

Make & Taste Dairy

Butter (Grades 6-8)



Lesson Activity

LESSON OVERVIEW:

During this lesson, students will be introduced to both the origin and science behind the process of making butter. The students will use a simple method to make butter and also discover ways to use butter to enhance the acceptance and enjoyment of nutrient-rich foods.

LESSON OBJECTIVES:

During this lesson, students will:

- Become familiar with the history and origin of butter.
- Explain the basic chemical reaction that occurs when cream is changed into butter.
- Become familiar with the nutritional composition of butter and gain an understanding of the essential role of fat in a healthy diet.
- Use a simple method and successfully make butter in the classroom.
- Participate in a tasting activity that pairs butter with both sweet and savory ingredients to make two spreads to taste on whole grain crackers.
- List at least five ways that butter can be used to enhance the acceptance and enjoyment of nutrient-rich foods.

LESSON MATERIALS NEEDED:

Ingredients for every 2-4 students:

- ½ cup heavy cream (at least 36% fat)

Equipment:

- Jar with lid (at least 1 cup capacity to allow for shaking)
- Measuring cups
- Paper towels
- Small plates, ingredient bowls, spoons, tongs, etc. for tasting activity

For Tasting:

Gather some or all the items below to create two spreads using the fresh butter to taste on whole grain crackers. If there is a school garden, consider using fresh herbs that are in season. The following ingredients and shown in example combinations and are divided into sweet and savory pairings in the lesson.

ACADEMIC INTEGRATION:

Science ♦ Health ♦ Language Arts



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Leader Background

Food Science & Nutrition

Butter is chemically known as an emulsion, which is a suspension of two liquids that under normal circumstance do not mix together (e.g. water and oil). In the case of butter, the two liquids in the emulsion include milkfat and water. Butter is formed when heavy cream is vigorously mixed or shaken. The mechanical force breaks down the fat particles (known as globules) and eventually, the globules stick together while also trapping smaller amounts of water. This forms what is known as a water-in-oil emulsion, or the solid mass we commonly recognize as butter.

Butter is generally around 80-82% fat, 16-18% water and 1-2% other solids. The additional liquid that is left over from this process is known as buttermilk. Buttermilk can be used as an ingredient in baked goods such as muffins, cornbread, waffles, pancakes and quick breads

Butter is mostly comprised of fat. Fat is an essential nutrient that humans need to help the brain develop, keep cells healthy and provide a source of stored energy for the body.

Butter is also a source of vitamin A. It contains both forms of vitamin A, including retinol (preformed vitamin A) as well as smaller amounts of carotene (provitamin A), which is responsible for the yellow hue of butter. Cows with a carotene-rich diet will produce butter with a deeper yellow color. While grass is a source of carotene, dairy cows also often receive beta-carotene in their grain.

Why Eat It?

Butter is a delicious, savory fat which adds enjoyment and satiety to many foods. Used in small amounts, it can increase the acceptability of nutrient-rich foods such as whole grains, fruits and vegetables. Adding butter to foods curbs the appetite and keeps humans satisfied longer between meals and snacks.

History of Butter

Butter goes way back, estimated at 10,000 years or more! It was likely an accidental discovery, caused by sheepskin bags filled with milk that agitated during nomadic travels. The butter eaten by our ancestors most likely came from the milk of yak, sheep or goats; not cows. The first reference to butter in our written history was found by archaeologists on a 4,500-year-old limestone tablet illustrating how butter was made.

Commercial butter production took off around the early 1900s. Before the late 1800s, the only way to separate cream from milk was to allow the milk to sit until the cream formed a layer on top of the milk and carefully skim off the layer of cream. In 1878, the Swedish engineer Gustaf de Laval invented the milk-cream separator, which featured a rapidly spinning container, known as a centrifuge, to efficiently separate the cream from the milk. This discovery was a key development in efficiently procuring the cream needed for commercial butter production.



