which may be measured by titrating with sodium hydroxide (NaOH) using phenolphthalein as an indicator.
  - ✓ The detailed process is as follows:
    1. Place 10 ml of milk in a white porcelain basin.
    2. Add 0.4 ml of saturated aqueous potassium oxalate and 0.5 ml of 0.5% phenolphthalein solution.
    3. Allow to stand for 2 minutes and titrate with N/9 NaOH until a pink colour is obtained, note the reading.
    4. Add 2 ml neutral 40% formalin, which will discharge/remove the pink colour.
    5. Continue the titration with N/9 NaOH until a pink colour of equal intensity is again obtained; note the new reading.[10]

- **Total bacteria count**
  - ✓ When bacteria grow in milk, they use up the oxygen present. Certain chemical dyes such as Resazurin change colour according to the amount of oxygen present. The Resazurin test is thus an indicator of the hygienic quality of milk. Resazurin first colours the milk blue, and then it will change colour according to the level of bacteria present. If it turns to pink or white, the bacteria level is too high. The Resazurin test can be carried out as a 10-minute, 1-hour or 3-hour test. The 10-

[10] O'Connor, C. (1995). *Rural dairy technology*. ILRI (aka ILCA and ILRAD).

minute Resazurin test is a rapid screening test used at the milk platform and is described below.

1. Fill two test tubes with 10 ml milk.
2. Pipette 1 ml of Resazurin solution to the first tube and stopper.
3. Mix by inverting the tube twice in 4 seconds.
4. Place the tube in the water bath at a temperature of 65°C and record the time.
5. Take the tube out after 10 minutes and immediately transfer to the Lovibond comparator.
6. Place the second tube (without Resazurin) in the comparator disc, then revolve the disc until the colour which indicates the quality of the milk is matched by one of the standards.[11]

Resazurin disc No.	Colour	Grade of milk	Action	Possible Grade *
6	Blue	Excellent	Accept	A
5	Light blue	v. good	Accept	A
4	Purple	Good	Accept	A
3	Purple pink	Fair	Separate	B
2	Light pink	Poor	Separate	B
1	Pink	Bad	Reject	C
0	White	Very bad	Reject	C

* Note: Need to test milk for fat and protein content as well to determine the grade.

- ✓ Level of bacteria allowed in Grade A milk: < 2×10^5 bacterial cells/ml
- ✓ Level of bacteria allowed in Grade B milk: > 2×10^5– < 10^6 bacterial cells/ml[12]

- **Density**
  - ✓ With a lactometer (also called hydrometer), the specific density (also called gravity) of milk is measured. The specific gravity of the milk varies according to the proportions of fat, SNF and water. At 15 °C, the normal density of the milk ranges from 1.028 to 1.034 g/ml, whereas water has a density of 1.0 g/ml.[13]

[11] Food and Agriculture Organization of the United Nations. (n.d.). *Milk Testing and Payment Systems: Resource Book*. https://www.fao.org/3/a-i0980e.pdf

[12] Mpatswenumugabo, J. P., Bebora, L. C., Gitao, G. C., Mobegi, V. A., Iraguha, B., & Shumbusho, B. (2019, November 30). *Assessment of bacterial contamination and milk handling practices along the raw milk market chain in the north-western region of Rwanda*. Academic Journals. https://academicjournals.org/journal/AJMR/article-full-text/AD9C2B662256

[13] Shiksha, K. (2012, April 17). *Milk and milk products technology: Specific gravity of milk*. E-Coures Online: Krishi Shiksha. https://ecoursesonline.iasri.res.in/mod/page/view.php?id=65154

1. Sample the milk while taking care not to introduce air bubbles into the milk during sampling, as these would interfere with the readings.
2. Place the sample in the cylinder, measure the temperature, and place the lactometer slowly into the milk until it is floating freely.
3. The lactometer should be read at the top of the liquid meniscus, i.e., where the meniscus appears to meet the stem. Record the reading together with the temperature.[14]

Guided Practice Activity

Topic 1.3 Task 3:

1. Read the following scenario and questions:

Impact Dairies Ltd. needs to provide various milk grades to exhibit at the East African dairy quality exhibition that is supposed to take place in two days at KCC in Kenya. The production manager has informed the dairy technician to receive milk and grade it in accordance with protein, fat content, total bacteria count, and density. This milk needs to be preserved to ensure a shelf life of 4 days of exhibition.

While you are still in your respective groups, perform the following tasks based on what you observed in the previous activity and read in **1.3 Key Facts**:

a. Cool milk (describe the process)

b. Grade milk (perform the various tests)

Application Activity

Topic 1.3 Task 4

1. Read the following and answer the questions:

[14] Siirtola, T. V. (2020, April). *Establishment of regional reference centre for milk processing and marketing*. Food and Agriculture Organization of the United Nations. https://www.fao.org/ag/againfo/themes/documents/lps/dairy/dap/qcm1.htm

Mr. Graham hired a new employee to watch and help Cesar while he graded the milk for an exhibition that he was attending in Kenya. Cesar asked the new employee to put labels on the milk to show the different grades. Unfortunately, the new employee got confused and couldn't remember which label should go on which milk. Cesar asks for your help to test the milk again so that grades can be correctly assigned. He gives each group one sample to test.

a. Grade the assigned milk sample (labelled, red, green and blue) by conducting the various tests. Write the test results in the table below and identify if your sample is Grade A quality or Grade B quality.

b. Present results and explain why you think your sample is Grade A or Grade B.

c. Write down the different uses for the different grades of milk.

Table: Record sheet for sample milk testing

Label Colour	Density	Protein content	Fat content (%)	Total Bacterial Count (TBC)	Temperature	Grade
Red						
Blue						
Green						

Points to Remember

- Cooling the milk will slow down the growth of spoilage bacteria and prolong the milk's shelf life.
- Testing milk shows what grade it is and what the milk can be used for.
- Grade A milk is used as fluid milk; Grade B milk is used for making butter, yoghurt, cheese, and other milk products.

Formative Assessment

1. What is the recommended temperature for the storage of milk?

- **a.** 8℃
- **b.** 9℃
- **c.** 4℃
- **d.** 5℃

2. Which of the following equipment is used for chilling milk at a dairy?

- **a.** Refrigerator
- **b.** Freezer
- **c.** Dry Ice
- **d.** Plate heat exchanger

3. What is the reason for the presence of an agitator in a milk silo?

- **a.** To prevent cream separation by gravity
- **b.** To prevent spoilage
- **c.** To prevent leakage
- **d.** To prevent off taste

4. When milk is graded, the followed is checked:

- **a.** Water, protein, and density
- **b.** Water, fat, and protein
- **c.** Protein and fat
- **d.** Protein, fat, and density

Self-Reflection

1. Re-take the self-assessment you did at the beginning of the Unit. Remember, it is not a test, but rather, it is a way to see the progress you have made in your knowledge and skills related to milk processing.

