

Thesis:

Producing, Retaining, and
Controlling the Flavor of Butter.

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5. Temperature at which they grow.
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The great importance of bacteria in the dairy industry is at present admitted by all who have given the subject thought. A knowledge of the influence of bacteria in the dairy will be of the highest value to the practical dairymen, and to all who handle milk. It will teach them not only to produce goods that will keep, but also to care for them after they are produced.

Bacteria are the tiniest forms of organic life known. They vary in form and also in size. Three types are known, namely, coccus, bacillus, and spirillum.

A common lactic acid bacterium is about three micro-millimeters long, and one wide. One micro-millimeter is one, one thousandth of a millimeter, or one two thousand five hundredths of an inch.

Bacteria multiply by division. The most common method is by fission. This separation takes place very rapidly.

Bacteria comprise a class of organisms found in the air, water, and soil, and in plants and animals. They produce great changes in the medium in which they grow. They grow very easily and readily in milk, but they grow even more readily in cream. They do not, however, grow very well in butter, on account of the removal of the albuminoids.

Some of the bacteria are harmless, while others are very hurtful. They render the milk opaque. They grow best at a temperature of 30° , but their action is arrested at the freezing point of water. They are killed in most fluids at a temperature of 60° .

The destruction of the hurtful bacteria can be accomplished in a very many ways. The best and only way to steer clear of them is by cleanliness. The stable should be kept clean, with the floor well sprinkled, and the air free from dust. The lower part of the cow should be rubbed off with a damp cloth

just before milking. The milk vessels should be kept bright and shining. All seams should be avoided if possible, or should be well soldered, and the vessels washed, scalded, and exposed to the direct rays of the sun immediately after use. And last, but not least, the milker himself should be clean.

Cooling and aerating the milk will stop the growth of the bacteria. In aerating, the milk is exposed to the action of the air, and then reduced to a low temperature, as soon as it is drawn.

If cooled to a temperature of 40° , and held there, little fermentation will go on, but in the course of three or four days, the milk will have a disagreeable flavor, due to the presence of those bacteria which will grow, even at that low a temperature.

Chemicals can be used in the destruction of bacteria. Some of these, while killing the bacteria, ^{are} also injurious

to life. Heat is found to be, however, the only agent that will destroy bacteria! The destruction by such an agent is called sterilization. The milk needs to be subjected to a temperature of between 212° and 240° , for one hour, on each of three successive days. But in order to overcome the bad effects which arise from over heating, pasteurization needs to be employed. In this, the milk is raised to the desired temperature, held there for ten or twenty minutes, and then cooled rapidly to 50° or below.

Cream is that part of the milk into which a large portion of fat has been gathered. This cream contains, like the milk, certain bacteria. These bacteria have to be destroyed in order to get good flavored butter. This destruction is accomplished by means of a certain process known as ripening. This is done by trusting to natural inoculation, or by the

addition of an artificial starter. The latter is the chief means employed. This starter consists generally of soured skim milk or buttermilk, but the former is generally considered the better of the two. Ripening of the cream makes churning more easy, decomposes or destroys the fibrin, and gives flavor to the butter. The fibrin in the milk rises with the cream, and is skimmed off. Ripening the cream destroys this fibrin, which would otherwise get into the butter, and, on putrefying, ruin the flavor.

Butter made from ripened cream will keep longer than that made from sweet cream. Bacteria are the cause of rancidity in butter: they cannot, however, live on pure fat, but require a certain amount of albuminous matter. The butter made from ripened cream will, of course contain more bacteria than that made from sweet cream, but the bacteria cannot as well grow and multiply.

Ripening gives a flavor to butter which sweet cream does not. Overripening produces, on the other hand, very bad effects. The flavor, quality, and texture of the butter are ruined. Underripening has almost the same effect upon butter as overripening.

If a portion of the cream is ripened and the other is not, or if there are different degrees of ripeness in the cream, the cream is very hard to churn. Part of the cream will be churned into butter sooner than the other, there will be small white specks through out the butter, and a very large portion of it will be wasted, unless that which is first formed is taken out, and the rest of the cream churned longer.

The least variations of temperature during the ripening process produces the best flavored butter. Cream ripens at a temperature between 80° and 90° , but the cream is best ripened at a temperature of between 55° and 60° . Cream exposed in a dairy at 60° will be ripe

enough for churning in twelve hours; but in cold weather, the addition of a starter is necessary. The amount of acid necessary as the proper point for churning is about six tenths per cent. Acid tests are employed in determining whether or not the cream is in the right condition as to ripeness. For ripened cream butter, 22 cubic centimeters of alkali should neutralize the acid in twenty five cubic centimeters of the cream. In making the test rain water should be used in washing the dishes, as strong alkaline water will destroy the accuracy of it. The alkali can only be prepared by one who has a delicate balance on hand. It is made by dissolving five and six tenths grams of potassium hydroxide or four grams of sodium hydroxide in one liter of distilled water.

The development of lactic acid in

ripened cream is what gives the butter its fine flavor. The bacteria which produced this lactic acid, have probably developed other products which aid in the improvement of the flavor.

Sweet cream produces butter of a most delicate, but an insufficiently full flavor. The flavor of cream raised at 60° for twelve hours in shallow vessels is perfect, but the butter it produces when churned sweet does not satisfy the requirements of those who prefer butter with a pronounced flavor. It contains less casein and water than butter made from ripened cream.

Ripened cream also yields the larger quantity of butter. It may be churned at a temperature of 54° in summer, and at 64° in winter.

