



Moooving Milk from the Farm to the Fridge

Middle School Food and Agricultural Literacy Curriculum

Precept

- C. Vision
- C4. Adapt to Opportunities and Obstacles.

National Standards

- FPP.03.01.02.a. Explain the application of chemistry and physics to food science.
- FPP.04.02.01.a. Identify and describe foods derived from meat, egg, poultry, fish, and dairy products.
- FPP.04.03.02.a. Explain methods and materials for processing foods for sale as fresh-food products.
- NL-ENG.K-12.4 – Communication Skills
- NL-ENG.K-12.12 – Applying Language Skills
- NS.5-8.2 – Physical Science
- NS.5-8.5 – Science and Technology

Student Learning Objectives

- As a result of this **unit**, the student will be able to...
 - Examine processes involved in food science.
- As a result of this **lesson**, the student will be able to...
 - Describe the steps in processing milk and dairy products.

Content Outline

I. Steps involved in processing milk products

- A. Milk is obtained from the cow
 - 1. This happens under sanitary conditions – from this point on, it is never touched by human hands.
 - 2. Milk is cooled to 45°F (7°C) within 2 hours of milking.
- B. Once cooled, milk is picked up by a hauler who pumps the milk from farm's bulk tank into the milk truck.
 - 1. The truck is refrigerated, keeping the milk cool at all times.
 - 2. A hauler may pick up milk from more than one farm, so a truck load may contain milk from several farms when it is delivered to the processing plant.

Time

Instruction time for this lesson: 45 minutes.

Resources

National FFA Organization. (2009). LifeKnowledge Online. Retrieved September 1, 2009 from <http://agedlearning.org>
Hayes, K. *Introduction to Food Science*, Purdue University CopyMat, 2005.

Tools, Equipment, and Supplies

- Overhead projector/transparencies
- Tape
- Paper
- Envelopes
- Small container – one, to place markers inside
- Markers – enough for 3 per group
- Writing surface
- Writing utensil
- MS.FS.2.5.AS.A – four copies, or one per group
- MS.FS.2.5.TM.A – one copy as a transparency or one copy per student as a handout
- MS.FS.2.5.AS.B – one copy per group on red paper, cut apart and number
- MS.FS.2.5.AS.C – one copy per group on blue paper, cut apart and number
- MS.FS.2.5.AS.D – one copy per
- MS.FS.2.5.AS.ESS.A – one per student

Key Terms

The following terms are presented in this lesson and appear in **bold italics**:

Standardization

Pasteurization

Homogenization

- C. Milk is then unloaded at the processing plant.
 - 1. At the plant, it is stored at less than 45°F.
 - 2. Within the plant, it is usually processed within 24 hours.
- D. To begin processing, ***standardization*** occurs. ***Standardization*** is where the original fat content of the milk has been changed to make all milk standard.
 - 1. Milk is processed through separators to create a skim portion and a cream portion of the milk.
 - 2. The skim portion and the cream portion are then recombined to form whole milk (3.25% fat), 2% and 1% fat milk, and skim milk (< 0.1% fat).



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E. Once **standardization** is finished, **pasteurization** happens. **Pasteurization** is the application of heat to destroy human pathogens in foods.

1. Milk is heated to 151°F for 15 seconds to destroy any bacteria that may be in the milk.
2. This results in fresh tasting milk that meets consumer safety specifications.

F. Lastly, milk goes through **homogenization**. **Homogenization** is breaking up the fat particles within milk and dispersing them uniformly.

1. Milk is subjected to extremely high pressure to break up fat particles.
2. This prevents the cream from rising to the top during storage in the refrigerator.
3. Once this is completed, milk can be bottled or sent for secondary processing.

II. Processing of dairy products

A. Once milk has been processed, it can be used to form many dairy products. These include ice cream, yogurt, butter, and cheese.

B. Ice Cream Processing

1. Blend the Ice Cream Mixture by mixing liquid and dry ingredients.
2. Pasteurize Mix at 155°F for 30 minutes.
3. Homogenize for smoother ice cream.
4. Age the Mix at 40°F overnight to allow ice cream to set before freezing.
5. Add Liquid Flavors and Colors for different tastes.
6. Freeze ice cream as quickly as possible to a temperature of less than -13°F

C. Yogurt Processing

1. Inoculate with bacteria for fermentation, where bacteria are mixed into the cooled milk
2. Hold at 108°F (42°C). This forms a soft gel and the characteristic flavor of yogurt. This process can take several hours
3. Cool the yogurt to 7°C to stop the fermentation process
4. Add fruit and flavors
5. Package by pumping from the fermentation holding tank.