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify equipment for receiving milk.					
Describe procedures for cleaning and sanitizing the workplace and equipment.					
Depict the equipment adjustment techniques for receiving milk.					
Prepare equipment for receiving milk.					
Clean and sanitize the workplace and equipment.					
Adjust equipment for receiving milk.					
Determine techniques of controlling raw milk.					
Describe the procedure of filtrating and weighing raw milk.					
Identify techniques for keeping records.					
Control raw milk.					

My experience Knowledge, skills, and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Filtrate and weigh/measure raw milk.					
Keep records.					
Describe techniques in milk grading.					
Explain degrees of milk in cooling process.					
Grade milk.					
Cool milk.					

2. Reflect on the results of the self-reflection and the work you have done during this unit. Fill in the table below.

Areas of strength	Areas for improvement	Actions to be taken to improve
1. **2.**	**1.** **2.**	**1.** **2.**

Unit 2: Processing milk

Topics

2.1 Organization and preparation of the work area

2.2 Making dairy products

2.3 Packaging and storing processed dairy products

2.4 Keeping dairy product records

Unit Summary:

This unit describes the knowledge, skills, and attitudes required to assist in milk processing. At the end of this unit, learners will be able to prepare and organize the work area, make dairy products, package and store processed products, and keep dairy records.

Self-Assessment: Unit 2

1. Look at the illustration above. What do you notice? What do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment. There are no right or wrong ways to answer this. It is for your own use during this course. The trainer will read a skill that is listed in the left column. Think about yourself: Do you think you can do this? How well? Read the statements across the topic. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again. This is not a test!

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify cleaning products for milk work area.					
Describe the cleaning methods and techniques.					
Apply cleaning methods and techniques.					
Identify milk products (e.g. yoghurt, ice cream) ingredients.					
Describe production techniques for different milk products.					
Produce milk products using the right production techniques.					
Identify packaging materials and techniques.					
Package dairy products.					
Use techniques for storing dairy products.					
Use appropriate record keeping techniques during					

production of dairy products.					

Topic 2.1: Organization and preparation of the milk work area

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify cleaning products for the milk work area.	**1.** Select cleaning products for the milk work area.	**1.** Analytical
2. Describe the cleaning methods and techniques.	**2.** Apply cleaning methods and techniques.	**2.** Attention to detail
3. Identify precautions to take while cleaning.	**3.** Take proper precautions when cleaning.	**3.** Respectful of safety precautions

Getting Started: What do we know and where are we going?

Topic 2.1 Task 1:

1. Review Learning **Unit 1, Topic 1.1**: What is the necessary equipment to keep the milk processing area clean and the 4-step process?

Group of tools, utensils, and materials	Specific examples
Tools and utensils	Brushes, mops, torchons (towels), basins, buckets
Disinfectants	Caustic soda, Nitric Acid
Detergents	Powder detergent, Liquid soap
Sanitizers	Air driers, chlorine
PPE	Gloves, boots

2. In groups of 4-5, discuss the following:

   a. We can use 2 disinfectants to help clean the milk processing area. These are Caustic soda and Nitric Acid. What precautions, if any, does a worker need to take when using these?

   b. What should be done if someone is splashed with nitric acid or caustic soda?

   c. Look at the picture in **Topic 2.1. Task 1**; what advice would you give the workers about health and safety if their job was to clean and prepare the milk processing area?

Problem Solving Activity

Topic 2.1 Task 2:

1. The following are the 3 different activities related to cleaning:
   a. Identify and select cleaning products for the milk work area.
   b. Consider what cleaning methods and techniques are appropriate.
   c. Apply cleaning methods and techniques.

2. Read the following:

Mr. Graham, the production manager of Impact Dairies Ltd., knows that keeping the milk processing area clean can be a challenge, especially when there are lots of deliveries in one day. He is worried that if the area is not kept clean, Impact may send out contaminated or spoiled milk products to customers who will then complain and demand their money back.

Thus, he decides to organize a quiz for groups of employees to review effective cleaning techniques.

3. In groups of 3-4 people, pretend to be Mr. Graham's employees who are taking part in the quiz.

Answer the following questions in your groups:

a. Write down all the cleaning utensils and materials that are needed to keep the milk area clean.

b. Write down a use for 3 of the utensils and materials that you have identified.

c. What special clothing should someone wear when cleaning the area?

d. What should be done if someone comes into the milk processing area who is not wearing the correct clothing?

e. There are 4 steps to cleaning milk—these are: preparation, cleaning, sanitizing and airdrying—what could happen if only 3 steps are followed?

f. What should be done if a sick employee comes to work?

g. What could happen if the 4 steps are followed in the wrong order?

h. Why is it important to use the correct tools, utensils, and materials for cleaning the milk processing area?

i. When should cleaning of the area/equipment occur?

j. How often should employees clean the area?

k. What should be done if there is a large spillage of milk over the floor?

4. Refer back to **1.1 Key Facts** in **Topic 1.1** for information on the preparation of the workplace and equipment for milk processing.

Guided Practice Activity

Topic 2.1 Task 3:

1. You will now practice cleaning the milk processing area and the equipment (protective clothing, buckets etc.) that you need to clean the area. Refer back to **1.1 Key Facts in Topic 1.1** to help you with the 4-step process.

2. Work in groups of 4-5 to:
   a. Review the different milk processing equipment (e.g. milk cans or milk cooler).

   b. Practice cleaning the different equipment.

   c. Clean the equipment/tools/protective clothing necessary to clean the milk processing area.

3. Then, answer the following:
   a. Why is it important to keep tools and materials used for cleaning the milk processing area clean?

Application Activity

Topic 2.1 Task 4:

1. Read the following:

   Mr. Graham, the production manager of Impact Dairies Ltd. has just received a big order from IKAMBA Hotel for 150kg of cheddar cheese, 200 cups of strawberry yoghurt, and 50L of fermented milk. He knows that an order of this size can overextend the employees which may lead to mistakes. In preparation, he decides to call a meeting to talk to all the production staff about their roles and responsibilities. Mr. Graham realizes at the meeting that there is only one senior member of staff available to help clean the milk processing area and that all other employees are interns who only started a week ago. He decides to ask the senior employee to help him clearly demonstrate the different steps for cleaning the area.

2. Review **1.1 Key Facts** from **Topic 1.1** and develop posters or a song/poem or any other fun text that will help the interns remember the different stages for cleaning the milk processing area. Working in a group of 2-4 people, be sure to include the following:

a. Identify the cleaning products needed for the milk work area including uses for each one.

b. Correctly apply cleaning methods and techniques.

