

Milk & Our Foods

Part I — Low-Fat Milk

by Kanza Easterly-Keill

Objective

This lesson will show students the relationship between butterfat and milk so students will understand why there are several types of milk for sale and their differences. They will also understand why the milk they drink is usually homogenized. Many students think that non-fat milk is “fake milk” or milk with water added to it.

NOTE: *You can use the butterfat that rises to the top to demonstrate how easy it is to make butter—in conjunction with the Butter lesson.*

Alaska Performance Standards for 7th and 8th Grade:

Science: SA1.1 and SE 3.1

Reading: R3.5.1

Resources

- Wikipedia
- Kowataluk, Helen. 1997. *Discovering Foods*, 5th edition, Glencoe.
- Alaska Field Office, National Agricultural Statistics Service, USDA. 2008. *Alaska Agricultural Statistics-2008*. USDA and DNR-AK.
- National Dairy Council. 1997. *Milk, From Cow to You* (poster). National Dairy Council.

Materials Needed

- Non-Fat Milk
- Whipping Cream
- Glass Jar and well-fitting lid (Large canning jar or mayonnaise jar)
- Towel (to wrap around jar in case of leaks)
- For the butter demo at end: zipper-lock bag, rubber scraper, saucer or custard cup, butter knife and several crackers

Time Required

I use this as a mini-lesson, intended to take no more than 15 min. in several class periods, but it can easily expand to much more time. It depends on how much background material, number of pictures, and whether each student does the experiment or if it is a class demonstration.



This project presented by Alaska Agriculture in the Classroom through funding from the Alaska Farm Bureau, with grant assistance from the Alaska Division of Agriculture. For information, visit www.agclassroom.org/ak

Alaska Ag in the Classroom is a 501(c)3 educational program of the Alaska Farm Bureau.



Vocabulary

- Homogenize
- Pasteurize
- Whole Milk
- Non-Fat (Skim) milk
- Cream
- butterfat

Background

Cow's milk is about 4% butterfat when it comes from the cow. The content varies from 3.6 percent (Holstein cows) to 5.2 % (Jersey cows). Butterfat content also depends on what the cows have been fed.

When fresh milk is allowed to sit, the butterfat rises to the top because the fat molecules are less dense (lighter) than the rest of the milk. This takes from 12-24 hours. Cream separators are now used to spin the fresh whole milk and cause the fat to rise to the top a lot faster. The cream is sold for other uses. Whole milk, 2% milk, and 1% milk have appropriate amounts of butterfat added (3.6 % for whole, 2% for the 2% milk, and so on).

When milking is done by on a small scale, the butterfat (cream) is actually “skimmed” off (using a spoon or ladle or other implement). The milk that is left is relatively fat-free and was traditionally called skimmed milk and, now, non-fat milk. This is actually the more natural form of milk—what is left when the butterfat rises to the top. The butterfat is what causes milk to coat the sides of a glass...the more butterfat, the more thickly the glass will be coated. When the butterfat is agitated (butter churn), the molecules clump together and form butter.

Because the fat separates from the milk, processors homogenize the milk, a process where the fat globules are broken down into smaller particles that won't separate from the milk. The milk is also pasteurized, a process where the milk is heated to kill microorganisms, so it will keep longer. Pasteurization, named for French scientist, Louis Pasteur, uses heat to destroy human pathogens in foods. Milk often has to travel long distances to where it will be sold and, if it weren't pasteurized, it would spoil before it could be sold.

Dairy Farming and Products in Alaska

It is amazing to most middle school students to discover that dairy farming is a viable business in Alaska. There are dairy farms in the Tanana Valley (Delta), and the Matanuska Valley (Palmer, Wasilla). In 2008 there were 15,500 cattle and calves—not all of these are dairy cows. There were 6 dairies in Alaska in 2008 and they produced \$2,000,000 of milk. They produce some of the milk we buy in the stores and some of the milk goes to cheese making and ice cream mixes. Two of these dairies are the Matanuska Creamery and the Northern Lights Dairy (neither of these have websites). Tell the students to look for these brands in the dairy case the next time they are in the grocery store.



Alaska Ag in the Classroom is a 501(c)3 educational program of the Alaska Farm Bureau.

*developed by Kanza Easterly-Keill
Fairbanks North Star Borough
School District*

Alaskan grocers and other consumers need to import much of their milk from the Lower-48 because there just isn't enough Alaska milk. Alaska dairy farms have many challenges that are so much easier to deal with in the Lower 48. The primary challenge for farmers in Alaska is the necessity of purchasing feed for the long winters when the cows can't be outside in the pastures eating "free" grass.

Lesson Introduction

Give students the background information, the vocabulary words that you feel are important, and show some pictures of milk cows, cows being milked, milk processing and so on. You might want to use a note guide for definitions you are going to emphasize or observations that you will be discussing.

Demonstration

For this demonstration, you will create a representation of whole milk, fresh from the cow, using homogenized, non-fat milk and whipping cream (which is almost 100% butterfat or 60 cal. Per Tbsp. with 60 calories from fat)

Fill the glass jar about 2/3 full with non-fat milk. Swirl to demonstrate that it doesn't coat the glass (showing that there is no fat to stick). Pour the whipping cream into a glass and swirl. The cream will coat the glass, showing that it is high in fat.

Add the whipping cream to the milk in the glass jar. Put in enough that when it separates you'll have an inch or so of cream. Put lid securely on the jar. Wrap the small towel around the jar and shake until they appear mixed—show class. Pass around if appropriate. Place jar in refrigerator.

The next class period, check the jar. While you won't see the obvious separation you would with "fresh from the cow" milk you will notice that it is different from plain milk. The cream will be on top and will appear foamy and thick.

If you wait 4-5 days, there will be a much more obvious separation between the fat and the non-fat milk. If you scoop the top layer off and put it in a zipper-lock bag, you can squeeze it for several minutes (or less) and you will have butter. Cut open the bag, and scrape the butter from the bag using a rubber scraper. Scrap onto a saucer or custard cup. When the butter sits for a bit, the last bit of non-fat milk (whey) will "drain" out. Serve on a cracker to brave students!

Extensions for this Unit

- Fat/calorie counts for different types of milks (fat-free, 1%, 2%, whole, cream, and other drinks such as juice, sports drinks, etc): There is a good poster called "Think your Drink" from the Washington State Dairy Council, 2006. It compares the nutrition of a glass of milk with other beverages.
- Cheese: types and how they are made. Students could research a particular type and create an informative poster. You could make some farmer's cheese (look on the web for recipes)!
- UHT milk, evaporated milk, sweetened condensed milk, ultra-pasteurized milk: what they are and what they are used for? It could be educational and fun to do a blind taste test!