– Chapter 8 –
Cheese

When people think of pizza, cheese usually comes to mind. Quantity, color, stretch, and flavor of cheese are a big part of the pizza-eating experience. This chapter describes the various cheese options along with how to purchase, store and process cheese.

Types of Cheese for Pizza

Worldwide there are over 400 varieties of cheese. About a dozen are commonly found on pizza, with mozzarella topping the list.

Cheese is categorized various ways, such as by degree of hardness, how it's made, amount of aging, sharpness of flavor, and country of origin. Degree of hardness is the most common way to categorize cheese. However country of origin is often used, too. At one time each variety was produced only in its native country. Today, however, major countries produce many varieties regardless of origin. So most of the cheese we buy is domestically produced. Because it travels a shorter distance domestic cheese is less expensive. Plus it's usually at least as good as imported cheese. The best imported cheese is that requiring a long aging period.

When viewed from country of origin, the predominant type of cheese used in pizza is the *Italian* cheeses. The most common are mozzarella, provolone, Parmesan, and Romano. However, other types — such as asiago, fontina, caciocavallo, bel paese, taleggio, gorgonzola, and ricotta — sometimes find their way onto "gourmet pizzas."

Many non-Italian type cheeses — such as cheddar, brick, Monterey Jack, muenster, gouda, colby, and Swiss or gruyere are also used on pizza. They're often blended with mozzarella or provolone.

To understand cheese it helps to know the cheese-making process. So, first we'll describe how cheese is made, then we'll look at some of the main varieties used on pizza.

Cheese-making Process

Most types of cheese are made by coagulating milk and then separating the solid portion, called curd, from the liquid portion, called whey. The curd is then made into cheese. The exact process differs among cheese varieties but there some basic steps common to all cheeses.

FIRST, a sample of the milk received by the cheese manufacturer is tested for key factors such as percent of milkfat, protein, sugar, pH (i.e., acidity-alkalinity), total solids, antibiotics, and bacterial count. The price paid for milk is partially determined by these factors.

SECOND, the milk is pasteurized or heat-treated to kill bacteria although a few cheeses are made with unpasteurized milk — known as raw milk. When raw milk is used the cheese must be aged for at least 90 days to kill harmful bacteria. Typically, cheese is made with cow's milk but sheep, goat, horse, and water buffalo milk can be used.

After pasteurization the milk passes through a centrifuge where the milk's fat content is adjusted (i.e., usually reduced) to suit the cheese-maker's purposes. *So contrary to common belief, the fat level of the original milk has no bearing on the fat level of the final cheese.* Milkfat removed during cheese-making is sold to butter and ice cream producers. After fat level adjustment, the pasteurized milk is cooled to setting temperature (about 88 degrees F) and then poured into a large trough or vat — the largest holding up to 50,000 lbs.

THIRD, lactic acid-producing bacteria, called starter, is added and the milk is stirred for about an hour. During that time it increases in acidity. A flavor-producing enzyme, such as lipase, might be added at this time. Also, if it's a cheddar-style cheese, annatto — a tasteless yellow dye derived from plant seed — might be added. Or, as in the case of mozzarella, a de-coloring agent is included to make the cheese white instead of yellowish.

FOURTH, after proper acidity is reached, a coagulant — usually rennet — is added. Typically rennet is extracted from calves' stomachs but it can also be made

from bacterial cultures for vegetarian cheese. After about 30 minutes the rennet sets the milk into a firm, custard-like mass.

FIFTH, using curd knives or wires, the coagulated mass is cut into 1/4-inch to 1-inch cubes, called *curd*. The larger the cube, the more moisture will be retained in the final cheese and, so, the softer it will be. Cutting allows a watery substance called *whey* to separate from the curd. Whey contains mostly lactose, or milk sugar. In condensed and dried forms whey has many uses in food processing and baking. For example, it's sometimes mixed into pizza dough to increase crust browning.

> At this point if the curd is processed no further it's dried and salted and made into an uncured cheese such as cottage cheese.

SIXTH, the curd and whey mixture is stirred and heated. The exact temperature depends on the type of cheese. The higher it's heated, the harder the cheese will become. For example, cheddar and mozzarella are heated to around 100 degrees F, Swiss is taken to 110 degrees, and Parmesan is heated to 125 degrees.

SEVENTH, after 1 to 2 hours of stirring, the curds and whey mixture is pumped to another vat or tank, sometimes called a cheddaring table, where the liquid whey is drained off, leaving a rubbery mass of curd in the bottom of the vat. At this point the curd consists mainly of moisture, milkfat (sometimes called butterfat), and milk protein, called casein.

EIGHTH, in traditional cheese-making the curd is stacked up about 7 to 8 inches deep along the sides of the vat, a process called "ditching" because it leaves a ditch down the center of the trough. During this time more of the whey drains off. After sitting and firming up, the product is cut into 6-inch to 8-inch wide strips and then piled up two to four strips deep. Due to the pressure additional whey is squeezed from the bottom strips. Periodically the strips are rotated top to bottom. The process of piling and rotating strips is called cheddaring. It's how cheddar cheese derived its name. However, today many kinds of cheeses go through the cheddaring process. During cheddaring the curd mats together and forms a more solid mass, a process known as matting. Following this, the curd might be rinsed, iced, refrigerated, or held at room temperature to ripen.

Instead of the above process, some cheese producers employ automated methods for extracting whey from the curd.

OPTIONAL KNEADING STEP. At this point if the curd is to be made into mozzarella or provolone it undergoes special treatment. It's immersed in hot (160 degrees F) water or whey, or is heated by steam, and then is kneaded and stretched like taffy, in a machine called a mixer-molder or cooker-extruder, until smooth and free of lumps. Kneading creates a tighter bond between protein molecules and also lines up the molecules into long strands. This results in the stringy texture of solid mozzarella and its famous stretch when melted. Products that undergo this kneading process are sometimes called *pasta filata* cheese — Italian for "spun curd" or "stringy curd."

The warm, taffy-like curd is then cut into portioned amounts and put into molds. The pieces are then immersed in cold salt brine to firm up, and then dried, wrapped, and shipped. Mozzarella is brine soaked for 8 to 12 hours, while provolone might be soaked for up to three days. (For comparison, Parmesan and Romano are brine soaked for 12 to 20 days.) Due to brine soaking, young cheese might have a salty-flavored surface. This occurs because the salt on the surface of the loaf (put there during soaking) has not yet absorbed into the loaf.

If, after production, it turns out that a product is out-of-spec (i.e., too high or too low in fat, moisture, or salt) it's possible that a manufacturer might "re-work" it. This is done by re-heating the out-of-spec cheese and then mixing it with a new batch of cheese of different composition. This procedure is not recommended nor is it approved by the USDA and, so, is avoided by quality-conscious plants.

NINTH, if the curd isn't kneaded into mozzarella or provolone, the solid 8-inch strips from cheddaring are cut into small cubes, a process called milling, and then spread over the bottom of a vat and stirred. At this time salt is added. Also, a mold or bacteria that helps develop the characteristic flavor of the particular cheese might be included.

TENTH, after the salt has dissolved, the product is put into molds or cloth-lined hoops, called hooping, and is then pressed for about 30 minutes. Common mold shapes include block, wheel, ball, and cylinder or salami-shape. After it's taken from the hoop it might be further pressed for 1 to 2 days, after which it might be dipped into a brine solution. Then it's refrigerated for a few days and allowed to dry. Afterward the cheese is wrapped one of several ways — for example, some types are dipped in paraffin or wax. At this point it's called "green cheese," which refers to its lack of age. Green cheese is firm and tight-bodied.

LASTLY, the cheese is *cured*. The process is also called *aging* and *ripening*. During curing, enzymes (and possibly bacteria) in the cheese break down the

milk protein and fat. The result with most cheeses, such as mozzarella, is that the flavor becomes stronger and more pungent and the texture changes from firm and resilient to softer and more pasty. In fact, the longer that mozzarella and provolone ripen, the stronger their flavor and softer their texture become. When over-aged they will have an objectionably strong flavor and mushy or runny texture. The curing process varies between cheeses. Some might be immersed in a vat of brine for a few days, then taken to a curing room. Others such as provolone might be smoked. All cheeses are eventually refrigerated during curing, usually at around 40 to 50 degrees F.

In general, to produce one pound of cheese requires ten pounds of milk. This means, whatever percent of milkfat the milk contains (after fat adjustment by the cheese-maker), the final cheese will contain 10-times that percent of milkfat. So if the milk used for making the cheese contained 2.5 percent fat, the resulting cheese would consist of about 25 percent fat (based on total cheese weight). To reduce the fat content of cheese there has been a trend toward making cheese from lower-fat milk.

Aging Process

Aging — or curing and ripening — is a vital part of cheese quality. Several factors affect the speed of aging. The higher the fat content of the cheese, the faster that the breakdown or aging process occurs. Also, the higher the moisture (water) content and the greater the acidity of cheese, the faster that aging occurs. Salt has the reverse effect — higher salt levels slow down aging. Cheese having too much salt will be slow to age and, if used for pizza, may result in dryness and blackish burnt spots.

To develop good cheese, aging must proceed at the proper rate. If aging is too fast the gas can cause the cheese to burst, called “failure.” To control rate of aging, cheese-makers adjust the salt, acid, and moisture content of the cheese, and also maintain optimum temperature and humidity in the curing room. Within a pizzeria, temperature is the main factor affecting rate of ripening.

Curing time can be shortened, called a “forced cure.” This is done by increasing the temperature and humidity of the curing room. The effect of higher temperature can be dramatic. For instance, cheese that would normally age in 12 to 18 months at 32 to 34 degrees F will age in 8 to 10 months at 40 degrees, and within just three months at 45 to 55 degrees.