3. Present your poster, song, or poem to the rest of the class.

4. After other groups present, give them feedback by:
a. Highlighting at least two successes.

b. Highlighting one area for improvement.

5. After all groups have presented, vote for the best group presentation.

Points to Remember

- Maintain high standards of cleanliness and sanitation in the work area and with all processing equipment.
- Schedule regular maintenance activities to avoid breakdowns.
- Keep work areas tidy and uncluttered to avoid accidents.

Formative Assessment

Choose the correct answer.

1. In the correct order, the key steps involved in the milking equipment cleaning process are:
a. pre-rinse, acid-rinse, hot wash, sanitize
b. pre-rinse, hot wash, air-drying, sanitize
c. hotwash, pre-rinse, acid-rinse, sanitize
d. pre-rinse, hot wash, sanitize, air-drying

2. In the pre-rinse cycle, the water temperature should be maintained at:
a. 45°C
b. 55°C
c. 60 ^{o}C
d. 70°C

3. True or False: The purpose of the sanitizing cycle, prior to the next milking, is to kill any bacteria.

4. True or False: The sanitizing cycle should be run for 2 minutes prior to cleaning.

Topic 2.2: Making dairy products

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify product ingredients.	**1.** Select ingredients.	**1.** Attentive to workplace requirements.
2. Describe product production techniques.	**2.** Follow correct production techniques.	**2.** Respect the protocol.

Getting Started: What do we know and where are we going?

Topic 2.2 Task 1:

1. In groups of 4-5, discuss the following:

a. List the ingredients needed to make:

i. Cheese

ii. Yoghurt

iii. Fermented milk

b. List the different production techniques needed to make:

i. Cheese
ii. Yoghurt
iii. Fermented milk

2. After discussing, share your answers with the class.

3. Review the Key Competencies table which includes the knowledge, skills, and attitudes for this topic

Problem Solving Activity

Topic 2.2 Task 2:

1. Review **2.1 Key Facts** about how to produce different products from milk.

2. Read the following:

Impact Dairies Ltd. has received an order for 1000l of fermented milk, 300 bottles of yoghurt, 10kgs of Cheddar cheese, and 25l of cream for the Radisson Blue Hotel who requires this new order for an international conference that will start in 2 days. The production manager finds the work area clean and organized. The production manager instructs the technical team to produce the products in 2 days.

3. In the same groups of 4-5 people, develop a plan of action for production of 1000l of fermented milk, 300 bottles of yoghurt, 10kgs of Cheddar cheese, and 25l of ice cream. The plan should answer the following questions:

a. Who is the team leader and what is her/his role and responsibility?

b. What are the roles and responsibilities of the remaining team members?

c. Identify the ingredients necessary to make the different products.

d. What is the production process for the different products e.g. yoghurt, fermented milk, cheese, and ice cream?

4. Share your answers with the rest of the class.

5. Refer to **2.1 Key Facts** and review them together.

2.1 Key Facts

Dairy products production techniques

- **Fermented Milk (ikivuguto) Production Flow:**[15]

Production steps	Process
1. Milk reception	Raw milk is received, checked for quality (Organoleptic (taste, smell, sight) density, acidity), and physical and biological contaminants.
2. Pasteurization at 85-90^{o}Cfor 30 seconds Homogenization at 150 bars(optional)	Milk is heated to 85– 90^{o}C to inactivate and/or kill both pathogenic and spoilage microorganisms.
3. Cooling (25^{0}C)	Milk is cooled to a temperature (25^{0}C) favourable for the growth of starter culture (Mesophlic). Used in fermentation of ikivuguto.
4. Inoculation 3-5% of mesophilic culture 	Using sterile equipment, the starter is put in the milk (inoculation) to ferment milk. Fermentation process changes milk sugar (Lactose to Lactic acid and aldehydes). The milk is left to stand for 10-12 hours to allow for fermentation process.
5. Incubation	The milk is left to stand for 10-12 hours to allow for fermentation process.
6. Cooling to 10-20^{o}C	After milk has coagulated, the milk is cooled to 10-20^{o}C to stop the fermentation process. This prevents the milk from being too acidic.

[15] Milk Facts. (n.d.). *Yogurt production*. https://www.milkfacts.info/Milk%20Processing/Yogurt%20Production.htm

7. Packaging	Milk is packaged in a clean and sterile package. This is done to protect the product and to ease product marketing
8. Storage and marketing	The packaged milk is stored at low temperature (4-70^{o}C) to prevent the growth of microorganisms that might have not been completely destroyed.

- Example of quantity:
  - If fermenting 1 litre of milk, you would add 30 - 50 ml of the culture.

- **Yoghurt production**
  - Ingredients
    - Milk
    - Dried milk
    - White refined sugar
    - Stabilizers (Pectins and modified starch)
    - Flavours (vanilla, strawberry, banana)
    - Starter cultures (*Lactobacillus bulgaricus* and *Streptococcus thermophilus)*.

  - Proportion of ingredients needed:

Yoghurt Ingredients	%
Fat	0.5-3
Milk solids non-fat (MSNF)	11-13
Stabilizer (if used)	0.3-0.5
Fruit	12-18

  - Example of quantity:
    - 1 L milk
    - 60 mL dry milk powder
    - 30 mL plain yoghurt or starter

- **Yoghurt production steps:**[16]

1. **Adjustment of Milk Composition & Blending of Ingredients**[17]
   - Before making yoghurt, the milk composition is adjusted.
   - Typically, fat content decreases and total solids increase.
   - For yoghurt manufacture, the solids content of the milk is increased to 16% with 1-5% being fat and 11-14% being solids-not-fat (SNF).
   - This is accomplished either by evaporating off some of the water or adding concentrated milk or milk powder. Increasing the solids content improves the nutritional value of the yoghurt, makes it easier to produce a firmer yoghurt and improves the stability of the yoghurt by reducing the tendency for it to separate on storage.
2. **Pasteurize Milk**
   - The milk mixture is pasteurized at 185°F (85°C) for 30 minutes or at 203°F (95°C) for 10 minutes.
3. **Homogenize**
   - The blend is homogenized for 15 to 20 minutes (2000 to 2500 psi) to mix all ingredients thoroughly and improve yoghurt consistency.
4. **Cool Milk**
   - The milk is cooled to 108°F (42°C) to bring the yoghurt to the ideal growth temperature for the starter culture.
5. **Inoculate with Starter Cultures**
   - The starter cultures are mixed with the cooled milk.
   - Most yoghurts are inoculated with a starter culture consisting of Lactobacillus bulgaricus and Streptococcus thermophilus. Once the live culture is added, the mixture of milk and bacteria is incubated, allowing for conversion of lactose to lactic acid.
6. **Hold**
   - The milk is held at 108°F (42°C) until a pH 4.5 is reached. This allows the fermentation to progress to form a soft gel and the characteristic flavour of yoghurt. This process can take several hours.
7. **Cool**
   - The yoghurt is cooled to 7°C to stop the fermentation process.
8. **Add Fruit & Flavours**
   - Fruit and flavours are added in different ways depending on the type of yoghurt. For set style yoghurt the fruit is added to the bottom of the cup with the inoculated yoghurt poured on top. This means the yoghurt ferments in the cup.