The flavor of the butter is derived from the serum, not from the fat of the milk and cream. It is very much

improved by the addition of a small quantity of fine dry salt. This addition of salt is preferable after the butter has been partially worked. A great many use brine as a means of salting, but this is not nearly so good as dry salting. The amount of salt to be incorporated varies with the demand. Some like a great deal of salt in the butter, while others like very little or none. The general amount is about $\frac{3}{4}$ of an ounce to every pound of butter.

The flavor of the butter is also affected by the food given to the cow. Good grass or hay is excellent feed where the milk is properly managed, but fermented foods of all kinds are to be avoided. Bran, cottonseed, oats, pea meal, linseed meal, soy bean meal, etc. are excellent additions to hay and grass. The animal should never be fed just before milking, but full time should be given the food to digest. If this rule be followed, turnips,

parsley, etc. can be eaten by the animal, and the milk will not be tainted.

The aroma of butter is a guide to its keeping qualities. It changes very rapidly in newly made butter which is exposed to the light and air. It requires time to develop; therefore, butter should not be judged direct from the churn.

Butter very readily takes in disagreeable odors from paint, fish, kerosene, cooked vegetables, tar, decaying substances, etc. These odors all produce very disagreeable flavors in the butter. So the cream and butter should not be kept in the cellar, where all the vegetables are stored, but should have a separate, cool, and well aired and drained building.

If the cream has been too much ripened, the addition of a small teaspoonful of powdered salt-petre to every three gallon jar of milk will usually prevent the bitter taste which

always arises from over ripened cream.

Churning has a great deal to do with the flavor of the butter. The cream is, of course, first ripened. The temperature of churning in cold weather should be about 62° , and in warm weather about 56° . The process of churning will raise the temperature a little, and so, to begin with, the cream should be a little too cold rather than too warm. The number of revolutions of the churn should be about from forty five to fifty a minute, but at first, they should be slower, increasing slowly in the first five minutes, and decreasing toward the end. The warmer the weather the fewer should be the revolutions.

All churns should have a valve through which the evolving gas can be repeatedly let off, until no more escapes, and also a circular plane of glass through which the state of the

cream may be observed, and when the place is no longer clouded but comparatively clear, the butter is beginning to come. At this stage, the churn should be turned slowly, and brought to a standstill as soon as the granules of butter have attained the size of a grain of wheat. The buttermilk should then be let out out of the churn through a small valve, and clear, cold water added, and the churn turned slowly for about half a minute. Then nearly the whole of the liquid should be let out, and again fresh water be put in, and this repeated several times until the liquid comes out nearly as clear as when it went in. When the butter has been sufficiently washed it will present a beautiful golden appearance in the churn, and it is then ready to be worked.

Now the dry salt is incorporated

in the butter by means of a worker. The use of the worker is to incorporate the salt, to consolidate the butter into a compact mass, and to press out the superfluous water. All this is accomplished without touching the butter with the hands. Few persons have hands which are cold enough to touch the butter with impunity, and as carbonic acid is continually exuded through the skin, the flavor of the butter is easily ruined. The roller or butter-worker is run by hand. The roller, in passing over the butter, flattens out the mass, and rolls it up again into a lump; and while the salt is being incorporated in the butter, the water is being pressed out, and the butter becomes a compact and solid mass. A little salt always improves and develops the flavor of the butter. The quantity to be added varies from an ounce down, to every pound of butter.

Once once to the pound is heavy salting, and therefore, so much is not used, save in butter which is to be kept a considerable time.

Butter made from good cream will keep fresh for weeks without salt, in a room whose atmosphere is free from odors, and whose temperature is under 60° .

If colouring is used, it should be added immediately before the cream enters the churn. It should not exceed the natural summer tint of butter. Annatto is preferable to other colouring, especially if prepared in spirit, which preserves it from fermentation or change.

Preparations in oil, are good, but there is a great danger of rancidity, and in all cases the body and texture of the butter are interfered with, according to the quantity used.

The butter is now ready to be

made into rolls, pats, etc. It is commonly made up into one half pound, one pound, or two pound lumps of various shapes, and often with more or less decorations.

It should not be packed in anything that will give it a woody flavor. Lining the box or package with parchment paper will not prevent this, but lining it with paraffine wax will, to a greater or less extent. A package so lined will retain the flavor of the butter for a month. The butter must also be packed solidly in boxes. The packing and wrapping has a great deal to do with the butter retaining its flavor. It should be so well protected that other odors such as that of kerosene, fish, vegetables, etc. will not be communicated. This has to be looked to, especially if the butter has to be shipped any great distance.

Commercial forms of butter.

Bricks are made with the Scotch hands. Some are plain, and others are fluted.

Rolls are made by rolling the lumps of butter between two boards or by compressing them into a mould.

Both forms are easy to handle, and pack, but are awkward for table use unless they are divided.

Pate can be made according to form by a cup mould and by a box print.

Heavily salted butter for keeping is put into pots, and is known as potted butter. The pots should be absolutely clean and not previously used for any purpose which is liable to spoil it for use. The butter is pressed into them with a scoop, so as to leave no crevices; the top levelled, and covered with a slightly wet muslin cloth, and this with half an inch of salt

pressed down upon it; covered finally with stiff paper and put into a cool, dry place.

In contact with the air, good butter keeps better in pots than it does in pails. Sunlight, apart from air and temperature, affects butter prejudicially, tending to convert the fixed fats into tallow, and to decompose the volatile fats. Storage in a ~~light~~ tight will secure the butter against any such risks. The composition of butter is: water, nine and five tenths percent; fat, eighty eight and thirty five hundredths percent; casein, seventy hundredths percent; sugar, fifteen hundredths percent; and ash, in the form of salt, one and five tenths percent.

The flavor of butter is then retained by keeping bad odors away from it; packing, salting, etc.; and by keeping it away from the direct rays of the sun.