A Guide to Cheese: Understanding the Differences and Similarities Behind Cheese Varieties

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introduction & history

The origin of cheese predates recorded history, but it is commonly believed cheese originated over 4,000 years ago in Europe, Central Asia, or the Middle East. While a mystery, it is believed cheese was created accidentally due to the practice of storing milk in bladders made from animal stomachs. Rennet, an enzyme found in the stomach of ruminant animals, combined with heat from the sun, separated the milk into curds and whey. The discovery of cheese stemmed from these curds.

Milk is composed of water, lactose, milk lipids, milk proteins, and minerals. Lactose, the carbohydrate in milk, and casein and whey, two types of milk proteins, play important roles in the cheese-making process. When producing cheese, the casein proteins in milk coagulate and the milk is separated into solid curds and liquid whey. Before this can occur, milk must be at a certain pH to separate into curds and whey. If the hydrophilic κ-casein chain is removed, the hydrophobic micelle areas are exposed; causing the hydrophobic micelle to clump together with nearby micelles, forming casein coagulates, also known as curds.

In the process of lactic acid fermentation, lactose is transformed into lactate and lactic acid is produced. This lactic acid helps reduce the pH of the milk. Lactic acid bacteria, present in unpasteurized milk, utilize the lactose in milk as a source of energy. In pasteurized milk, citric acid can be added to help reduce the pH or cultures can be added to initiate lactic acid fermentation.

Once the pH is lowered, the casein proteins in the milk are able to coagulate, owing to the fact that a certain pH is required for this coagulation to occur. There are different types of casein proteins, including α-, β-, and κ-caseins. α- and β-caseins are hydrophobic, but cluster with κ-caseins, which have hydrophilic peptide chains. Caseins arrange
themselves in a manner such that the hydrophobic components are hidden, but the hydrophilic κ-casein chain is on the outside. This arrangement contributes to the formation of casein micelles. If the hydrophilic κ-casein chain is removed, the hydrophobic micelle areas are exposed; causing the hydrophobic micelle to clump together with nearby micelles, forming casein coagulates, also known as curds. Enzymes, commonly known as rennets, are one method used to cleave the hydrophilic κ-casein chain from the micelle.

In order to create a block of cheese from a bucket of milk, much of the water content of milk needs to be removed. This liquid is removed in the form of whey, another protein found in milk. The more whey removed, the longer the cheese can ferment and be preserved. The steps after coagulation play an important role in determining what variety of cheese is being made. Both how the cheese is stored and the amount of whey drained off changes the flavor and texture of cheese curds and affects the final cheese product.

According to Fox et al, there have been a number of attempts to classify cheese varieties into groups and there is no clear manner for cheese classification (388). Fox et al., however, have broken cheeses into the following categories:

• Acid coagulated
  o Production of these cheeses do not rely on rennet enzymes to coagulate and are usually consumed fresh and do not ripen. Examples include ricotta and cottage cheese.

• Rennet coagulated
  o Production requires the use of rennet enzymes to coagulate the cheese curds and these enzymes will continue to act on the cheese during storage, also known as ripening. Examples include mozzarella and cheddar.

For the purpose of this guide, we will be focusing on rennet-coagulated cheeses, the process of which is described above. These cheeses can be further broken down into three categories:

• Internal bacterially-ripened
• Mold-ripened
• Surface ripened
internal bacterially-ripened cheeses

Internal bacterially-ripened cheeses lack the presence of any surface bacteria or internal mold growth. The only components that contribute to the aging of these cheese are the milk, rennet enzymes, and internal bacteria. This category of cheese can be further broken down based on moisture content into the following categories:

- Extra-Hard
- Hard
- Semi-Hard
- Semi-Soft
- Cheese with eyes
- High Salt Varieties
- Pasta-Filata Varieties

**extra-hard:**

Examples: Parmesan, Asiago, Romano

These cheeses are usually characterized by a hard, grainy texture, and an intense and sharp flavor.

Once the coagulum is produced, it is broken by a basketlike implement. The curds are then cooked to 53-55 degrees Celsius for 10-12 minutes before being transferred to a large mold. Once in the mold, the cheese may be under light pressure and/or turned frequently to help expel whey. The cheese is brine-salted for 20-23 days, meaning salt is applied to the outside of the cheese, in order to draw salt into the cheese and moisture out of the cheese. During this process, the rind is cleaned frequently, as to discourage mold growth. These cheeses will usually mature for two years or more; the duration the cheese is matured depends on the intensity of flavor desired.
hard:

Example: Cheddar

The differentiation between hard and semi-hard cheese is not always clear, and some of these cheeses are often characterized in either category depending on who is classifying them. Most hard cheeses are packed into molds under pressure in order to expel most of the whey. These cheeses have a hard, uniform texture and are often elastic in texture.

Once the milk has congealed, the coagulum is cut into small pieces and the curds are cooked to 39-40 degrees Celsius. When making cheddar, a popular hard cheese, the curds are first cheddared. The cheddaring process involves piling blocks of curd on top of each other, regularly turning and stacking the curd blocks, which allows acidity to develop in the curds and assists in whey drainage because the curds are kept under constant pressure. Cheddaring also helps the texture of the curd become more pliable and is a process used when making other cheeses besides Cheddar.

After cheddaring, the curds are milled and dry-salted to increase whey drainage. These salted curds are then put into molds and pressed for at least 12 hours and then matured for up to 2 years.

semi-hard:

Examples: Colby, Monterey

The distinctions between semi-hard cheeses and hard cheeses are not very clear; however, these cheeses are usually more elastic than hard cheeses, but firmer than semi-soft cheeses.