[16] Milk Facts. (n.d.). *Yogurt production*. https://www.milkfacts.info/Milk%20Processing/Yogurt%20Production.htm

[17] Watson Dairy Consulting. (n.d.). *Yogurt - Manufacturing, production and processing*. Yogurt Production. https://dairyconsultant.co.uk/yoghurt-yogurt-production.php

- For swiss style yoghurt, the fruit is blended with the fermented, cooled yoghurt prior to packaging.

9. Package

- The yoghurt is pumped from the fermentation vat and packaged as desired.

- **Cheese production:**
  - Ingredients
    - Milk
    - rennet
    - Calcium chloride
    - Brine (salt)
    - Cultures (*Lactobacillus delbruckii* subsp. *Bulgaricus* and *Lactobacillus helveticus*)

  - Proportion of ingredients needed:

Cheese ingredients	Quantity
Milk	100 kg
Calcium chloride 20g/100 kg of milk	20g/100kg of milk
Saltpetre, if permitted by law 30 g/100 kg of milk	30g/100 kg of milk
Starter bacteria	Appropriate to type of cheese
Rennet as coagulant 30 ml/100 kg of milk	30 ml/100 kg of milk

  - Notes
    - It takes approximately 10 litres of milk to make 1 kg of hard cheese. [18]
    - A litre of milk weighs approximately 1 kg.
    - It takes 100 kg of milk to result in 10 kg of cheese.

- **Cheese production steps:**

1. Standardize Milk

- Milk is standardized before cheese optimizing the protein to fat ratio to make a good quality cheese with a high yield (Standardization refers to the practice of adjusting the composition of cheese milk to maximize economic return from the milk components, while maintaining both cheese quality and cheese composition specifications. Composition specifications may be self-imposed (e.g., low fat cheese) or imposed by government standards of identity).[19]

[18] Dairy Food Safety Victoria. (n.d.). *Cheese*. https://www.dairysafe.vic.gov.au/consumers/dairy-foods/cheese#:~:text=Typically%20it%20takes%20about%2010,different%20cheeses%20can%20be%20produced

[19] University of Guelph. (n.d.). *Standardization of milk for cheese making*. Improve Life. https://www.uoguelph.ca/foodscience/book-page/standardization-milk-cheese-making

- There are three methods of standardizing milk, namely:[20]
  - Addition of concentrated non-fat milk solids (i.e., skim milk powder or condensed skim).
  - Addition of skim milk.
  - Removal of cream.
- These methods are based on the assumption that the milk has a high fat content relative to the protein content. This is normally the case, so that cows' milk usually has excess fat over that required to produce a legal cheese. The exceptions are high fat cheese such as cream cheese or double cream blue cheese.

2. Pasteurize/Heat Treat Milk

- Depending on the desired cheese, the milk may be pasteurized (pasteurization is the process of heating milk up and then quickly cooling it down to eliminate certain bacteria.)
- For effective pasteurization, milk can be heated up to 63°Celsius for 30 minutes, but this method isn't very common. More common is heating milk up to at least 72°Celsius for 15 seconds, which is known as High-temperature Short-Time (HTST) pasteurization, or flash pasteurization. This method will keep milk fresh for two to three weeks) or mildly heat-treated to reduce the number of spoilage organisms and improve the environment for the starter cultures to grow.[21]
- Some varieties of milk are made from raw milk, so they are not pasteurized or heat-treated. Raw milk cheeses must be aged for at least 60 days to reduce the possibility of exposure to disease causing microorganisms (pathogens) that may be present in the milk.[22]

3. Cool Milk

- Milk is cooled after pasteurization or heat treatment to 32°C to bring it to the temperature needed for the starter bacteria to grow. If raw milk is used the milk must be heated to 32°C.[23]

[20] University of Guelph. (n.d.). *Methods of standardizing*. Improve Life. https://www.uoguelph.ca/foodscience/book-page/methods-standardizing

[21] Otieno, K. (n.d.). *Milk pasteurization: HTST, LTLT, and UHT treatment*. Dairy Technologist. Retrieved March 2, 2020, from https://dairytechnologist.com/milk-pasteurization/

[22] Milk Facts. (n.d.). *Cheese production*. MilkFacts.info. https://milkfacts.info/Milk%20Processing/Cheese%20Production.htm#:~:text=Cheese%20made%20from%20raw%20milk%20must%20be%20aged%20for%20at,aged%20longer%20than%2060%20days

[23] Milk Facts. (n.d.). *Cheese production*. MilkFacts.info. https://milkfacts.info/Milk%20Processing/Cheese%20Production.htm#:~:text=Cheese%20made%20from%20raw%20milk%20must%20be%20aged%20for%20at,aged%20longer%20than%2060%20days

4. **Inoculate with Starter & Non-Starter Bacteria and Ripen**
   - The starter cultures and any non-starter adjunct bacteria are added to the milk and held at 32°C for 30 minutes to ripen. The ripening step allows the bacteria to grow and begin fermentation, which lowers the pH and develops the flavour of the cheese.[24]
   - Starter is added at the rate of 1-3% of the quantity of cheese milk.[25]

5. **Add Rennet and Form Curd**
   - The rennet is the enzyme that acts on the milk proteins to form the curd. After the rennet is added, the curd is not disturbed for approximately 30 minutes so that a firm coagulum forms.[26]
   - Commercial rennet is supplied in two forms:
     - Powder
     - Tablets
   - In addition, cheese milk for good coagulation is at the rate of 2.5 grams per 100 litres of cheese milk. The rennet should be diluted at least 10 times in clean cold water.[27]
   - Additives in cheese milk:
     - Calcium chloride (CaCl2): Added at the rate of 10 - 20 grams per 100 litres of milk (or 0.02% maximum) to restore the calcium level changed during handling and heating processes. Correct calcium level is required for proper coagulation using rennet.
     - Sodium or Potassium nitrate/nitrite (KNO3/NaNO3 or KNO2/NaNO2): Added at the rate of 10 - 20 grams, per 100 litres milk (or 0.02% maximum) to prevent growth of gas producing spoilage microbes e.g. coliforms (which cause blowing of young cheese) and spore forming bacteria (which cause blowing of aged cheese and bitter taste).

