Milk is sometimes described as the perfect food. With its mixture of water, proteins, and minerals, milk can meet many of our daily dietary needs.

**Objective:**

- Discuss the composition of milk.

**Key Terms:**

- casein
- emulsion
- homogenization
- solids-not-fat

**What Is the Composition of Milk?**

Milk itself is primarily water, which makes up nearly 87 percent of the total volume. The other 13 percent of milk is composed of solid material, mostly fats and nutrients. Besides the fat content of milk, proteins, lactose (milk sugar), and minerals make up a category known as solids-not-fat, or SNF. Casein is the primary protein found in milk, accounting for nearly 80 percent of the total protein content.

The fat content of milk can vary between breeds of dairy cattle. Some breeds, such as the Jersey and Guernsey, produce milk with very high fat content, while other breeds, such as the Holstein and Milking Shorthorn, produce milk with relatively low fat content.

The composition of milk can also vary based on conditions that affect an individual cow.

- **Feed**—The type of feed given to a dairy cow can affect the composition of the milk. A cow fed more grain will tend to produce milk with a higher percentage of fat.
- **Stage of lactation**—After a cow gives birth, she will produce milk for her new calf. The cow’s milk composition will change based on how recently she has calved or how long she has been milked after calving.
Health of animal—The cow’s body will naturally give health a higher priority than milk production. This means that if a cow is not healthy, she will not produce the volume or quality of milk that a healthy cow would.

Age of animal—Just as our bodies change with age, so does the cow’s body. As she ages, her milk composition will change until she will no longer be a productive milk producer.

Seasonal conditions—Once again, the cow must be healthy and comfortable to produce quality milk. As the seasons change, the cow must adapt. This may cause differences in the composition or volume of milk produced.

Table 1. Comparison of Milk Production and Milk Fat Percentage of Several Breeds of Dairy Cattle

<table>
<thead>
<tr>
<th>Breed</th>
<th>Milk (gal)</th>
<th>Fat (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayrshire</td>
<td>13,897</td>
<td>3.93</td>
</tr>
<tr>
<td>Brown Swiss</td>
<td>14,526</td>
<td>4.02</td>
</tr>
<tr>
<td>Guernsey</td>
<td>12,737</td>
<td>4.54</td>
</tr>
<tr>
<td>Holstein</td>
<td>18,254</td>
<td>3.66</td>
</tr>
<tr>
<td>Jersey</td>
<td>12,489</td>
<td>4.76</td>
</tr>
<tr>
<td>Milking Shorthorn</td>
<td>13,455</td>
<td>3.68</td>
</tr>
</tbody>
</table>

Source: USDA.

FIGURE 1. Many factors will affect the composition of a cow’s milk. (Courtesy, Agricultural Research Service, USDA)
Environmental conditions—Any adverse environmental conditions will ultimately affect the milk production of the cow, including the composition of the milk. Dairy producers strive to keep their cattle healthy and comfortable year round.

Milk fat is generally considered the most complex of all common fats. Whole milk has approximately 3.3 percent fat, while fat-free milk (formerly skim milk) may contain only 0.2 percent fat. Milk itself is actually an emulsion, a finely divided mixture of two immiscible liquids, water and fat. The emulsion is stabilized by phospholipids that are absorbed on the fat globules in milk. This stabilization prevents the fat from separating from the liquid. Homogenization, or the forcing of the milk through a small screen, decreases the size of fat globules while increasing their uniformity. Churning will also affect the milk by breaking down the emulsion and separating the fat globules from the water in milk.

![Figure 2. This line graph shows the difference in milk composition based on the stage of lactation.](image)

![Figure 3. This bar graph shows how the season can affect milk fat concentration in dairy cattle.](image)

![Figure 4. This bar graph shows the effect of season on milk fat tests.](image)
Summary:
Milk is sometimes called the perfect food. Liquid milk contains solid material—fat, protein, lactose, and minerals—along with a large amount of water. Milk is extremely beneficial to our daily diets. The actual composition of milk can be affected by the species, diet, stage of lactation, health, age, and seasonal and environmental conditions.

Checking Your Knowledge:
1. Describe the composition of milk, giving specific percentages of components.
2. What is homogenization?
3. What term does the dairy industry now use to identify what was formerly called skim milk?

Expanding Your Knowledge:
Using the Internet and/or print-media materials, research current milk labeling requirements based on fat content. Prepare a report on your findings.
Web Links:

Milk Composition
http://classes.aces.uiuc.edu/AnSci308/milkcomp.html

University of Guelph—Homogenization
http://www.foodsci.uoguelph.ca/dairiedu/homogenization.html

Agricultural Career Profiles
http://www.mycareer.com/career-profiles