



Make & Taste **DAIRY**



Mozzarella Cheese (Grades 6-8)

Lesson Activity

LESSON OVERVIEW:

During this lesson, students will be introduced to both the history and science behind the process of making mozzarella cheese. They will also discover ways to incorporate cheese into recipes featuring additional nutrient-rich ingredients.

LESSON MATERIALS NEEDED:

*Ingredients for each work station (3-5 students)**

- 1 gallon whole milk (not ultra-pasteurized)
- 1 1/4 cup cool water (chlorine-free)
- 1 1/2 teaspoon citric acid
- 1/4 rennet tablet or 1/4 teaspoon liquid rennet
- 1 teaspoon kosher salt
- Ice water

**Ingredients are available at most supermarkets*

Tools for each work station (3-5 students)

- 1 gallon stainless steel pot (or non-aluminum/non-cast iron)
- Thermometer
- Colander
- Slotted spoon
- Long knife (blade should reach bottom of the pan)
- Microwaveable bowl
- Microwave
- Gloves

LESSON OBJECTIVES:

During this lesson, students will:

- Become familiar with the history of cheese
- Explain the basic science of cheesemaking
- Recognize that cheese offers a unique package of essential nutrients
- Follow a simple recipe to make mozzarella cheese
- Create a snack plate with nutritious pairings, like fruit and nuts
- List ways that cheese can be part of a healthy meal

ACADEMIC INTEGRATION

- Science
- History
- Language Arts



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Leader Background

HOW IS CHEESE MADE?*

Quality cheese begins with one key ingredient – quality milk. Dairy farmers make it a top priority to ensure milk is safe and nutritious by providing excellent care of their animals. Dairy farmers care for their cows and calves by providing a nutritious diet, good medical care and healthy living conditions. Cheesemakers turn milk into cheese.

STANDARDIZATION

Before the cheesemaking process begins, incoming milk is tested for quality and purity. It takes approximately 10 pounds of milk to make 1 pound of cheese! Next, **cheesemakers pasteurize and weigh the milk** to ensure product safety and uniformity.

STARTER CULTURE & COAGULANT

Starter cultures, or good bacteria, are added to the cheesemaking process (the recipe in this lesson uses citric acid). They help determine the ultimate flavor and texture of the cheese. Next, a milk-clotting enzyme called **rennet is added to coagulate the milk**, forming a custard-like mass.

CUTTING

It's then cut into small pieces to begin **the process of separating the liquid (whey) from the milk solids (curds)**. Large curds are cooked at lower temperatures, yielding softer cheeses like mascarpone and ricotta. Curds cut smaller are often cooked at high temperatures, yielding harder cheeses like parmesan and romano.

STIRRING, HEATING & DRAINING

Cheesemakers cook and stir the curds and whey until the desired temperature and firmness of the curd is achieved. The whey is then drained off, leaving a tightly formed curd.

CURD TRANSFORMATION

Different handling techniques and salting affect how the curd is transformed into the various cheese varieties.

Pressing determines the characteristic shape of the cheese and helps complete the curd formation. Most cheese are pressed in 3-21 hours, depending on their size.

Curing may be another step, depending on the variety, helps fully develop the flavor and texture of the cheese. Cheese is moved to a room that's carefully controlled for required humidity and temperature. Cheeses may be aged from weeks to several years.

*Source: Wisconsin Milk Marketing Board



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Teaching the Lesson



FOOD SCIENCE:

Making cheese is really a lesson in microbiology. Cheese is a living food! The combination of lactose (sugar) being turned into lactic acid (acidification), bacteria, molds and yeast all work together to create different types of cheese. Rennet, a coagulant, which used to be only available from certain animal's stomach lining, is now grown from fermented algae and is considered a vegetable. Thanks science! What other foods start as a liquid and change into edible solids?

CLASS DISCUSSION

1. Begin the lesson by finding out what students know about the history of cheese.
2. Ask students if they can describe the process of how milk becomes cheese. Explain the basic process of acidification and coagulation. (See food science section above)
3. Ask students if they can name some of the nutrients found in cheese. Discuss how milk also has these same nutrients.
4. Describe how the class will break into small groups, or watch the instructor demonstrate the cheese making process. Students should taste the finished product and discuss what other items (herbs and spices) could be used to flavor the cheese.

Glossary

Citric Acid: An acid present in the juice of lemons and other sour fruits. In the food industry, it is used as a flavoring and setting agent.

Rennet: A milk-clotting enzyme that curdles the casein in milk, forming a custard-like mass. The enzyme originated from the stomach lining of certain animals, and can now be grown from fermented algae.

Casein: The primary protein present in milk. Casein is known to coagulate or thicken when exposed to certain conditions and forms the lumps or curds necessary for cheese making.

Whey: The liquid by-product of cheesemaking. Whey contains significant proteins, lactose and minerals, and is commonly used as an ingredient in other foods.

Salt: A crystalline compound, sodium chloride, is commonly used for food seasoning and as a preservative.



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Making & Tasting



MAKE YOUR OWN CHEESE

Number of participants per group: 3-5

Ingredients

- 1 gallon whole milk (not ultra-pasteurized)
- 1 1/4 cup cool water (chlorine-free)
- 1 1/2 teaspoon citric acid
- 1/4 rennet tablet or 1/4 teaspoon liquid rennet
- 1 teaspoon kosher salt
- Ice water

Equipment

- 1 gallon stainless steel pot
- Thermometer
- Colander
- Slotted spoon
- Long knife (blade should reach bottom of the pan)
- Microwaveable bowl
- Microwave
- Gloves

Cheese Yield

Yield will vary depending on the milk, typically 1 pound of cheese from 10 pounds of milk. The whey portion can be used in smoothies, baked goods or processed again as ricotta cheese.

