

US06DZOO26 (Dairy Industry)

The production of milk on dairy farms and the processing of milk and milk products at dairy plants make up the dairy industry. Along with producing many kinds of milk, the industry makes butter, cheese, yogurt, and ice cream.



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Dairying produces food products that form a regular part of many people's diets, and in many parts of the world it is a big business and major employer. Among the leading milk producers are India, the United States, the European Union, Russia, Pakistan, Brazil, China, Ukraine, New Zealand, Australia, Argentina, and Mexico. Most of the milk used for human consumption worldwide comes from cows, but in some areas milk and dairy products are produced from buffalo, goats, sheep, camels, or reindeer. In the early 21st century, the world's dairy plants produced some 650 million tons of milk each year, more than 80 percent of which was cow's milk. In the United States the dairy industry produced about 80 million tons of cow's milk annually.

Without proper handling and storage, milk spoils easily and can potentially transmit diseases. Normally, dairy farms and plants are regulated by government sanitation laws to ensure that their products meet basic quality and safety standards.

DAIRY FARMS

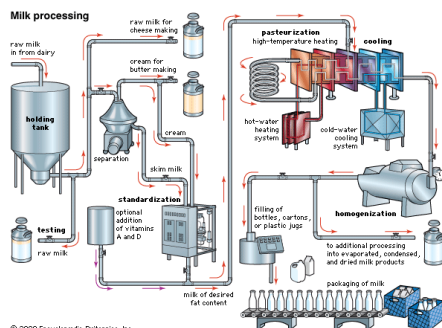
Dairying begins on the farms that breed, raise, and milk the cows. Farm size varies greatly. A typical dairy farm in the Midwestern United States, for example, may have 60 cows, while one in California may have 500 or more animals. The major breeds of dairy cattle have been established over years of careful selection and controlled mating to encourage the development of desired traits. Holstein-Friesian cows, for example, produce a greater volume of milk overall, while breeds such as Ayrshire, Guernsey, Brown Swiss, and Jersey produce richer milk, with a higher percentage of butterfat, protein, and milk solids.

Farmers also use selective breeding to improve the individual animals in their herd. Herd management involves providing the animals with proper food, maintaining clean surroundings, and monitoring health so as to maximize milk production and minimize disease. Sick or injured animals must be isolated from the herd.

Most milking is done with machines operated by specially trained milkers. Typically, the cows are milked twice a day in milking barns. After a cow's teats are cleaned, they are attached to milking cups and a pulsating vacuum draws the milk out.

To prevent the milk from spoiling, it must be refrigerated within two hours. It must be kept cold during transit, processing, and storage and moved rapidly from the farm to the consumer. Typically, the milk is collected in stainless steel bulk tanks and transported to the processing plant by refrigerated tank trucks. In some parts of Europe, pipelines may carry the milk from farm to plant, while in parts of western India, the women who milk the cows carry it to the plant in large jars.

HOW FLUID MILK IS PROCESSED



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At the processing plant, the milk is pumped into temporary holding tanks. It is then weighed, and samples are sent to the laboratory where tests are made for odor and flavor, bacteria, sediment, and milk protein and fat content.

Milk of inferior quality may be rejected. Only the highest-quality raw milk, usually designated "Grade A," is used for fresh fluid milk. Such milk requires high standards of cleanliness at every stage of production. At the dairy plant, the equipment and all the machines through which the milk has flowed are sterilized every day.

From the temporary holding tanks the milk flows through stainless steel pipes to machines that filter it and may also separate out the cream. Usually the milk is then treated to kill bacteria and to make its consistency uniform.

SEPARATION

Dairy plants control the fat content of their products with separators, which extract the desired percentage of butterfat, or cream, from the milk. The milk remaining after the cream has been removed is known as skim. The dairy may sell it for cattle feed, convert it into powdered skim milk, or package it for sale for human use as liquid skim milk.

The separator works on the principle that the heavier a whirling body, the greater the force acting on it to move it from the center. From a tank at the top of the separator, the milk flows down into a large bowl, or drum, making from 5,000 to 9,000 rotations per minute. The cream, being lighter, stays in the center and is drawn off through a tube. The heavier skim milk, forced to the outside, is carried through another tube. Small particles of debris, which are heavier than the skim milk, are flung to outside pockets for disposal. Milk that is not separated is sent through a clarifier, which filters the debris without altering the fat content.

Computer-controlled separators can yield milk of nearly any fat content. Terms and definitions vary by country, but whole milk often has at least 3.25 percent fat; low-fat milk, about 1 or 2 percent; and skim milk, less than 1 or 0.5 percent.

PASTEURIZATION

Almost all milk and most milk products sold today are pasteurized, or processed with heat to kill harmful bacteria. The process is named for the French scientist Louis Pasteur, who first developed it to prevent spoilage of other food products. Cream used in making butter is pasteurized before churning. Ice cream is always pasteurized. Much of the cheese produced is made from pasteurized milk. Cheese tends to ripen more slowly and less fully if it is made from pasteurized milk, however, so in some countries some varieties are produced without pasteurization.

Several pasteurization methods are available. The batch method involves the heating of milk or milk product in a vat for at least 30 minutes at 145° F (63° C). The most widely used method for pasteurizing milk is known as high-temperature, short-time (HTST). In the HTST procedure the milk is heated to 161° F (71.6° C) for at least 15 seconds. If the product is to be stored for long periods of time, as with half-and-half used for coffee, it may be processed by ultra-high temperature (UHT) pasteurization at 280° F (138° C) for at least 2 seconds. Milk pasteurized with the UHT process remains fresh at least 45 days if refrigerated or, if packaged in special sterile containers, for many months at room temperature. Regardless of the method used, after pasteurization the milk must be rapidly cooled to preserve its flavor.

HOMOGENIZATION

In the homogenizer the milk is forced under high pressure through many tiny holes. This breaks up the fat globules into minute particles. They do not rise to the top as cream, making the shaking of milk, as was once common, unnecessary. Homogenized milk also yields an improved body and texture in many dairy products.

FURTHER PROCESSING

Depending on its intended use, the milk may undergo additional processing. It may be fortified with vitamins A and D. Some of its liquid may be removed to produce a concentrated product called evaporated or condensed milk, or it may be dried completely.



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Cultured milk products such as yogurt, sour cream, and cultured buttermilk are fermented by adding harmless bacteria that produce lactic acid. Such bacteria are used also in the complex process of making cheese. They are added to the milk along with enzymes, both of which cause the milk protein to curdle, or clump, into a solid form called the curd. The curd is heated until it shrinks and then ripened into cheese.



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Butter is produced by churning, or agitating, unhomogenized milk to separate out the butterfat granules. Ice cream is made from a mix of cream, milk, sugar, stabilizers, and various flavorings. The mix is rapidly frozen while stirred to incorporate air.

PACKAGING

Fluid milk may be packaged in plastic containers, glass bottles, or in cardboard cartons that are coated with paraffin wax to make them leakproof. Filled containers then go to a refrigerated room to remain until the delivery trucks pick them up.

HISTORY OF DAIRYING

Humans have been drinking animals' milk since ancient times. Sanskrit records mentioned milk 6,000 years ago. The Bible describes the promised land as "a land flowing with milk and honey." Some 2,300 years ago, the Greek physician Hippocrates recommended milk as a medicine. Christopher Columbus brought cattle to the New World on his second voyage. Cows were brought from Europe to the American colonies in the early 1600s and to Australia in 1788.

Cheese making originated in the Middle East. It was later introduced into ancient Rome and thus the vast Roman Empire, where cheese was used as an article of commerce. European monks developed cheese making into an art during the Middle Ages.

The modern large-scale dairy industry developed with the growth of cities and fast, refrigerated transportation. In 1841, at the request of railroad stationmaster Thomas Selleck, a farmer successfully shipped a wooden churn of milk by rail 60 miles (97 kilometers) to New York City. A few years later wooden shipping containers were replaced by metal cans. Sometimes the cans were packed in ice to keep the milk cool. Mechanical refrigeration began to be used between 1880 and 1890. In 1892 Nathan Straus established the first infant milk depot in the United States. He offered sterilized milk for sale at five cents a quart or one cent a glass. The glass milk bottle was invented by Hervey D. Thatcher in 1880.

The end of the 19th century also saw the advent of the power cream separator and the first commercial pasteurizers. The industry first began using the HTST and UHT methods of pasteurization in the 1940s and '50s. Paper milk containers largely replaced glass bottles in the early 20th century, and plastic bottles came into wide use in the 1960s and '70s. In many regions, government regulation of dairy products increased throughout the 20th century.

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