

## Chapter 7

# Milk & Cheese



Milk and cheese products provide important nutrients in the diet such as calcium; phosphorus; riboflavin; vitamins A, D, and B12; and protein. Whole milk and regular cheese products have a high fat content; lower fat versions should be chosen more often for a healthy, balanced diet. Vegans and individuals with milk allergies do not consume milk products. Instead, they often consume fortified milk analogs such as fortified soy milk and soy cheese to ensure consumption of important nutrients like calcium.

Cow's milk is an important nutritional component of many children's diets. However, it is important to remember that milk is not a good source of iron. Over reliance on milk as a sole source of calories and protein for a child can be problematic. Early transition from breast milk or formula to cow's milk is linked to iron deficiency anemia. Parents or caretakers need to make sure infants are consuming adequate sources of iron and other nutrients before transitioning from breast milk or formula to cow's milk. Usually, nutritionists recommend that children make this transition after their first birthday.

In order to be effective in recommending appropriate milk and cheese consumption, you need to be knowledgeable about the variety of milk and cheese products that are available, the nutrient composition of those products (particularly fat content), the cost, how the products are made, how to incorporate them into a healthy diet, and how to utilize them in tasty recipes that your consumers will enjoy.

 THINK ABOUT IT

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◆ List a few suggestions for decreasing the fat content of beverages or foods made with milk and cheese products.

◆ List 3 things you would like to learn about milk and cheese or 3 questions you have relating to milk and cheese.

1.

2.

3.

**LAB ASSIGNMENT:**

# Milk & Cheese

There are many different food science principles to be explored with milk and cheese. This laboratory will focus on making cheese and evaluating milk and cheese products based on sensory characteristics and nutrient composition.

**Overview:**

All students will participate in a sensory evaluation of milk and cheese products. Students will observe, smell, and taste each milk and cheese product and evaluate each product based on the sensory experience and nutrient composition. Each group will prepare a soft unripened cheese using their assigned milk and acid.

**Kitchen 1:** Homemade cheese: Whole milk, Vinegar

**Kitchen 2:** Homemade cheese: Whole milk, Lemon juice

**Kitchen 3:** Homemade cheese: 2% milk, Vinegar

**Kitchen 4:** Homemade cheese: 2% milk, Lemon juice

**Kitchen 5:** Homemade cheese: Skim milk, Vinegar

**Kitchen 6:** Homemade cheese: Skim milk, Lemon juice

**Kitchen 7:** Homemade cheese: Organic 2% milk, Vinegar

**Kitchen 8:** Homemade cheese: Organic 2% milk, Lemon juice

**Evaluation Tools:**

- Nutritional Evaluation of Milk Products
- Sensory Evaluation of Milk Products
- Evaluation of Cheese Products
- Evaluation of Homemade Cheeses

**Directions:**

1. Always begin by washing your hands and thoroughly cleaning/sanitizing work surfaces.
2. Gather ingredients needed for your assigned homemade cheese recipe and begin preparing your cheese.
3. While your milk is heating, taste a sample of all the milk and cheese products. Observe the appearance, smell, and taste. To cleanse your palate, you may sip on water or take a bite of a saltine cracker between tastes. Complete the “Nutritional Evaluation of Milk Products,” “Sensory Evaluation of Milk Products,” and the “Evaluation of Cheese Products” as you taste the products.
4. While your curds and whey cool, read “Milk & Cheese Science” and “Milk & Cheese Tips for Consumers.” Complete the “Milk & Cheese Questions.”
5. When all homemade cheeses are ready, observe, and taste each variety. Complete the “Evaluation of Homemade Cheeses.”
6. Clean your work station and check out before leaving.

## RECIPES:

## Cheese

*Homemade Soft Curd Cheese***Ingredients:**

- |                            |   |
|----------------------------|---|
| 1 gallon milk, as assigned | 1/2 cup vinegar or lemon juice, as assigned |
| 1 teaspoon salt            |   |

**Method:**

1. Gradually heat milk in a large non-aluminum stock pot over medium-high heat. Stir occasionally.
2. Use a thermometer to check the temperature of the milk. When the milk reaches 180° Fahrenheit, turn off the heat. (Note: It will take about 30 to 40 minutes to heat the milk.)
3. Then, add the vinegar or lemon juice as assigned. The curds and whey will quickly separate.
4. Let it cool for about 30 minutes.
5. Line a colander with cheesecloth, if available. Then, pour the curds and whey into the colander. Use a large spoon to press the curds and drain off more whey. Use the cheesecloth to lift the cheese out of the colander and squeeze out more whey. *Note: You could save the whey for other uses, such as cooking pasta.*
6. Pour curds into a bowl and sprinkle with the salt. Mix well.
7. Taste a sample of each variety of homemade cheese. *Note: You could spread this cheese on a cracker to enjoy or use to prepare lasagna.* You can store this cheese in the refrigerator for up to 2 days.

## NUTRITIONAL EVALUATION OF MILK PRODUCTS

Fill in the serving size, calories, fat, and calcium content for each milk product.

VARIETY	PERCENTAGE OF WATER	PERCENTAGE OF FAT	PERCENTAGE OF PROTEIN	SERVING SIZE	CALORIES (PER SERVING)	FAT (GRAMS PER SERVING)	CALCIUM (PERCENT DAILY VALUE PER SERVING)
DRY MILK SOLIDS	90	0.1	3.6				
SKIM MILK	90	0.1	3.6				
SKIM PLUS/DELUX MILK	90	0.1	3.3				
WHOLE MILK	87	3.0-4.0	3.5				
EVAPORATED MILK	74	Not less than 7.9	10.0				
SWEETENED CONDENSED MILK	26	Not less than 8.5	8.1				
HALF AND HALF	80	11.5	3.1				
HEAVY WHIPPING CREAM	58	36.0	2.2				

## SENSORY EVALUATION OF MILK PRODUCTS

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numerical score.

VARIETY	APPEARANCE	AROMA/FLAVOR	CONSISTENCY
DRY MILK SOLIDS			
SKIM MILK			
SKIM PLUS/ DELUX MILK			
WHOLE MILK			
EVAPORATED MILK			
SWEETENED CONDENSED MILK			
HALF AND HALF			
HEAVY WHIPPING CREAM			

## EVALUATION OF CHEESE PRODUCTS

1. Fill in the serving size, calories, and fat for each cheese product. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numerical score.

VARIETY	SERVING SIZE	CALORIES (PER SERVING)	FAT (GRAMS PER SERVING)	APPEARANCE	FLAVOR	CONSISTENCY
CHEDDAR CHEESE						
LOW-FAT CHEDDAR						
FAT-FREE CHEDDAR						
AMERICAN CHEESE SLICES						
LOW-FAT AMERICAN CHEESE SLICES						
FAT-FREE AMERICAN CHEESE SLICES						

## EVALUATION OF CHEESE PRODUCTS (CONTINUED)

1. Fill in the serving size, calories, and fat for each cheese product. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numerical score.

VARIETY	SERVING SIZE	CALORIES (PER SERVING)	FAT (GRAMS PER SERVING)	APPEARANCE	FLAVOR	CONSISTENCY
CREAM CHEESE						
LOW-FAT CREAM CHEESE						
FAT-FREE CREAM CHEESE						
MUENSTER						
BLUE CHEESE						
PARMESAN						

## EVALUATION OF HOMEMADE CHEESES

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numerical score.