Food Safety

- Thoroughly clean table or preparation area with soap and warm water before starting this project.
- Always wash hands with soap and warm water before beginning food preparation
- All ingredients should be kept chilled, both before and after preparation.



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DIRECTIONS

1. Dissolve 1/4 rennet tablet or 1/4 teaspoon liquid rennet into 1/4 cup of cool, chlorine-free water. Stir and set aside. Wrap the remaining pieces of the tablet in plastic wrap and store in the freezer.
2. Mix 1 1/2 teaspoons citric acid into 1 cup of cool, chlorine-free water until dissolved. Pour into pot.
3. Pour 1 gallon of milk into pot and stir vigorously.
4. Heat milk to 90°F while stirring. Once the desired temperature is reached, remove pot from burner.
5. Slowly add the rennet solution to the pot, stirring in an up and down motion for approximately 30 seconds.
6. Cover the pot and leave it undisturbed for 5 minutes.
7. Check the pot. You should see curd that looks like custard, with a clear separation between the curds and whey. If the curd is too soft or the whey is too milky, let sit for a few more minutes.
8. Cut the curd using a knife that reaches to the bottom of the pot.
9. Place the pot back on the stove and heat to 105°F while slowly moving the curds around with your spoon.
10. Once the desired temperature is reached, take the pot off the burner and continue slowly stirring for 2-5 minutes or until firm.
11. Pour off the floating whey.
12. Ladle your curds into a large microwaveable bowl and drain off as much of the whey as you can without pressing the curds too much. Put on your rubber gloves.
13. Place the bowl in the microwave on HIGH for 1 minute
14. Remove and drain off the whey as you gently fold the curds into one piece. Add 1 teaspoon of salt.
15. Microwave on HIGH for 30 seconds. Drain again and stretch the curd. It must be 135°F to stretch properly. If it isn't hot enough, microwave an additional 30 seconds.
16. Stretch the cheese by pulling it like taffy until it is smooth and shiny. Shape your cheese into a log or ball.
17. Submerge the cheese ball into ice water for 15 minutes to cool. This step is critical as it protects the silky texture and keeps it from becoming grainy.





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References



1. **Pocket Guide Club, 2018 PGC Group**
www.pocketguide.club
2. **Learn How To Make Cheese**
www.cheesemaking.com/learn.html
3. **Cheese Production, Cornell University**
www.milkfacts.info
4. **Wisconsin Milk Marketing Board**
www.eatwisconsincheese.com
5. **International Dairy Foods Association**
<http://www.idfa.org/news-views/media-kits/cheese/history-of-cheese>
6. **National Dairy Council**
www.nationaldairycouncil.org

Resources

- **What is Cheese?**
<https://dairygood.org/content/2016/what-is-cheese>
- **8 Fun Facts About Cheese**
<https://dairygood.org/content/2013/did-you-know-check-out-these-8-cheese-facts>
- **Cheese and Healthy Eating**
<https://www.drink-milk.com/wp-content/uploads/2015/11/Cheese-and-Healthy-Eating.pdf>
- **Types of Cheese**
<https://dairygood.org/content/2016/cheese-types-what-you-need-to-know-about-cheese>
- **6 Ways Cheese Can Help Your Body**
<https://www.drink-milk.com/wp-content/uploads/2017/02/6-Ways-Cheese-Can-Help-Your-Body.jpg>
- **Virtual Dairy Farm Tour**
<https://www.discoverundeniablydairy.com/virtual-field-trip>



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Leader Background



WHY EAT CHEESE?*

One serving of cheese contains many of the essential nutrients your body needs, including:

- **Calcium** – helps build and maintain strong bones and teeth.
- **Protein** – helps build and repair muscle tissue.
- **Phosphorus** – helps build and maintain strong bones and teeth, and supports tissue growth.
- **Vitamin B12** – helps with normal blood function, and helps keep the nervous system healthy.
- **Pantothenic Acid** – helps your body use carbohydrates, fats and protein for fuel.
- **Niacin** – used in energy metabolism in the body.

Enjoying 3 daily servings of lowfat or fat-free milk, cheese or yogurt, as recommended by the Dietary Guidelines for Americans, is a delicious way to improve your overall diet, get more nutrients and improve bone health.

**Source: National Dairy Council*

HISTORY OF CHEESE*

According to ancient records passed down through the centuries, the making of cheese dates back more than 4,000 years.

No one really knows who first made cheese. According to an ancient legend, it was made accidentally by an Arabian merchant who put his supply of milk into a pouch made from a sheep's stomach, as he set out on a day's journey across the desert. The rennet in the lining of the pouch, combined with the heat of the sun, caused the milk to separate into curd and whey. That night he found that the whey satisfied his thirst, and the cheese (curd) had a delightful flavor which satisfied his hunger.

Did you know? The Pilgrims included cheese in the Mayflower's supplies when they made their voyage to America in 1620. The making of cheese quickly spread in the New World, but until the 19th century it remained a local farm industry. It wasn't until 1851 that the first cheese factory in the United States was built by Jesse Williams in Oneida County, New York.

Currently, more than one-third of all milk produced each year in the U.S. is used to manufacture cheese.

**Source: International Dairy Foods Association*