Interest Approach

Use **MS.FS.2.5.AS.A** to prepare the first part of the activity. Below is a list of activities found in **MS.FS.2.5.AS.A**. Make four copies, one per group, and cut each activity as its own slip of paper. Place these slips into an envelope. Next, place the envelopes, markers, and paper on a table in front of the room. Students will need to grab an envelope and put the slips of paper in order before completing the activity. Listed below is the correct order:

Activity list:

- Think of what comes to mind when you hear "dairy." Each member needs to draw his or her thoughts on a sheet of paper. One person should be the time keeper and should allow 60 seconds for group members to draw.
- One person needs to grab two markers from the container.
- Trade the group's drawings with another group.
- Circle everything on the newly traded sheet in common with your original drawing.
- Trade your circled copy with a second group.
- Circle everything on the newly traded sheet in common with your original drawing again.
- On a separate sheet of paper, create a four-line rhyme about the common aspects of "dairy" you found in all three of the groups' drawings.
- WHEN COMPLETELY FINISHED, one person should shout the group's rhyme for all to hear. See if you can be first.

To begin our activity today we need to complete three tasks. First, we will break into groups of four; second, we will grab an envelope; and third, we will take the tasks inside the envelope, put them in order, and complete the activity described. Our goal is to complete this as quickly as possible. What questions are there? Let's begin!

Group students using whatever method you prefer.

Looks like X group has it done! Let's circle up. What happened after you got to your station?

Solicit student response.

What did we have to do with the activity list?

Solicit student response.

What does this tell us about how we get a "product" out of a bunch of steps?



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Solicit student response.

As you move back to your seats, high-five your neighbor to celebrate your effort. When you arrive, think about how this activity relates to the dairy industry. Be prepared to share when asked.

Solicit student response when students arrive back to their seats.

Move back into room, have students high-five or something to celebrate their effort, and hang up the pictures to appreciate their effort throughout the lesson.

Let's get started by sharing your thoughts on how this activity relates to the dairy industry! Today we will learn how our milk moves from the cow to the carton, discovering throughout this path how safety is maintained and how the milk is made into other forms such as cheese and ice cream. Get ready, because today we will be exploring the dairy industry. Be prepared to take notes and work diligently throughout today's lesson.

Summary of Content and Teaching Strategies

Objective 1. Describe the steps in processing milk and dairy products.

Use **MS.FS.2.5.AS.B** and **MS.FS.2.5.AS.C** for the Go Get It e-Moment®. Students will be in the same groups as they were for the previous activity. The goal for each group is to locate all the red and blue slips of paper that have their assigned group number on them. Each group is responsible for arranging these slips in order to create an outline of dairy processing. Use the outline in the Summary of Content and Teaching Strategies as the answer key.

Main ideas are on **MS.FS.2.5.AS.B**; supporting details are on **MS.FS.2.5.AS.C**. Make one copy of each activity sheet for each group. Cut along the solid lines so that the set contains both red and blue slips. On the back of each set of red and blue slips place a 1, 2, 3, or 4. Group 1 will find red and blue slips marked 1; Group 2 will find red and blue slips marked 2, etc.

Around the room are red and blue slips of paper marked with a 1, 2, 3, or 4. You will be working with the same group as you did earlier.

Group 1 will need to find all the slips marked with the number 1; Group 2 will need to find all the slips marked with the number 2; etc. On each red slip is a step in dairy processing. After the group has found all the red slips, arrange them in order from first to last. After ordering the red slips, place the blue slips that contain details for each of the main steps under the correct red slip. Red slips: steps. Blue slips: correspond to those steps. We will compete for the most accurate. As soon as your group has all of your set of slips placed, shout, "Mooove over. We GOT this!" and I will check for accuracy. We will work with this until the first group arranges the steps in order. What questions are there? Go!

After a group "wins," allow them to walk through the steps while others offer input on why they agree or disagree. Re-order if necessary. Once finished, ask them to take their seats and take notes as you provide more details. **MS.FS.2.5.AS.D** can be used as a guided notes sheet for students to capture information if needed. Use **MS.FS.2.5.TM.A**.

Back in the day, milk wasn't pasteurized, but now that consumers want producers to be more accountable for food safety, the FDA requires a certain level of sanitation not only in the stores and processing facilities, but also on the private farms; therefore, their leadership impacted the way dairy was processed.

How do we see our OWN impact on how dairy is processed?

Solicit student answers.