VARIETY	APPEARANCE	FLAVOR	CONSISTENCY
HOMEMADE CHEESE, WHOLE MILK, VINEGAR			
HOMEMADE CHEESE, WHOLE MILK, LEMON JUICE			
HOMEMADE CHEESE, 2% MILK, VINEGAR			
HOMEMADE CHEESE, 2% MILK, LEMON JUICE			
HOMEMADE CHEESE, SKIM MILK, VINEGAR			
HOMEMADE CHEESE, SKIM MILK, LEMON JUICE			
HOMEMADE CHEESE, ORGANIC 2% MILK, VINEGAR			
HOMEMADE CHEESE, ORGANIC 2% MILK, LEMON JUICE			

## LEARN MORE:

## Milk & Cheese Science

- ◆ Milk is approximately 87% water and 13% solids. Milk solids are classified as fats and “solids-not-fat.” About 95-96% of the fats are triglycerides. The solids-not-fat portion consists of proteins (casein and whey proteins), carbohydrates (lactose), vitamins, and minerals. Milk is an especially good source of the minerals calcium, potassium, and phosphorus.
- ◆ With its high fat content, whole milk is a good source of the fat-soluble vitamins A and D. Skim milk lacks fat and therefore lacks the fat soluble vitamins, so producers **fortify** skim milk with vitamins A and D by adding quantities higher than naturally found in whole milk. Whole, 2%, and 1% milk are usually fortified with vitamin D too. When milk is fortified with vitamin D, it supplies about 25% of the Daily Value of vitamin D, making milk one of the few excellent food sources of this important nutrient.
- ◆ Different breeds of cows typically produce milk with different amounts of fat. For instance, milk from Jersey cows contains more than 5% milk fat and milk from Holstein cows contains about 3.5% milk fat. In the United States, federal “identity standards” for various grades of fresh milk are defined by the FDA and include specifications for minimum percentages of milk fat: 3.25% for whole milk, 0.5-2% for reduced-fat, and <0.5% for fat-free. To produce these various types of milk, producers use centrifuge technology to separate the milk fat (cream) from the skim milk and then recombine the two parts in specific amounts to get the desired percentage of fat.
- ◆ Cheese producers add enzymes (**rennin**) and/or acids to milk to curdle the milk protein, **casein**; the curds that form are then drained and pressed to separate them from the liquid whey. If the whey is not fully drained, the result is cottage cheese. Usually, the curds are drained and pressed a great number of times, gathered into a mold, salted (to expel more whey, help preserve the cheese, and add flavor), and aged or ripened. Different aging environments yield the many different varieties of cheese. Some cheeses, such as cream cheese, do not undergo ripening; these so-called fresh cheeses are typically mild in flavor. Other cheeses such as blue cheese are inoculated with a mold and aged.
- ◆ Because so much water is removed during cheese making, cheese is a very concentrated source of calories and nutrients, particularly protein, calcium, fat, and the fat-soluble vitamins. Cottage cheese and other cheeses made using acids to form curds are lower in calcium. Many of the water-soluble nutrients in milk are drained off with the whey, so cheese has a lower content of lactose, water-soluble vitamins, and some minerals than milk.

Since salt is added during processing, cheese is fairly high in sodium.

- ◆ Yogurt, buttermilk, and sour cream are examples of cultured dairy products produced by fermentation. Creating these products involves introducing “friendly” bacteria to milk; the bacteria multiply and utilize lactose (milk sugar) as a feeding substrate. In turn, the bacteria produce acids that **coagulate** the casein (milk protein) and contribute to their characteristic tangy flavor.
- ◆ Lactose is the major type of sugar in milk. People who are lactose-intolerant lack the digestive enzyme, lactase, which breaks down lactose. Consuming milk and milk products upsets their stomachs because gas forming bacteria break down the lactose that remains in their gut.
- ◆ In contrast to individuals who experience lactose intolerance, people with milk allergies experience an immune reaction to one or more of the proteins in milk, such as casein. People who are allergic to milk should not consume milk or milk products since reactions can be severe or even life-threatening. They will need to read food labels carefully to avoid hidden milk ingredients.

## Milk & Cheese Tips for Consumers

- ◆ It is recommend to consume 3 servings from the dairy group every day (based on a 2,000 kilocalorie diet).
- ◆ One serving from the dairy group is equal to 1 cup of milk or yogurt, 2 cups of cottage cheese, 1 1/2 ounces of regular cheese, or 2 ounces of processed cheese.
- ◆ One cup of milk or 3/4 cup of yogurt contains about 300 mg of calcium. How much calcium do you need each day? Requirements vary by age:

Age	Calcium Recommendation
1 to 3 years	700 mg
4 to 8 years	1000 mg
9 to 18 years	1300 mg
19 to 50 years	1000 mg
50+ years	1200 mg

- ◆ Low-fat milk products are an integral part of the DASH (Dietary Approaches to Stop Hypertension) Diet. This diet emphasizes fruits, vegetables, and low-fat milk products. It has shown dramatic results in reducing blood pressure.
- ◆ Full-fat milk and cheese products are a major source of saturated fat in the American diet. Saturated fats, along with *trans* fats, are the main dietary components associated with raising blood cholesterol levels and increasing the risk for heart disease.
- ◆ One ounce of full-fat cheese can have up to 6 grams of saturated fat, about 1/3 of a day's recommended saturated fat allowance for most Americans. One ounce of cheese is the size of 1 cube of cheddar cheese or a slice of Swiss or provolone cheese.
- ◆ Mozzarella is a lower-fat choice. Part-skim mozzarella has 5-6 grams of fat per ounce versus about 9-10 grams per ounce of regular cheddar cheese.

- ◆ Choosing light or reduced-fat cheeses can cut your saturated fat intake by at least half. They melt nicely in moist heat, such as sprinkled on pasta, baked potatoes, or a bowl of steaming chili. Shredded versions may melt better than blocks.
- ◆ Making the switch from whole to skim milk saves 8 grams of total fat, 5 grams of saturated fat, and 70 calories per 8-ounce cup. You will likely adjust best if you make the change gradually by first moving to 2%, then 1%, and finally to skim.
- ◆ Younger toddlers usually need the extra calories and fat in whole milk, but after age 2 most children should switch to skim or low-fat milk.
- ◆ Pregnant women and individuals with weakened immune systems have a higher risk of getting Listeria. This foodborne illness is associated with consuming raw milk, soft cheeses, uncooked deli meats, and hotdogs. It can cause miscarriages, premature delivery, and stillbirths. Pregnant women should avoid eating soft cheeses like feta cheese, Brie, Camembert, blue cheese, gorgonzola, and queso blanco fresco, unless the package label clearly states that the cheese was made with pasteurized milk. Similarly, pregnant women should avoid drinking unpasteurized milk or eating foods containing unpasteurized milk.
- ◆ Some people with a lactose-intolerance are able to consume small quantities of milk without much discomfort or can tolerate yogurt and cheese. Since cheese and cultured milk products typically contain less lactose than fresh milk, they are often tolerated better. For individuals with more severe symptoms, the best choice may be to drink special lactose-free milks (examples: nut and rice milks, Lactaid, or Acidophilus milk) or take lactase enzymes when consuming milk or milk products. Individuals should pay close attention to ingredient lists. Many products reuse the whey as an ingredient, which could aggravate symptoms.

# Milk & Cheese Questions

1. Given the quality differences you noted between full-fat and reduced fat cheeses and milk products, what role do you think fat plays in food quality?
2. Which cheese product that you tasted was the healthiest and which was the least healthy?
3. What are the advantages and disadvantages for using low-fat or fat-free cheese to prepare casseroles or macaroni and cheese?
4. List two dishes that you enjoy that contain milk and/or cheese. Can you think of ways to modify these recipes so the dishes provide less fat?
5. The cheese you prepared is a soft cheese. What additional steps are needed to prepare hard cheeses, like cheddar cheese?