6. **Cut Curd and Heat**
   - The curd is allowed to ferment until it reaches pH 6.4.
   - The two most common ways to test the pH of cheese is to use either a pH Meter or pH Strips. (A pH meter often referred to as the probe is dipped into the milk or whey. Within a few seconds it provides a reading of the current pH level and is easy to use with accurate results. Whereas pH strips are dipped into the milk or whey and react to create a certain colour depending on the pH level present. The final colour is then compared to a chart to assess what pH level your cheese is currently sitting at.[28]
   - The curd is then cut with cheese knives into small pieces and heated to 100°F (38°C). The heating step helps to separate the whey from the curd.

7. **Drain whey**
   - The whey is drained from the vat and the curd forms a mat.

8. **Texture curd**
   - The curd mats are cut into sections and piled on top of each other and flipped periodically (every 15 minutes, for 2 hours). This step is called **cheddaring**. Cheddaring helps to expel or remove more whey, allows the fermentation to continue until a pH of 5.1 to 5.5 is reached, and allows the mats to "knit" together and form a tighter matted structure. The curd mats are then milled (cut) into smaller pieces.[29]

9. **Dry, Salt, or Brine**[30]
   - For cheddar cheese, the smaller, milled curd pieces are put back in the vat and salted by sprinkling dry salt on the curd and mixing in the salt. In some cheese varieties, such as mozzarella, the curd is formed into loaves and then the loaves are placed in a brine (saltwater solution water containing 15 - 20% common salt). A good way of checking the right concentration of the brine, is to add salt to the water until an egg or Irish potato can float in it. Place the cheese in the brine for 12 hours. The cheese will take more salt the more it stays in the brine.

10. **Form Cheese into Blocks**
    - The salted curd pieces are placed in cheese hoops and pressed into blocks to form the cheese.

11. **Store and Age**
    - The cheese is stored in coolers until the desired age is reached. Depending on the variety, cheese can be aged from several months to several years.

12. **Package**
    - Cheese may be cut and packaged into blocks or it may be waxed.

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- **Ice cream production steps:**
  - Ingredients
    - Sweeteners
    - Milk fat
    - Milk not fat (cream, condensed milk, evaporated milk, dry milk, and whey)
    - Stabilisers (plant gums)
    - Sugar
    - Cream
    - Crushed ice/water

  - Proportion of ingredients needed:

Ice cream ingredients	**%**
Milk, cream, butter or vegetable fat	10
Milk solids-non-fat (protein, lactose, salts)	11
Sugar	15
Emulsifier and stabilizer	0.5
Crushed ice/water	63.5

- **Ice cream production steps:**[31]
  1. **Blend the Ice Cream Mixture**
     - The milk fat source, non-fat solids, stabilizers and emulsifiers are blended for at least 1 minute or until it is smooth to ensure complete mixing of liquid and dry ingredients.
     - Example:
       - 120 mL of whole milk
       - 118 g of non-fat dry milk powder
       - 113 g of heavy cream
       - 137 g of granulated sugar
       - 118 g of unsweetened cocoa powder
       - 4 g of vanilla extract
       - 470 mL of ice
  2. **Pasteurize Mix**
     - Ice cream mix is pasteurized at 68.3°C for 30 minutes or 79.4°C for 25 seconds.
     - The conditions used to pasteurize ice cream mix are greater than those used for fluid milk because of increased viscosity from the higher fat, solids, and sweetener content, and the addition of egg yolks in custard products.

[31] Milk Facts. (n.d.). *Ice cream production*. https://www.milkfacts.info/Milk%20Processing/Ice%20Cream%20Production.htm

3. **Homogenize**
   - Ice cream mix is homogenized for 15 to 20 minutes (2500 to 3000 psi) to decrease the milk fat globule size to form a better emulsion and contribute to a smoother, creamier ice cream.
   - Homogenization also ensures that the emulsifiers and stabilizers are well blended and evenly distributed in the ice cream mix before it is frozen.
4. **Age the Mix**
   - Ice cream mix is aged at 5°C for at least 4 hours or overnight. Aging the mix cools it down before freezing, allows the milk fat to partially crystallize, and the gives the proteins stabilizers time to hydrate.
   - This improves the whipping properties of the mix.
   - Add liquid flavours and colours.
5. **Freeze**
   - The process involves freezing the mix and incorporating air. Ice cream mix can be frozen in batch or continuous freezers and the conditions used will depend on the type of freezer.
   - Fruits, swirls, and any bulky type of flavourings (nuts, candy pieces, etc.) are added at this point.
6. **Package**
   - Package as desired, depending on the product.
7. **Harden**
   - The ice cream is cooled as quickly as possible down to a holding temperature of less than -25°C. The temperatures and times of cooling will depend on the type of storage freezer. Rapid cooling will promote quick freezing of water and create small ice crystals.
   - Storage at -25°C will help to stabilize the ice crystals and maintain product quality. At this temperature there is still a small portion of liquid water. If all the water present in the ice cream were frozen, the ice cream would be as hard as an ice cube.

Guided Practice Activity

Topic 2.2 Task 3:

1. Do the following:

a. In small groups of 4-5, you will produce a sample of the product for the Radisson Blue Hotel so that they can try the product before scaling up production.

b. Follow the action plans developed in the previous activity; each person should be involved in each of the different production techniques.

c. Remember to:

i. Select ingredients.

ii. Use the right production techniques, following the steps in **2.1 Key Facts**.

iii. Ask the trainer for assistance as needed.

2. After completing the task, answer the following:

a. What was easy about the task?

b. What has been difficult or challenging about the task?

c. If you were to do this task again, what would you change about the way that you initially did this?

Application Activity

Topic 2.2 Task 4:

1. You are going to have the opportunity to visit a dairy product producing plant. While there, you will:

a. Observe and assist as much as possible in making either fermented milk, yoghurt, cheese, or ice cream.

b. Take note of any observations about safety and sanitation procedures used in the workplace, equipment used, and processes undertaken.

2. Be prepared to share your observations and experience with the class upon your return.

Points to Remember

- All personnel involved in production, handling, and distribution of milk and milk products should be medically examined by an authorized medical practitioner every six months.
- Do not use colostrum and mastitis milk for making yogurt.
- Handle milk and processing ingredients hygienically to avoid bacterial contamination.

Formative Assessment

In this section, please circle the correct answer and provide an explanation.