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Teaching the Lesson

Class Discussion

1. Begin the lesson by asking students if they know how butter is made and whether anyone has made butter at home. Ask students to describe their favorite uses for butter.
2. Describe how butter is an ancient food that is thought to be at least 10,000 years old and was originally made from the cream from sheep, goats or yaks. The earliest depiction of how to make butter was discovered by archaeologists on a 4,500-year-old limestone tablet.
3. Ask students if they are familiar with the chemistry behind the formation of butter. Explain that butter is a water-in-oil emulsion created by vigorously breaking apart the milkfat molecules until the fat globules reattach into butter. As this happens, some water is trapped inside the globules. (See above for full explanation).
Students may have heard the word churn before, which is the container or device that was historically used to make butter as well as the process of vigorously shaking or mixing cream to make butter.
4. Ask students if they can name the primary nutrient found in butter (fat). Point out that fat is an essential nutrient that helps the brain develop, keep cells healthy and provide a source of stored energy for the body. Since dietary fat is a concentrated source of calories, it is best enjoyed in small amounts.
Butter is also a source of vitamin A, including retinol (preformed vitamin A) and also smaller amounts of carotene, which give butter its yellow color.
5. Later in the lesson, students will complete an activity sheet using the Nutrition Facts label for butter.
6. Describe how the class will break into small groups and take turns creating their own butter. Students will then use the butter at a tasting station to create delicious, unique spreads with butter and other ingredients.

Glossary:

Butter: A solid emulsion of fat globules, air and water made by vigorously mixing, shaking or churning heavy cream.

Buttermilk: The liquid remaining after butter is produced from heavy cream. Commercial buttermilk sold in stores is generally not true buttermilk but instead is milk with added lactic acid cultures.

Churn: A container in which cream is stirred or shaken to make butter. It is also used as a verb which means to agitate or stir cream vigorously in order to make butter.

Emulsion: An emulsion is a suspension of two liquids that usually do not mix together (e.g. water and oil). Butter is an example of an emulsion that is formed with mechanical force. When shaken vigorously, the fat particles break apart and eventually stick back together while also trapping smaller amounts of water. This forms what is known as a water-in-oil emulsion, or the mass commonly known as butter.

Fat: Fat in food belongs to a group of substances called lipids, and includes both animal and plant sources. The fat found in milk is known as cream and is also used to make butter. Fat is also an essential nutrient that we need to help our brains develop, keep our cells healthy and provide a source of stored energy on our body.

Satiety: the feeling after eating of being full, satisfied.

Heavy Cream: A liquid dairy product commonly made up of approximately 36% fat with the remaining volume coming primarily from water. Heavy cream is used to produce both whipped cream and butter.



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Making and Tasting

MAKE YOUR OWN BUTTER: Number of participants in a group: 2-4

Ingredients for every 2-4 students:

- ½ cup heavy cream (at least 36% fat)
- Whole grain crackers (neutral flavor)
- Additional ingredients for tasting activity (ideas given in table below)

Equipment

- Jar with lid (at least 1 cup capacity to allow for shaking)
- Measuring cups
- Paper towels
- Small plates, ingredient bowls, spoons, tongs, etc for tasting activity

Directions

Food Safety:

- Thoroughly clean table or preparation area with soap and warm water before starting this project.
- Students should thoroughly wash their hands with soap and warm water immediately prior to beginning the food preparation.
- All ingredients should be kept chilled up until the time of preparation and again chilled after the project is complete.

1. Measure ½ cup of heavy cream and pour into jar.
2. Fasten lid securely.
3. Shake vigorously for 10-15 minutes, or until a soft mass forms. Students can take turns shaking the mixture.
4. Pour off as much of the liquid as you can. This liquid is known as buttermilk.
5. Rinse solid butter with ice cold water and gently pat dry with paper towels. Store in an air-tight container and refrigerate.

Yield: ½ cup of heavy cream will result in approximately ¼ cup of butter and ¼ cup buttermilk.

Note: The liquid drained from the butter is known as buttermilk and can be used as an ingredient in baked goods such as muffins, cornbread, pancakes, waffles and quick breads.

Tasting

Once a group of students completes the butter process, they can move to a separate table set with small plates, crackers, and toppings.

1. Spread crackers with butter.
2. Provide students with some of the following toppings. If there is a school garden, consider using available herbs or vegetables. If possible, have at least one sweet choice and one savory choice.
3. Encourage students to prepare at least two crackers, one with sweet additions and one with savory additions. They need just a small amount of the ingredients per cracker.

SWEET	SAVORY
Cinnamon + Brown Sugar	Chopped Chives + Dill
Pureed Apples + Vanilla Extract + Chopped Pecans	Smoked Paprika + Chopped Cilantro + Minced Lime Zest
Dried Cranberries + Minced Orange Zest	Capers + Chopped Tarragon
Cardamom + Maple Syrup	Sundried Tomatoes + Basil
Honey + Citrus Zest	Blue Cheese + Chopped Walnuts
Raspberry Preserves + Nutmeg	Jalapeño + Lime Juice
Fig Jam + Lemon Zest	Minced Garlic + Rosemary

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Lesson Activity

Answer the following questions after completion of the lesson.

1. History of butter

- Food historians believe that butter is at least _____ years old.
- The milk-cream separator invented by Gustaf de Laval was important to the mass commercial production of butter.

TRUE or FALSE

- The first butter likely came from the milk of cows.
- Archaeologists have discovered a 4500 year old limestone tablet that shows the process of making butter.

TRUE or FALSE.

2. The process of creating butter requires:

- An acid ingredient to break up the fat molecules
- Agitation through shaking or beating to break up fat globules
- High Heat
- Slow simmering of cream

3. Use the Nutrition Facts label at right to answer the following questions about unsalted butter.

- Name the primary nutrient contained in butter.
- The standard serving size for butter is 1 tablespoon (shown on label). How many calories would you be adding to your toast if you used just 1 teaspoon of butter?
- This label is for unsalted butter. Which nutrient would change in a label for salted butter?
- Is butter a good source of calcium?
- What vitamin is present in butter?

4. List at least five ways that small amounts of butter can be used to enhance nutrient-rich foods such as whole grains, vegetables or fruit dishes.

5. The liquid left after making butter is known as _____.

BONUS: How can this liquid be used in food preparation?

Nutrition Facts

8 servings per container	
Serving size	1 tbsp (14.2g)
Amount Per Serving	
Calories	100
<small>% Daily Value*</small>	
Total Fat 12g	15%
Saturated Fat 7g	35%
<i>Trans Fat</i> 0g	
Cholesterol 30mg	10%
Sodium 0mg	0%
Total Carbohydrate 0g	0%
Dietary Fiber 0g	0%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 0g	0%
Vitamin D 0mcg	0%
Calcium 3mg	0%
Iron 0mg	0%
Potassium 3mg	0%
Vitamin A	8%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



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Answer Key

Answer the following questions after completion of the lesson.

1. History of butter

- a. Food historians believe that butter is at least **10,000** years old.
- b. The milk-cream separator invented by Gustaf de Laval was important to the mass commercial production of butter.

TRUE or FALSE

- c. The first butter likely came from the milk of cows.

TRUE or **FALSE**

- d. Archaeologists have discovered a 4500 year old limestone tablet that shows the process of making butter. **It is thought that the first butter started with the milk of sheep, goats, or a yak**

TRUE or FALSE.

2. The process of creating butter requires:

- a. An acid ingredient to break up the fat molecules
- b.** Agitation through shaking or beating to break up fat globules
- c. High Heat
- d. Slow simmering of cream

3. Use the Nutrition Facts label at right to answer the following questions about unsalted butter.

- a. Name the primary nutrient contained in butter.

Fat

- b. The standard serving size for butter is 1 tablespoon (shown on label). How many calories would you be adding to your toast if you used just 1 teaspoon of butter?

33 Calories

- c. This label is for unsalted butter. Which nutrient would change in a label for salted butter?

Sodium

- d. Is butter a good source of calcium?

No, but milk, yogurt and cheese are good sources of calcium. The milkfat used to produce butter contains only trace amounts of calcium.

- e. What vitamin is present in butter?

Vitamin A

4. List at least five ways that small amounts of butter can be used to enhance nutrient-rich foods such as whole grains, vegetables or fruit dishes.

Answers will vary - all types of hot vegetables, baked potatoes, baked fruit dishes such as crisps, cobblers and poached apples or pears, whole grain breads, brown rice, quinoa, oatmeal, etc.

5. The liquid left after making butter is known as **buttermilk**.

BONUS: How can this liquid be used in food preparation?

Buttermilk works well in recipes for baked goods such as cornbread, muffins, waffles, pancakes and other quick breads.

Nutrition Facts	
8 servings per container	
Serving size	1 tbsp (14.2g)
Amount Per Serving	
Calories	100
% Daily Value	
Total Fat 12g	15%
Saturated Fat 7g	35%
Trans Fat 0g	
Cholesterol 30mg	10%
Sodium 0mg	0%
Total Carbohydrate 0g	0%
Dietary Fiber 0g	0%
Total Sugars 0g	
Includes 0g Added Sugars	0%
Protein 0g	0%
Vitamin D 0mcg	0%
Calcium 3mg	0%
Iron 0mg	0%
Potassium 3mg	0%
Vitamin A	8%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.



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Take Home Activity

Try Making Your Own Butter at Home: Now that you have created your own butter at school, you can make it at home for your family and use as part of many dishes!

Ingredients

1 cup heavy cream (at least 36% fat)

Equipment

Jar with lid (at least 1 cup capacity to allow for shaking)

Directions

1. Measure 1 cup of heavy cream and pour into jar.
2. Fasten lid securely.
3. Shake vigorously for 10-15 minutes, or until a soft mass form.
4. Pour off as much of the liquid as you can. This liquid is known as buttermilk.
5. Rinse with ice cold water and gently pat dry with paper towels. Store in an air-tight container and refrigerate.

Yield: 1 cup of heavy cream will result in approximately 1/2 cup of butter and 1/2 cup buttermilk.

Note: The liquid drained from the butter is known as buttermilk and can be used as an ingredient in quick breads such as muffins, cornbread, pancakes, waffles.

Using Your Butter...

WITH WHOLE GRAINS: Spread your favorite whole grain toast, waffle or bagel with a dab of butter. Butter is also a great addition to brown rice, quinoa, oatmeal and whole grain pasta dishes.

AS AN INGREDIENT IN A FRUIT CRISP: Fruit such as sliced apples, peaches, pears and blueberries make delicious fruit crisps. Place 4-5 cups of fruit in a 2-quart square baking dish. Mix 1/2 cup oats, 1/2 cup packed brown sugar, 1/2 cup flour, and 1/2 cup melted butter with a fork until crumbly. Sprinkle this topping over the fruit and bake at 375° for 30 minutes.

WITH VEGETABLES: Warm vegetables of all kinds are more appealing and acceptable with the addition of butter. Add to steamed vegetables or drizzle butter over cut-up vegetables and roast in the oven.

COOK EGGS IN BUTTER: Whether scrambled, fried or as part of an omelet creation, cooking in butter enhances the flavor and acceptability of any egg dish.

FOR DESSERT: Butter is versatile and adds a delicious rich flavor and texture to cookies, muffins, quick breads and many other baked goods.

BUTTER PAIRINGS: Butter pairs well with both sweet and savory ingredients. Try some of the pairings listed in the table below or create your own!

SWEET	SAVORY
Cinnamon + Brown Sugar	Chopped Chives + Dill
Pureed Apples + Vanilla Extract + Chopped Pecans	Smoked Paprika + Chopped Cilantro + Minced Lime Zest
Dried Cranberries + Minced Orange Zest	Capers + Chopped Tarragon
Cardamom + Maple Syrup	Sundried Tomatoes + Basil
Honey + Citrus Zest	Blue Cheese + Chopped Walnuts
Raspberry Preserves + Nutmeg	Jalapeño + Lime Juice
Fig Jam + Lemon Zest	Minced Garlic + Rosemary