As a consumer? Maybe as a farmer?

Solicit student answers.

How can we use our own leadership influence to educate the rest of the consumers about safe practices on dairy farms and processing facilities?

Solicit student answers.



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Review/Summary

Use the *Fred Astaire e-Moment®* to present a review of the lesson as if it were a series of dance steps for the students to follow. The Fred Astaire e-Moment also helps the students see the linear relationships found in the content and enhances students' movement and logical-mathematical intelligences. Challenge students to provide a review of each of the steps using different dance moves for each process that milk travels through. Students need about eight minutes to create their dance. Once the students have completed the task, they should demonstrate their moves to the class and check for understanding.

When you hear MOVE, your objective will be to create new dance moves that represent each of the processing steps in dairy production – those steps found on the red slips of paper. Keep the same groups and create a dance move for each processing step. Be prepared to share your grooving with the rest of the class. How can I clarify? You have eight minutes to complete your dance. MOVE!

Allow students eight minutes to complete dance moves. Each group will present to the class.

We have just witnessed some awesome dance moves! I'm quite positive milk has never had so much fun moving and grooving through the processing system!

Application

Extended classroom Activity:

Have students process their own milk product by creating baggie ice cream. The recipe can be found at <http://crafts.kaboose.com/ice-cream-in-a-bag.html>

FFA Activity:

Have students evaluate cheese, milk, and ice cream products following the guidelines of the Dairy Foods CDE. This is a great introduction to the components of the CDE, and members can be encouraged to participate in this event.

SAE Activity:

As middle school students, throughout SAE activities, students should be developing an SAE on an exploratory basis. Students may visit a local dairy farm or milk-processing plant to witness the opportunities within the dairy industry. If this is unavailable, have a student with a Dairy Production SAE visit the class to present to students some opportunities within the Dairy Industry.

Evaluation

MS.FS.2.5.ASSESS.A

Answers to Evaluation

1. A
2. Blend the Ice Cream Mixture by mixing liquid and dry ingredients.
Pasteurize Mix at 155°F for 30 minutes.
Homogenize for smoother ice cream.
Age the Mix at 40°F overnight to allow ice cream to set before freezing.
Add liquid flavors and colors for different tastes.
Freeze ice cream as quickly as possible to a temperature of less than -13°F.
3. B
4. B
5. A



Activity list:

- Think of what comes to mind when you hear “dairy.” Each member needs to draw his or her thoughts on a sheet of paper. One person should be the time keeper and should allow 60 seconds for group members to draw.
- One person needs to grab two markers from the container.
- Trade the group’s drawings with another group.
- Circle everything on the newly traded sheet in common with your original drawing.
- Trade your circled copy with a second group.
- Circle everything on the newly traded sheet in common with your original drawing again.
- On a separate sheet of paper, create a four-line rhyme about the common aspects of “dairy” you found in all three of the groups’ drawings.
- **WHEN COMPLETELY FINISHED**, one person should shout the group’s rhyme for all to hear. See if you can be first.



Steps involved in processing milk products

Milk is obtained from the cow.

- This happens under sanitary conditions – from this point on, it is never touched by human hands.
- Milk is cooled to 45°F (7°C) within two hours of milking.

Once cooled, milk is picked up by a hauler who pumps the milk from farm's bulk tank into the milk truck.

- The truck is refrigerated, keeping the milk cool at all times.
- A hauler may pick up milk from more than one farm, so a truck load may contain milk from several farms when it is delivered to the processing plant.

Milk is then unloaded at the processing plant.

- At the plant, it is stored at less than 45°F.
- Within the plant, it is usually processed within 24 hours.

To begin processing, standardization occurs. Standardization is where the original fat content of the milk has been changed to make all milk standard.

- Milk is processed through separators to create a skim portion and a cream portion of the milk.
- The skim portion and the cream portion are then recombined to form whole milk (3.25% fat), 2% and 1% fat milk, and skim milk (< 0.1% fat).

Once standardization is finished, pasteurization happens. Pasteurization is the application of heat to destroy human pathogens in foods.

- Milk is heated to 151°F for 15 seconds to destroy any bacteria that may be in the milk.
- This results in fresh tasting milk that meets consumer safety specifications.

Lastly, milk goes through homogenization. Homogenization is breaking up the fat particles within milk and dispersing them uniformly.