1. Butter milk is a fluid product resulting from the manufacture of:

- **a.** Cheese
- **b.** Yoghurt
- **c.** Ice Cream
- **d.** Butter

2. Yoghurt contains mixed lactic acid culture containing which of the following:

- **a.** Lactobacillus bulgaricus and Streptococcus thermophilus
- **b.** Lactobacillus bulgaricus and Propionibacterium
- **c.** Lactobacillus bulgaricus and Leuconostoc
- **d.** Leuconostoc and Propionibacterium

3. Ice cream mix is homogenized to:

- **a.** Make a smoother, creamier ice-cream
- **b.** To make the fat globules in the mix larger
- **c.** Make it safer to eat
- **d.** To remove any bacteria from the mix

Topic 2.3: Packaging and storing processed products

Key Competencies:

Knowledge	Skills	Attitudes
1. Recognize different types of packaging materials.	**1.** Select correct packaging materials.	**1.** Use relevant standards and product specifications.
2. Describe packaging techniques.	**2.** Apply appropriate techniques for packaging the products.	**2.** Apply protocol.
3. Depict storing techniques.	**3.** Use appropriate techniques for storing the products.	**3.** Respect the protocol.

Getting Started: What do we know and where are we going?

Topic 2.3 Task 1:

1. Discuss the following in groups of 4-5:
   a. List as many different packaging materials for milk products that you can think of.

   b. What are some of the different ways or techniques that can be used to pack milk products (yoghurt, fermented milk, cheese, ice cream) efficiently and effectively?

   c. What are some of the different ways or techniques that can be used to store the milk products (e.g. fermented milk, cheese, yoghurt)?

2. Share your answers with the rest of the class.

3. Now look at how we package and store the milk products (e.g. yoghurt, cheese).

4. Discuss the following with your group:
   a. Why is it important to use the correct packaging for the product?

   b. Why is it necessary to correctly store the product?

5. Listen to the trainer's explanation of key concepts.

6. Refer to the Key Competencies table which includes the knowledge, skills, and attitudes for **Topic 2.3.**

Problem Solving Activity

Topic 2.3 Task 2:

1. Read the following:

   Mr. Ngabo, a production manager at Impact Dairies Ltd., decides that the new technicians who have just completed the milk processing course should have a refresher course on packaging materials. However, he knows that lectures are not very effective for technicians, so he decides to set a task where they need to work in pairs.

2. The first task allows them to collaborate on the different packaging materials. Review the list of packaging materials and identify what materials are suitable for which milk product:
   a. Paper
   b. Fibreboard
   c. Plastic
   d. Glass
   e. Steel
   f. Aluminium

3. Share your answers with the rest of the class and verify them with the trainer.

Topic 2.3 Task 3:

1. Read the following as Mr. Ngabo still has some tasks left to do:

   Mr. Ngabo knows that labelling of the product is an important and essential job. He realizes that the dairy has not changed its labelling process for many years. He wants you to design new labels for fermented milk, yoghurt, cheese, or ice-cream.

2. In pairs, choose one product to design a label for and:
   a. Consider what information is required on the label.

   b. Design the label.

3. Display your labels according to the product group. Review all labels and choose your favourite label for each product and then an overall winner. Mark your favourite label with a small dot or sticky note. Remember that the best label may not always be the one with the best picture, etc. It must also contain all the necessary information.

4. After counting the votes, congratulate the winning teams for each product and the overall winners.

Topic 2.3 Task 4:

1. Read the following:

   Mr. Ngabo tells you that the packaging is an extremely important part of the product, not only to keep it safe to consume BUT for 3 other reasons as well. These are

convenience, promotion of the product, and clear identification of the product. Mr Ngabo wants trainees, in pairs, to explain to a group of school children visiting the dairy why convenience, promotion, and identification of the product are so important in packaging.

2. Discuss and share responses for the different reasons as to why packaging is so important.

Topic 2.3 Task 5:

1. Mr. Ngabo has one final task; he has the storage instructions for different products confused. Help him out by matching up the correct storage technique with the product.

Product	**Storage instructions**
Ice-cream	Store at 4-7^{o}C
Fermented milk	Store at 12^{o} C
Yoghurt	Store at 4-7^{o}C
Cheese	Store at 0 to -5^{o}C and not with smelly products, such as fish

2. Refer to **2.2 Key Facts** on packaging and storing techniques of milk processed products and review them together.

2.2 Key Facts
Packaging and storing techniques of milk processed products

- **Packaging material:**
  - The most common types of materials used for milk product packaging are:
    - Paper
    - Fibreboard
    - Plastic
    - Glass
    - Steel
    - Aluminium

- **Storing techniques:**
  - Store yoghurt and fermented milk in place with an optimum storage temperature, 4 and 7^{o}C.
  - Store cheese in place at 12^{o}C.

- Store ice cream in place at between 0 to -5^{o}C and not with products with a smell (e.g. fish).

Food Packaging and Labelling Regulations[32]

- **General Principles:**
  - Pre-packaged food shall not be described or presented on any label in a manner that is false, misleading or deceptive, or is likely to create an erroneous impression regarding its character in any respect.
  - Pre-packaged food shall not be described or presented on any label by words, pictures, or other devices which refer to or are suggestive either directly or indirectly, of any other product with which such food might be confused, or in such a manner as to lead the purchaser or consumer to suppose that the food is connected with such other product.

- **Mandatory labelling of pre-packaged foods:**
  - **Name of the food:** The name shall indicate the true nature of the food and normally be specific and not generic.
    - Where a name or names have been established for a food in a Codex standard, at least one of these names shall be used.
    - In other cases, the name prescribed by national legislation shall be used.
    - In the absence of any such name, either a common or usual name existing by common usage as an appropriate descriptive term which was not misleading or confusing to the consumer shall be used.
  - **Brief descriptions:** There shall appear on the label either in conjunction with, or in close proximity to, the name of the food, such additional words or phrases as necessary to avoid misleading or confusing the consumer in regard to the true nature and physical condition of the food, including but not limited to the type of packing medium, style, and the condition or type of treatment it has undergone
    - For example: dried, concentrated, reconstituted, smoked
  - **List of ingredients:**
    - The list of ingredients shall be headed or preceded by an appropriate title which consists of or includes the term 'ingredient.'
    - All ingredients shall be listed in descending order of ingoing weight (m/m) at the time of the manufacture of the food.

