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Cheese Production Standards and Techniques: An Overview

Tina[1], *Mahendra Kumar[2] and Kamal Kishore[3]

[1]Department of Home Science, University of Rajasthan, Jaipur, Rajasthan, India
[2]College of Dairy and Food Technology, Rajasthan University of Veterinary and Animal Sciences, Jobner, Jaipur, Rajasthan, India
[3]Department of Forestry, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India
*Corresponding Author's email: mahendra1.cdfst@gmail.com

Raw or pasteurized milk can be used to make cheese. The resulting cheese has distinct aromas and textures due to the use of raw milk. Before manufacturing various types of cheese, raw milk is mildly heated (below pasteurization) to eliminate some of the organisms that cause spoiling and to improve the conditions for the cheese cultures. Raw milk cheese needs to be matured for a minimum of sixty days, to reduce the possibility of exposure to disease causing microorganisms (pathogens) that may be present in the milk. For some varieties cheese must be aged longer than 60 days.

In general, cheese can be divided into two categories: natural or processed cheeses, and acid or rennet cheese. To make acid cheeses, milk is treated with acid to cause the proteins to coagulate. Direct acidification is used to create fresh cheeses like cream cheese and queso fresco. The majority of cheeses, including Swiss and cheddar, coagulate the milk using an enzyme called rennet in addition to the starter cultures. In the industry, cheese prepared straight from milk is referred to as "natural cheese." Process cheese is created by cooking natural cheese with additional substances to alter its melting and/or textural characteristics and lengthen its shelf life.

The Indian cheese market was valued at INR 107.54 billion in 2024. It is projected to reach INR 593.47 billion by 2033, with a CAGR of 19.86% during 2025-2033. The market is also expected to reach INR 512.1 billion by 2032, with a growth rate of 21.47% during 2023-2032.

Main Ingredients of Cheese

Milk is the primary ingredient of cheese. Cow, goat, sheep, water buffalo, or a combination of these milks are used to make cheese. The chosen cheese type determines the kind of coagulant that is employed. An acid source, like acetic acid (found in vinegar) or gluconodelta-lactone (a mild food acid), is used for acid cheeses. Calf rennet or, more frequently, rennet made via microbial bioprocessing are used for rennet cheeses. In order to enhance the milk's coagulation qualities, calcium chloride is occasionally added to cheese. Depending on the cheese, flavors can be added. Herbs, spices, horseradish, sweet and spicy peppers, and port wine are a few typical ingredients.

Cultures Used for Cheese Making

Cultures for cheese making are called lactic acid bacteria (LAB) because their primary source of energy is the lactose in milk and their primary metabolic product is lactic acid. There is a wide variety of bacterial cultures available that provide distinct flavor and textural characteristics to cheeses. Initially in the cheese-making process, starter cultures are employed to reduce the pH before adding rennet, which aids in coagulation. In addition to providing desired flavor ingredients, the starter cultures' metabolism inhibits the growth of infections and spoiling organisms. *Streptococcus salivarius subsp. thermophilus*, *Lactobacillus delbruckii subsp. bulgaricus*, *Lactobacillus helveticus*, and *Lactococcus lactis subsp. lactis* or *cremoris* are common starter bacteria.

Cheese's distinctive flavors and textures are provided by or enhanced by adjunct cultures. *Propionibacterium freudenreichii* is used to generate Swiss eyes, and *Lactobacillus casei* and *Lactobacillus plantarum* are frequently introduced as adjunct cultures during manufacturing to enhance the flavor of Cheddar cheese. *Brevibacterium linens* of gruyere, brick, and limburger cheeses are examples of adjunct cultures that can be employed as a smear to wash the outside of the produced cheese. Some cheese kinds get their distinctive colors and flavors from the usage of yeasts and molds. The spread used to ripen brick and limburger cheese contains torula yeast. Molds include, for example, *Penicillium roqueforti* in blue cheeses and *Penicillium camemberti* in camembert and brie.

Procedure of Cheese making

Cheese kinds range greatly in terms of the temperatures, durations, and desired pH for various processes, the order of processing steps, the use of brining or salting, block formation, and aging.

A very basic overview of the stages involved in manufacturing cheese can be found in the flow chart below follows. For demonstration, the standard processing procedures for Cheddar cheese are employed.

Process Flow Chart

- Standardize Milk
- Pasteurize/Heat Treat Milk
- Cool Milk
- Inoculate with Starter & Non-Starter Bacteria and Ripen
- Add Rennet and Form Curd
- Cut Curd and Heat
- Drain Whey

- Texture Curd
- Dry Salt or Brine
- Form Cheese into Blocks
- Store and Age
- Package

Individual formulations and the cheese's intended final use will determine the best timeframes, temperatures, and pH levels to utilize for cheddar cheese. These parameters can be changed to maximize the qualities of Cheddar cheese for melting, shredding, or aging for a number of years.

1. **Standardize Milk**: Milk is often standardized before cheese making to optimize the protein to fat ratio to make a good quality cheese with a high yield
2. **Pasteurize/Heat Treat Milk**: Depending on the desired cheese, the milk may be pasteurized or mildly heat-treated to reduce the number of spoilage organisms and improve the environment for the starter cultures to grow. Some varieties of milk are made from raw milk so they are not pasteurized or heat-treated. Raw milk cheeses must be aged for at least 60 days to reduce the possibility of exposure to disease causing microorganisms (pathogens) that may be present in the milk.
3. **Cool Milk:** Milk is cooled after pasteurization or heat treatment to 90°F (32°C) to bring it to the temperature needed for the starter bacteria to grow. If raw milk is used the milk must be heated to 90°F (32°C).
4. **Inoculate with Starter & Non-Starter Bacteria and Ripen:** The starter cultures and any non-starter adjunct bacteria are added to the milk and held at 90°F (32°C) for 30 minutes to ripen. The ripening step allows the bacteria to grow and begin fermentation, which lowers the pH and develops the flavor of the cheese.
5. **Add Rennet and Form Curd:** The rennet is the enzyme that acts on the milk proteins to form the curd. After the rennet is added, the curd is not disturbed for approximately 30 minutes so a firm coagulum forms.
6. **Cut Curd and Heat:** The curd is allowed to ferment until it reaches pH 6.4. The curd is then cut with cheese knives into small pieces and heated to 100°F (38°C). The heating step helps to separate the whey from the curd.
7. **Drain whey:** The whey is drained from the vat and the curd forms a mat.
8. **Texture curd:** The curd mats are cut into sections and piled on top of each other and flipped periodically. This step is called **cheddarin**g. Cheddaring helps to expel more whey, allows the fermentation to continue until a pH of 5.1 to 5.5 is reached, and allows the mats to "knit" together and form a tighter matted structure. The curd mats are then milled (cut) into smaller pieces.
9. **Dry Salt or Brine**: For cheddar cheese, the smaller, milled curd pieces are put back in the vat and salted by sprinkling dry salt on the curd and mixing in the salt. In some cheese varieties, such as mozzarella, the curd is formed into loaves and then the loaves are placed in a brine (salt water solution).
10. **Form Cheese into Blocks**: The salted curd pieces are placed in cheese hoops and pressed into blocks to form the cheese.
11. **Store and Age**: The cheese is stored in coolers until the desired age is reached. Depending on the variety, cheese can be aged from several months to several years.
12. **Package**: Cheese may be cut and packaged into blocks or it may be waxed.

Summary

Cheese processing involves several key steps, including milk preparation, acidification, coagulation, curd handling, salting, shaping, and ripening. These steps transform milk into a wide variety of cheeses with distinct flavors and textures. Natural cheese is made from four basic ingredients including milk, salt, a starter culture (which contains bacteria), and rennet, an enzyme.

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