The process of creating a semi-hard cheese is very similar to that of a hard cheese, like cheddar; however, semi-hard cheeses are stirred often to inhibit the development of the extensive structure found in cheddar. As a result, these cheeses have a higher moisture content and a softer texture. The curds are salted, molded, and pressed to expel whey and ripened for two to three months.
semi-soft:

Examples: Fontina

Semi-soft cheese is a broad category, as many of these cheeses also belong in other categories, such as Gouda, Monterey, and Blue cheeses. Broadly, semi-soft cheeses are classified as those that have smooth interiors with little or no rind. These cheeses have higher moisture contents than semi-hard cheeses and can be very mild in flavor to very pungent.

cheese with eyes:

Examples: Swiss and Gouda

These cheeses are classified by the development of eyes, holes that result from bubbles of carbon dioxide (CO2) gas that is produced by bacteria in the cheese. In Swiss cheese varieties, the eyes, which are usually larger, are a result of CO2 that is produced by Propionibacterium freudenreichii spp. Shermanii. These bacteria transform lactate into propionate, acetate, and CO2. The acetate and propionate both contribute to the flavor of Swiss cheese. Most of the CO2 diffuses in the curd, but if enough Propionibacterium freudenreichii spp. Shermanii is present, sufficient CO2 will be produced to induce eye formation and the rubbery nature of the curds will trap the CO2. While these bacteria won’t react in milk, they will while the cheese matures in a hot room. (247). In the Dutch varieties, like Edam and Gouda, the eyes are usually smaller and result from CO2 that is produced from citrate in the DL starter culture.

high salt varieties:

Examples: Feta

High salt variety cheeses are often stored in brine, resulting in a high salt content. Feta cheese is usually made from sheep or goat milk. Once the coagulum is created, it is cut into cubes and transported into molds. Whey drains off in the molds, but once the curds are firm enough, they are cut into blocks and salted. Once salted, the curds are placed in brine where they stay for around seven days at 14-16 degrees Celsius until the pH drops to around 4.5, at which point the cheese is stored at 3-4 degrees Celsius for at least two months.
pasta-filata varieties:

Example: Mozzarella, Provolone

Pasta Filata varieties are semi-hard cheeses that are characterized by the fact that they were stretched and kneaded during the production process. The process of creating Mozzarella is fairly similar to Cheddar: whey is drained off of the coagulum after it is cut and heated. The curd are cheddared until the pH drop to 5.1-5.3. Once the curds have been cheddared, however, they are placed in hot water or heated by another method and kneaded until the desired texture is reached. At this point, the cheese is salted and molded.
mold ripened cheeses

Mold ripened cheeses are characterized by mold that grows in or on the cheese during the ripening process. These cheeses fall into two broad categories:

• Surface mold-ripened cheeses
• Blue-veined cheeses

surface mold ripened:

Examples: Brie and Camembert

These cheeses are also classified as soft cheeses with bloomy rinds or soft-ripened cheeses. These soft cheeses are characterized by the growth of the white mold *Penicillium camemberti* on the surface of the cheese.

Once the coagulum has formed, the curds drain for a while until most of the whey is drained. At this point, the curds are salted and placed in molds. Once firm enough, the surfaces of the cheeses are sprayed with a culture of *Penicillium camemberti*. This mold produces enzymes, which ripen the cheese from the outside in, developing a white, fluffy rind on the outside of the cheese, often referred to as a “bloom”. These cheeses ripen for about a month while the texture and color of the cheese become more consistent.

*Penicillium camemberti* metabolize lactate to CO2 and H2O, causing an increase in pH. Once the lactate is gone, *Penicillium camemberti* metabolizes proteins, which produces NH3 and further increases the pH. This increase in pH occurs initially at the surface, creating a pH gradient from the outside of the cheese to the center. This increase in pH contributes to proteolysis, the breakdown of proteins into smaller amino acid, which contributes to the softening of the inside of the cheese.
blue-veined cheeses:

Example: Roquefort

Blue cheeses are soft, internal mold-ripened cheeses. The bacteria P. roqueforti is added to the milk or curds and grows throughout crevices in the cheese. Once the coagulum has been formed and cut, the curds are cooked at low temperature, and then, placed in molds to allow for whey drainage. Once most of the whey is removed, the cheese is pierced allow air into the cheese, as P. roqueforti requires O2 to grow. The holes also allow the CO2 produced by the cheese to escape.

The flavor of blue cheeses is largely due to alkan-2-ones (methyl ketones, which are responsible for flavors and odors), which are byproducts of free fatty acids produced by the mold.
surface ripened cheeses

Examples: Taleggio and Limburger

Surface ripened cheeses, also known as surface smear-ripened cheeses or washed-rind cheeses, describes those cheeses characterized by an orange or reddish rind that results from the cheese being washed with a brine solution containing bacteria.

After the coagulum has been cut and the curds have drained, the curds are placed in molds until the cheese is firm enough to retain its shape. At this point, the cheese surface is washed with a brine solution that often consists of salt water and the bacteria *Br. Linens*, although this solution can also contain beer, wine, brandy, or other ingredients that will encourage the growth of bacteria. While *Br. Linens* are commonly used bacteria, for some cheesemakers, the bacteria present in the cheesemaking environment are sufficient.

Products of the metabolic activities occurring on the cheese surface diffuse into the cheese and affect its flavor. These cheeses are usually soft or semi-hard; Soft surface ripened cheeses will usually have a stronger flavor than semi-hard surface ripened cheeses.

bibliography:


