

4 FOOD SCIENCE AND INDUSTRIES NO. 5—  
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# Psychrophilic Bacteria Cause Food Spoilage

Sometimes food spoils in the refrigerator. Milk, raw meat, and other highly perishable foods will develop strong, fruity odors or undesirable flavors after a few days' storage.

This spoilage is caused by psychrophilic bacteria growing in the food in the refrigerator. Psychrophilic means cold-loving. Psychrophilic bacteria grow at refrigerator temperatures; but they grow much faster at warmer temperatures.

These types of bacteria are very common in the environment. They can live in water and soil, and they can grow on very small quantities of food; some can exist in water with only a few trace minerals. Of course, when food becomes more readily available, these microbes grow and spread much more rapidly.

Psychrophiles can become implanted on dirty food processing equipment, kitchen surfaces, and utensils. Thus food contacting any contaminated surface becomes contaminated.

Storage temperature of the food influences the growth of this kind of microbe. The generation time (time required for one bacterial cell to become two) for a typical psychrophilic bacterium is determined over a range of temperatures. These figures are the approximate generation times at various temperatures.

Temperature	Generation Time
90° F.	½ hour
70	1½ hours
60	2¼ hours
50	3 hours
40	12 hours
32-35	36 hours

This information shows that this type of bacteria grows more rapidly at high temperatures.

How does this affect the food in your refrigerator? Since milk is often spoiled by psychrophilic bacteria, let's use it as an example. When milk contains 5 to 10 million psychrophilic bacteria per milliliter, it develops a detectable off-flavor. Assume that the milk contains 10,000 of these bacteria per milliliter when purchased.

Storage Temperature	No. of Bacteria/ml. after 48 hours
60° F.	21,400,000,000
50	692,000,000
40	160,000
32-35	30,000

From the table you can see that when stored at 50 and 60° F. this milk would spoil very rapidly. However, when stored at 40° F. and lower temperatures the growth of the bacteria is slowed considerably and the milk should keep much longer.

Or, assume that the quart of milk contains only one psychrophilic bacterium, and that the milk is stored at 48° F. (generation time approximately 6 hours). Look at figure 1. The dotted line follows the growth of this one cell in the quart of milk in 8 days. This one bacterium per quart has now become over 5 million bacteria per milliliter of milk, and the milk has developed an off-flavor and is unacceptable.

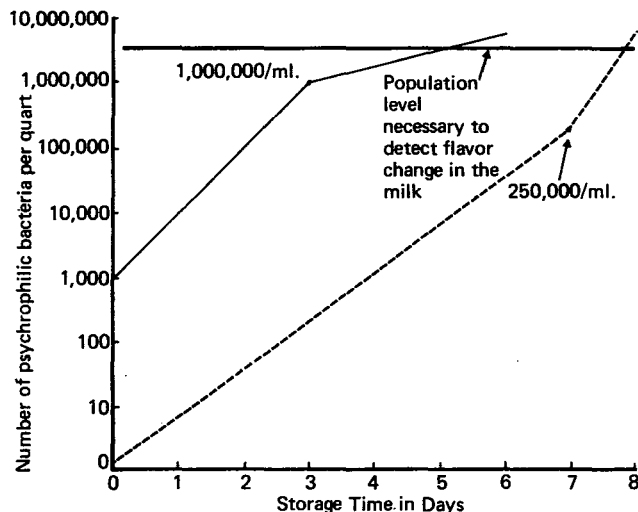


Figure 1. Growth of psychrophilic bacteria in pasteurized milk stored at 48° F. with beginning population levels of 1,000/qt. and 1/qt. (generation time = 6 hours).

If the quart of milk contains 1,000 psychrophiles or approximately one per milliliter of milk, how long will it take the milk to develop an off-flavor? The solid line in figure 1 follows the growth of these cells. In 5 days the milk has spoiled in the refrigerator.

Similar changes can occur in almost any food stored in the refrigerator. Some foods will spoil faster than milk; others will take longer. Any perishable food containing psychrophilic bacteria will spoil in the refrigerator and become aesthetically unacceptable.

Very few types of psychrophilic bacteria cause illness; however, under special conditions, specific species of this type of bacteria can cause skin infections. It is highly unlikely that this could occur from eating food containing this kind of bacteria.

The best way to prevent spoilage by psychrophiles is to keep bacteria out of the food. These bacteria are very heat sensitive and common cooking temperatures will destroy them, as will the treatments used to pasteurize milk.

The trick is to prevent recontamination after the food has been heated. Make sure that all surfaces or utensils that come in contact with the heated food are clean and sanitary. In the home, utensils washed in a dishwasher are clean and sanitary. If there is no dishwasher, the utensils should be cleaned with warm water and detergent or soap, rinsed with hot water, and allowed to air dry.

In the food processing plant or milk processing plant, complete cleanup and competent sanitation practices are essential to prevent psychrophilic bacterial contamination.

By keeping psychrophilic bacteria out of food, it is possible to store food at refrigerator temperatures for a longer time without spoilage. However, if the food product contains these kinds of microbes, you can retard growth by keeping the temperature low, below 40° F. If possible, maintain refrigerator temperature as close to 35° F. as possible. These temperatures will slow the growth of psychrophiles and help minimize food spoilage.

Remember, the best way to prevent psychrophilic spoilage is to keep these bacteria out of the food by proper and complete cleaning and sanitation of all equipment and utensils that come in contact with food. Refrigeration will not cover-up faulty cleaning and sanitation practices, nor will it keep food from spoiling indefinitely. With proper care, you can keep perishable food safe and palatable in the refrigerator for several days.

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