

# Liquids and Solids

Although we think of milk as something to drink, it is really a liquid that also contains solids. Milk is made up of water, fat, and milk solids. The milk solids are made of carbohydrates and protein that are **dispersed**, or evenly spread out within the milk. The fat, also called milkfat or butterfat, tends to gather at the top of the milk, unless it has been homogenized.

Almost all milk is **homogenized** to keep the milk fat from separating and floating to the top. Milk fat is what makes milk creamy, rich, and flavourful. A homogenizer is a machine that forces the milk at high pressure through tiny holes. This process breaks up the milk fat

globules into particles one-eighth their original size. When the milk fat particles are that tiny, they stay mixed in the milk.

Raw milk has 3.7 % milk fat. When raw milk is processed, the milk fat is separated from the milk and then added back in to make products with different milk fat contents. Milk that has 3.25 % milk fat is labelled homogenized milk. In 1% and 2% milk, some of the fat has been removed, but the remaining fat has been homogenized back into the milk. Skim milk has had almost all the milk fat removed. To be called skim milk, it must have less than 0.3 % milk fat.

## Milk is a Mixture

Milk is a mixture of solids and liquids. Milk solids are made of proteins and carbohydrates. The main protein in milk is called **casein**. The casein is found throughout the milk. The main carbohydrate is called lactose. **Lactose** is broken down in your body by an enzyme. An **enzyme** is a protein that is produced by cells in the body. **Lactase** is the enzyme that breaks down lactose.

Enzymes react with substances you eat. People who do not have an adequate amount of the lactase enzyme are “**lactose intolerant**.” This means that they have trouble digesting milk and dairy products.

Butter is a very concentrated form of milk fat. Butter is composed of milk fat, water, and milk solids. The fat in milk is part of the milk mixture. When cream is **churned**, or mixed very hard, the fat separates from the milk mixture and forms a small ball. The fat solids can usually be seen, and are about the size of a grain of rice.

### Examples of Milk Fat Content in Some Dairy Products



**Milk =**  
 Water (88%) + Butterfat (5%)  
 + Solids (7%)

	<b>Condensed (26-28% fat) or Evaporated Milk</b> Milk Solids
	<b>Whole Milk (3.25% fat)</b> <b>Low Fat (1-2% fat)</b> <b>Skim / Cream (&lt;0.5% fat)</b>
	<b>Ice Cream (10% fat)</b> <b>Frozen Yogurt (3.25% fat)</b>
	<b>Butter</b> (82% fat, 16% water, 2% solids)
	<b>Cheese (55-85% fat)</b> Curds, Cheddar, Whey, Ricotta
	<b>Cultured Products (12-30% fat)</b> Yogurt, Buttermilk, Sour Cream

## Enriching Milk

Canadian milk processors add a nutrient, **vitamin D**, to all table milk. We need it, along with calcium, to grow strong, healthy bones and teeth. When we add nutrients to food, we say that food has been **enriched** or **fortified**. The law in Canada requires all fluid milk products to be fortified with vitamin D.

Sometimes, dairy processors need to add a nutrient that is taken out when they remove the fats. Partly skimmed and skim milk are fortified with vitamin A, which is good for our eyes. Homogenized milk is not fortified with vitamin A because it contains enough naturally in the milk fat.

### Researcher's Corner

## Exploring Mixtures

1. What different ingredients is milk mixed with?  
What products do these mixtures create?

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2. What difference does the fat content make to different types of milk? Why?

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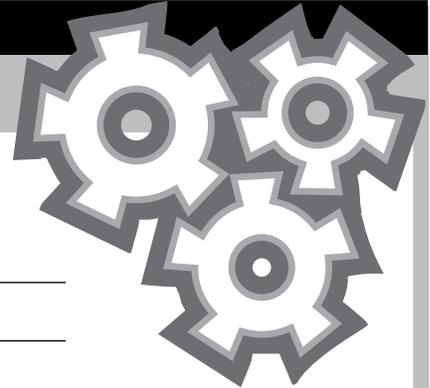
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Play the *It's All in the Mix Interactive App* in the **It's All in the Mix** inquiry page or the **Game Corner** on the *Moo2You* website at [www.moo2you.ca](http://www.moo2you.ca). Use the **Mix It Recipe Cards** if you need help to make different dairy products.

Use what you learned to help you answer these questions.

3. Why do you think it is important for Canadian milk processors to add vitamin D to milk?

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4. Did you know that Vitamin D can also be added to orange juice and some cereals? Check how much Vitamin D is added to orange juice or a cereal you eat at home and record the quantity below:

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## Scientist's Corner

### What to Use

- Salt
- Colander
- 125 ml of whipping cream
- Glass or plastic jar with a lid

### What to Do

Place 125 ml of whipping cream into a glass or plastic jar with a lid. Take turns with a partner shaking the jar. Shake it for at least ten minutes. At first, the cream will start to look like whipped cream. Keep shaking!

When a lump of butter forms, pour the contents of the jar into a colander to separate the butter. You can add a little salt to the butter, mix it well, and spread it on a cracker to try it!