# Milk & Cheese Teacher Tips

## Overview

If cheese making is done as a demonstration, the lab takes about 1 ½ hours. It could be combined with another short lab (e.g. fruit) or a special project.

- ◆ Students will be introduced to a variety of dairy foods and substitutes (e.g. soy milk) that they can compare for sensory characteristics and nutrient value as a product as well as in selected food product applications.
- ◆ Students will be introduced by demonstration or their own preparation to the process of cheese making.
- ◆ The students will learn the cooking properties of different types of cheese.

## Lab Management

### Demonstrations

- ◆ You may choose to do the cheese making as a demonstration.

### Time Management

- ◆ While the kitchens are beginning to prepare their cheese, the instructor can begin to set up the milk and cheese tasting.
- ◆ As each kitchen's milks are heating, students can taste each milk and cheese variety and complete the evaluations.
- ◆ Kitchens should bring their assigned milk up to temperature slowly. Do not heat too quickly. Heating the milk too quickly will result in small amounts of curds and possibly scorching the milk.
- ◆ If you decide to not use cheesecloth or you run out, groups can use a fine mesh strainer to separate the curds from the whey. Students should consider safety precautions when pouring hot liquids into the strainer in the sink.

### Sensory Evaluation

- ◆ Instruct the students on how to display and when to evaluate the products. As time allows, a student from each kitchen should comment about the preparation of the dish and the final product.
- ◆ Students can use small plastic cups to taste the milk. They should change cups between each milk tasting.
- ◆ Students can use plastic spoons to taste the sweetened condensed milk.
- ◆ Evaluate at the same time, side by side: all milks, all cheese products, and homemade cheese products.

### Nutrition Points for Discussion:

- ◆ The Dietary Guidelines for Americans recommend that most adults and children increase their intake of fat-free or low-fat milk or milk products like milk, yogurt, cheese, or fortified soy beverages.
- ◆ Both the DASH (Dietary Approaches to Stop Hypertension) and the Mediterranean diets include low-fat dairy for its calcium, potassium, magnesium, and vitamin D. Some, but not all, dairy substitutes are fortified with calcium and vitamin D.
- ◆ Discuss the function of fat in each of the recipes where it is used.
  - The cheese recipes call for whole milk. Can this recipe be made with a reduced fat or skimmed milk? What is the role of fat in making cheese?
- ◆ Salt has either been eliminated from the traditional recipe or listed as optional. Discuss with the students the function of salt in these recipes, especially cheese.
- ◆ Discuss the different kinds of yogurts. Describe active cultures and the benefits of different micro-organisms.

## SHOPPING LIST: (8 SECTIONS)

Item	Utilized Unit/Lab Section	Purchased Unit
Lemon Juice	2 cups	1 bottle
Vinegar	2 cups	1 bottle
Salt	8 tsp.	1 cont.
Dry milk solids	1/3 cup	1 sml. box
Skim milk	2 ½ gal.	3 gallon
Skim plus/deluxe	½ gal.	½ gal.
2% Milk	2 gal.	2 gal.
Organic 2% milk	2 gal.	2 gal.
Whole Milk	2 ½ gal.	3 gal.
Evaporated milk	1 can	1 can
Sweetened Condensed Milk	1 can	1 can
Half and Half	1 pint	1 pint
Heavy Whipping Cream	1 pint	1 pint
Munster	16 oz	16 oz
Cheddar Cheese	8 oz	16 oz
Low-fat cheddar	8 oz	16 oz
Fat-free cheddar	8 oz	16 oz
Cheese slices	12 slices	1 package
Low-fat cheese slices	12 slices	1 package
Fat-free cheese slices	12 slices	1 package
Cream cheese	1 bar	1 bar
Low-fat cream cheese	1 bar	1 bar
Fat-free cream cheese	1 bar	1 bar
Blue cheese	¼ cont.	1 cont.
Parmesan cheese	¼ cont.	1 cont.