[32] Food and Agriculture Organization of the United Nations. (2018). *General Standard for the labelling of prepackaged foods*. https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS%2B1-1985%252FCXS_001e.pdf

- Where an ingredient is itself the product of two or more ingredients, such a compound ingredient may be declared, as such, in the list of ingredients, provided that it is immediately accompanied by a list, in brackets, of its ingredients in descending order of proportion (m/m). Where a compound ingredient (for which a name has been established in a Codex standard or in national legislation) constitutes less than 5% of the food, the ingredients, other than food additives which serve a technological function in the finished product, need not be declared.
- Added water shall be declared in the list of ingredients except when the water forms part of an ingredient such as brine, syrup or broth used in a compound food and declared as such in the list of ingredients. Water or other volatile ingredients evaporated in the course of manufacture need not be declared.
- As an alternative to the general provisions of this section, dehydrated or condensed foods which are intended to be reconstituted by the addition of water only, the ingredients may be listed in order of proportion (m/m) in the reconstituted product provided that a statement such as "ingredients of the product when prepared in accordance with the directions."

- **Net contents and drained weight:**
  - The net contents shall be declared in the metric system ("Système International" units).
  - The net contents shall be declared in the following manner:
    - For liquid foods, by volume.
    - For solid foods, by weight.
    - For semi-solid or viscous foods, either by weight or volume.
  - In addition to the declaration of net contents, a food packed in a liquid medium shall carry a declaration in the metric system of the drained weight of the food. For the purposes of this requirement, liquid medium means water, aqueous solutions of sugar and salt, fruit and vegetable juices in canned fruits and vegetables only, or vinegar, either singly or in combination.
- **Name and address**
  - The name and address of the manufacturer, packer, distributor, importer, exporter, or vendor of the food shall be declared.
- **Country of origin**
  - The country of origin of the food shall be declared if its omission would mislead/ deceive the consumer.
  - When a food undergoes processing in a second country which changes its nature, the country in which the processing is performed shall be considered to be the country of origin for the purposes of labelling.
- **Lot identification**
  - Each container shall be embossed or otherwise permanently marked in code to identify the producing factory and the lot.

- **Date marking and storage instructions**
  - the day and the month for products with a minimum durability of not more than three months;
  - the month and the year for products with a minimum durability of more than three months. If the month is December, it is sufficient to indicate the year.
  - The date shall be declared by the words:
    - "Best before..." where the day is indicated;
    - "Best before end..." in other cases.

- **Additional mandatory requirements:**
  - **Quantitative labelling of ingredients**
    - Where the labelling of a food places special emphasis on the presence of one or more valuable and/or characterizing ingredients, or where the description of the food has the same effect, the ingoing percentage of the ingredient (m/m) at the time of manufacture shall be declared.
    - Similarly, where the labelling of a food places special emphasis on the low content of one or more ingredients, the percentage of the ingredient (m/m) in the final product shall be declared.
    - A reference in the name of a food to a particular ingredient shall not of itself constitute the placing of special emphasis. A reference in the labelling of a food to an ingredient used in a small quantity and only as a flavouring shall not of itself constitute the placing of special emphasis.

  - **Irradiated Foods**
    - The label of a food which has been treated with ionizing radiation shall carry a written statement indicating that treatment in close proximity to the name of the food. The use of the international food irradiation symbol, as shown below, is optional, but when it is used, it shall be in close proximity to the name of the food.
    - When an irradiated product is used as an ingredient in another food, this shall be so declared in the list of ingredients.
    - When a single ingredient product is prepared from a raw material which has been irradiated, the label of the product shall contain a statement indicating the treatment.

- **Optional labelling:**
  - Any information or pictorial device written, printed, or graphic matter may be displayed in labelling provided that it is not in conflict with the mandatory requirements of this standard and those relating to claims and deception given in Section 3 -General Principles.

- If grade designations are used, they shall be readily understandable and not be misleading or deceptive in any way.

- **Presentation of mandatory information:**
  - Labels in pre-packaged foods shall be applied in such a manner that they will not become separated from the container.
  - Statements required to appear on the label by virtue of this standard or any other Codex standards shall be clear, prominent, indelible, and readily legible by the consumer under normal conditions of purchase and use.

- **Important functions of packaging:**[33]
  - **Product Identification:**
    - Packaging serves as an identification of the product.
    - A product is packed in special sized, coloured and shaped container for keeping its difference from the products of competitors.
  - **Product Protection:**
    - The main function of packaging is to provide protection to the product from dirt, insects, dampness, and breakage.
    - For example, the products like biscuit, jam, chips, etc., need to be protected from environmental contact. That is why they are tightly packed.
  - **Convenience:**
    - Packaging provides convenience in the carriage of the product from one place to another, in stocking and in consuming.
    - For example, the new pet bottles of COKE makes the carriage and stocking easier. Similarly, the pack of FROOTI provides convenience in its consumption.
  - **Product Promotion:**
    - Packaging simplifies the work of sales promotion.
    - Packing material in house reminds the consumers constantly about the product.
    - In this way, the packaging performs the role of a passive salesman.
    - Consequently, it increases the sales.

[33] Samiksha, S. (2014, February 24). *4 important functions of packaging*. Your Article Library. https://www.yourarticlelibrary.com/production/4-important-functions-of-packaging/1089

Guided Practice Activity

Topic 2.3 Task 6:

1. Think of the products you made previously and the corresponding packaging. Use the label that was designed previously. Consider the following:
   a. Select the correct packaging materials for at least 2 out of 4 products (trainees may choose for themselves).

   b. Apply techniques to correctly package the products.

   c. Consider how their products should be stored after packaging.

2. After completing the task, think about:
   a. What was easy about this task?

   b. What was challenging?

   c. How can the challenges be overcome?

Application Activity

Topic 2.3 Task 7:

1. Your group will be given 2 samples of the same product, but the packaging will be different.
   a. Examine the packaging and determine which packaging you prefer and why. Consider:
      - Labelling
      - Type of packaging
      - What the packaging is trying to do for the consumer.
      - If it responds to the promotional aspects required.
      - If it is easy to identify the product.
      - If the packaging provides the consumer with the convenience needed.
   b. Develop a short 2-minute presentation about the sample packaging, clearly showing which packaging you prefer and why.

2. Ask for support from the trainer as needed.

3. Give your presentation to the rest of the class.

4. Ask questions and provide feedback to other groups.

5. Review the main points from **2.2 Key Facts** and **Points to Remember.**

Points to Remember

- Package finished products in sanitized packaging material to prevent contamination.
- Store products in accordance with the recommended conditions (e.g. chilled or frozen).
- Packaging should avoid recontamination and exposure to light and environmental contaminants.

Formative Assessment

1. What is the recommended temperature for the storage of fermented milk?
   a. 0-4°C
   b. 4-7°C
   c. 0-8°C
   d. 7-9°C

2. Which of the following equipment is used for chilling of milk in dairy products?
   a. Refrigerator
   b. Cool box
   c. Dry Ice
   d. Plate heat exchanger

3. Name 3 reasons why packaging is important.

Topic 2.4: Keeping dairy records

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify appropriate record design of milk products.	**1.** Use appropriate record design of milk products.	**1.** Respect the requirements.
2. Explain record techniques of milk products.	**2.** Take various records of milk products.	**2.** Attention to detail while following the protocol.