- Milk is subjected to extremely high pressure to break up fat particles.
- This prevents the cream from rising to the top during storage in the refrigerator.
- Once this is completed, milk can be bottled or sent for secondary processing

Steps Involved in Processing of dairy products

Ice Cream Processing

1. Blend the Ice Cream Mixture by mixing liquid and dry ingredients.
2. Pasteurize Mix at 155°F for 30 minutes.
3. Homogenize for smoother ice cream.
4. Age the Mix at 40°F overnight to allow ice cream to set before freezing.
5. Add liquid flavors and colors for different tastes.
6. Freeze ice cream as quickly as possible to a temperature of less than -13°F.

Yogurt Processing

1. Inoculate with Starter Cultures, where bacteria are mixed into the cooled milk.
2. Hold at 108°F (42°C). This forms a soft gel and the characteristic flavor of yogurt. This process can take several hours.
3. Cool the yogurt to 7°C to stop the fermentation process.
4. Add fruit and flavors.
5. Package by pumping from the fermentation holding tank.



A. Milk is obtained from the cow.
B. Once cooled, milk is picked up by a hauler who pumps the milk from farm's bulk tank into the milk truck.
C. Milk is then unloaded at the processing plant.
D. To begin processing, standardization occurs. Standardization is where the original fat content of the milk has been changed to make all milk standard.
E. Once standardization is finished, pasteurization happens. Pasteurization is the application of heat to destroy human pathogens in foods.
F. Lastly, milk goes through homogenization. Homogenization is breaking up the fat particles within milk and dispersing them uniformly.
A. Once milk has been processed, it can be used to form many dairy products. These include ice cream, yogurt, butter, and cheese. Today, we will learn about ice cream and yogurt.
B. Ice Cream Processing
C. Yogurt Processing



1. This happens under sanitary conditions – from this point on, it is never touched by human hands. 2. Milk is cooled to 45°F (7°C) within two hours of milking.
1. The truck is refrigerated, keeping the milk cool at all times. 2. A hauler may pick up milk from more than one farm, so a truck load may contain milk from several farms when it is delivered to the processing plant.
1. At the plant, it is stored at less than 45°F. 2. Within the plant, it is usually processed within 24 hours.
1. Milk is processed through separators to create a skim portion and a cream portion of the milk. 2. The skim portion and the cream portion are then recombined to form whole milk (3.25% fat), 2% and 1% fat milk, and skim milk (< 0.1% fat).
1. Milk is heated to 151°F for 15 seconds to destroy any bacteria that may be in the milk. 2. This results in fresh tasting milk that meets consumer safety specifications.
1. Milk is subjected to extremely high pressure to break up fat particles. 2. This prevents the cream from rising to the top during storage in the refrigerator. 3. Once this is completed, milk can be bottled or sent for secondary processing.
1. Blend the Ice Cream Mixture by mixing liquid and dry ingredients. 2. Pasteurize Mix at 155°F for 30 minutes. 3. Homogenize for smoother ice cream. 4. Age the Mix at 40°F overnight to allow ice cream to set before freezing. 5. Add liquid flavors and colors for different tastes. 6. Freeze ice cream as quickly as possible to a temperature of less than –13°F.
1. Inoculate with bacteria for fermentation, where bacteria are mixed into the cooled milk. 2. Hold at 108°F (42°C). This forms a soft gel and the characteristic flavor of yogurt. This process can take several hours. 3. Cool the yogurt to 7°C to stop the fermentation process. 4. Add fruits and flavors. 5. Package by pumping from the fermentation holding tank.



Steps involved in processing milk products

1. Milk is obtained from the cow.
2. Once cooled, milk is picked up by a hauler who pumps the milk from farm's bulk tank into the milk truck.
3. Milk is then unloaded at the processing plant.
4. To begin processing, _____ occurs. _____ is where the original fat content of the milk has been changed to make all milk standard.
5. Once standardization is finished, _____ happens. _____ is the application of heat to destroy human pathogens in foods.
6. Lastly, milk goes through _____. _____ is breaking up the fat particles within milk and dispersing them uniformly.
7. Ice Cream Processing
8. Yogurt Processing



Name _____

Directions: Read each statement and decide...

1. _____ **Once milk leaves the cow, it does not touch human hands.**
 - A. True
 - B. False

2. **List two steps involved in ice cream processing.**
 - A. _____
 - B. _____

3. _____ **Which step uses heat to destroy any pathogens in the milk?**
 - A. homogenization
 - B. pasteurization
 - C. standardization
 - D. processing

4. _____ **Milk must be cooled to 45°F within 5 hours of milking from the cow.**
 - A. True
 - B. False

5. _____ **Bacteria is used to ferment yogurt into the characteristic taste we know today.**
 - A. True
 - B. False