Getting Started: What do we know and where are we going?

Topic 2.4 Task 1:

1. Discuss the following in groups of 2-3:

a. What are some of the records that should be kept in the dairy when processing different milk products?

b. What types of items should be recorded?

c. List the different reasons for keeping records.

2. Share your responses with the rest of the class.

3. Listen and take notes as the trainer explains key concepts.

4. Review the Key Competencies table for information on what knowledge, skills, and attitudes you will acquire throughout this topic.

Problem Solving Activity

Topic 2.4 Task 2:

1. Read the following:

Mr. Mutunzi, a dairy technician at Impact Dairy Ltd., had the responsibility of keeping accurate records of all processes for the day. Unfortunately, after 1 hour, he had to return home as his wife was sick. The dairy found no one to replace Mr. Mutunzi for 45 minutes, meaning that no records were maintained for that time. Mr. Sam, his replacement, quickly realized that without records for these 45 minutes, the client may refuse the product. Instead of stopping the production, Mr. Sam decided to fill in the records as if there had been no 45-minute gap.

2. In groups of 3-4 consider the following:

a. Do you think what Mr. Sam has done is correct or incorrect? Explain.

b. What would your suggestion be for Mr. Sam?

3. Share your group's responses with the rest of the class.

4. Read the following:

Mr Ngabo explained to the dairy technicians that they would be moving from paper-based records to using computers. The dairy technicians were initially excited about this as they felt it would be less work for them. Mr. Ngabo wanted all the technicians to think about the benefits and challenges of using computers for record keeping. He tells the technicians to work in pairs and to write down as many benefits and challenges they can think of for using computers. He says that the winning pair will win the employee of the month award.

5. Pretend that you are dairy technicians; using the table below, write down as many benefits and challenges that you can think of to use computers for record keeping.

Advantages/benefits to using computers for record keeping	**Disadvantages/challenges to using computers for record keeping**
Records are permanent	Users need to be computer literate

6. Take turns reading aloud one benefit and one disadvantage. While other groups read, mark your paper to identify if you listed the same benefits and/or disadvantages.

7. Ask trainees to count the number of benefits or disadvantages. Congratulate the winning pair. Consider awarding a small prize to the winning pair.

2.3 Key Facts

- **Record keeping:**[34]
  - The collection of relevant information that helps when making decisions and keeping track of activities in production.
  - Importance of record keeping:
    - Used in determining profitability of various techniques used at the farm
    - Used to keep your memory on what you did and/or what happened
    - Used in decision-making, especially on a strategic level
    - Used to compare the efficiency of use of inputs, such as land, labour and capital; for example, when implementing a new/alternative system
    - Helps the farmer/investor in improving the efficiency of farm's operations

- **Recording designs of dairy products**
  - Keep it short and simple. Use bullet points and flow diagrams instead of long sentences and lengthy paragraphs.
  - Clarity is important. Step-by-step instructions are easily understood.

[34] Albertin, V. (2019). *Record keeping*. Infonet Biovision. https://www.infonet-biovision.org/AnimalHealth/Record-keeping

- Use a standardized, consistent format. Although different programs may need different documents and records, using a consistent approach will help staff learn quickly.

- **Recording techniques for dairy products:**
  - Records should include:
    - Who is responsible for a specific duty
    - How he/she perform the duty
    - When the duty is performed
    - Spaces where the record is taken from

Guided Practice Activity

Topic 2.4 Task 3:

1. Different dairies have different structures for their forms, but they should all include the key information. Read the following:

Mr. Ngabo knew that the previous dairy that he had worked in had different forms to what was used in Impact Dairies. He also knew that the forms being used by Impact Dairies were from almost 20 years ago and production techniques had changed. So, the forms may not be as relevant or useful as they initially were.

2. Review the 2 different forms and do the following:

a. Write down the positive points about the forms.

b. Write down the points that you do not like about the forms.

c. What suggestions do you have for any changes to the forms?

Form presently used by Impact Dairies

Impact Dairies

Date and Time:
Name of dairy person:
What is the process being undertaken?
What time did the process
b) Start:
c) End:
Any other comments:

Form used in a previous dairy Mr. Ngabo worked in

Daisy Dairies
Date and Time: Name of dairy person (s): Position of dairy person (s): Name of process: cheese making fermented milk yoghurt ice cream Amount of milk: Amount of other ingredients: Step 1: Step 2: Step 3: Process complete: yes/no Time finished: Temperature:

Application Activity

Topic 2.4 Task 4:

1. Note that different dairies/milk processing areas may use different forms for recording information, but there are always common things the forms should include.

2. Work in groups of 3-4. Develop a form/document for recording information for when milk is processed to make cheddar cheese.

3. Display your form/document for recording information.

4. Observe other groups' forms/documents. Write down any suggestions for improvement.

5. Vote for the best form.

6. Provide evidence: Give 3 reasons as to why you consider this form to be the best.

7. Listen closely as the trainer explain key concepts.

Points to Remember

- A successful dairy enterprise needs to keep good records, as the saying goes: “When you fail to plan, you are planning to fail.”
- Accurate records are essential if you are to maintain control of your business affairs.

Formative Assessment

Read the following questions and select the correct answer.

1. The main purpose of record-keeping and reporting is:
   a. To determine the production process
   b. To avoid theft
   c. To predict production out put
   d. To ensure proper production management.

2. Which of the following is the easiest way to store data and keep records?
   a. Computer Filing
   b. Horizontal Filing
   c. Lateral Filing
   d. Vertical Filing

3. What type of information should be included on a dairy record form?

Self-Reflection

1. Re-take the self-assessment you did at the beginning of the unit. Remember, it is not a test, but rather, it is an opportunity to see the progress you have made in your knowledge and skills related to milk processing.

My experience **Knowledge, skills, and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify cleaning products for milk work area.					
Describe the cleaning methods and techniques.					
Apply cleaning methods and techniques.					
Identify milk product (e.g. yoghurt, ice cream) ingredients.					
Describe production techniques for different milk products.					
Produce milk products using the right production techniques.					
Identify packaging materials and techniques.					
Package dairy products.					
Use techniques for storing dairy products.					

Use appropriate record keeping techniques during production of dairy products.					

2. Refer to the start of this unit, consider your knowledge, skills, and attitudes and where you feel you have improved, what still needs to be improved, and how you will do this. Complete the following table.

Areas of strength	Areas for improvement	Actions to be taken to improve
1. **2.**	**1.** **2.**	**1.** **2.**

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