



Food Science and Technology Notes

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MILK PASTEURIZATION FACTS

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by

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Milk is one of our best sources of food nutrients such as proteins, minerals, and vitamins. Like any raw food, milk might harbor microorganisms; some could be potential pathogens (cause disease).

In the past, the United States Public Health Service officials have reported outbreaks of septic sore throat, dysentery, gastroenteritis, scarlet, typhoid, paratyphoid and undulant fevers, and tuberculosis which have been traced to bacteria in raw milk.

Make Milk Safe -- and Keep Longer Too

Food of all kinds can easily be contaminated with spoilage and/or disease-causing microorganisms, including molds, yeasts, and bacteria. Even when care is taken to keep milk clean and safe, bacteria and other microorganisms may get into raw milk from many sources.

It is not always possible for health authorities to be sure that all persons who handle milk are free from disease causing bacteria or other microorganisms that can be transmitted by human beings. The probability exists that a person, called a CARRIER, may harbor and transmit a communicable disease to which he, the carrier, is immune.

Also, it is not a certainty that milk from diseased cows will not accidentally enter the milk supply. Nor is there assurance that polluted water contaminants from other sources do not enter the milk.

Regardless of the source of microorganisms, the presence of only a few disease-causing bacteria make milk unsafe. In a like manner, under conducive growing conditions, a few spoilage organisms can multiply rapidly into enormous numbers and cause flavor and other changes prior to consumption.

Fortunately, the risk of contracting disease from raw milk can be overcome by pasteurization, a simple procedure which makes milk safe to consume. Pasteurization makes it possible, for persons who might otherwise consume raw milk, to achieve the same protection from disease as persons who purchase pasteurized milk at retail outlets. In addition, pasteurization improves and extends the keeping quality of milk by destroying microorganisms and inactivating certain enzymes which may cause flavor changes and/or spoilage.

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Pasteurization Defined

Milk purchased at retail outlets is usually pasteurized. Pasteurization refers to the process in which all of the product involved is exposed to a heat treatment which will destroy all pathogenic organisms and nearly all other bacteria which may cause spoilage, without altering the flavor or composition of the product. It may be accomplished by one of several processing methods.

Two of the pasteurization procedures commercially used which have been approved by the United States Public Health Service, U.S. Department of Health, Education, and Welfare, are the HOLDING and the HIGH-TEMPERATURE SHORT-TIME methods.

The HOLDING or VAT process makes use of an approved and properly operated, jacketed vessel in which the milk is heated and/or cooled. Milk is heated until every particle reaches 145F* (62.8 C) and is held at this temperature for not less than 30 minutes.

Pasteurization may be achieved by other methods which have been shown to be at least equivalent to the HOLDING process. For example, pasteurization also includes a method called the HIGH-TEMPERATURE SHORT-TIME process. This is the process of heating every particle of milk to 161 F (71.7 C) and holding at that temperature or above for not less than 15 seconds.

After pasteurization, milk is cooled immediately to 40 F (4.4 C) or lower.

Pasteurization in the HOME

Pasteurization which simulates the above processes can be done in the home. When properly done, this affords the same protection for consumers as for those who purchase milk pasteurized at modern processing plants.

Since the temperature-time relationship is important in achieving pasteurization, an accurate thermometer is a necessity. If the milk is underheated, the harmful organisms that might be present will not be killed; if overheated, the milk will develop a flavor that varies from cooked to scorched, depending on the degree and length of overheating.

Methods of Home Pasteurizing

There are several methods that may be used to effectively pasteurize milk in the home. These involve direct or indirect heating methods described in the following paragraphs.

In a jar or bottle. Be certain that the jar or bottle is heat resistant, such as that used to preserve foods. Make a hole in the cover of sufficient size to insert the thermometer to be used. With the cover removed, pour the milk to be pasteurized into the container. Fill to within one inch from the top to allow room for expansion of the milk when heated.

* F refers to degrees Fahrenheit and C refers to degrees Centigrade.

Replace the cover, insert the thermometer, and place the container in a deep pan or pail. Pour warm water into the pan or pail until the water is level with the milk. Heat the water until the thermometer in the milk registers 145 F (62.8 C).

When 30 minutes time has elapsed, gradually replace the hot water with cold water to allow time for the glass of the container to contract; a few minutes in water is sufficient. Cool the container of milk in ice water to 40 F (4.4 C) or lower. Store at 40 F or below.

Saucepan on direct heat. A saucepan with a cover is needed. Pour the milk into the sauce pan. The procedure for home pasteurizing by this method follows:

1. Place saucepan with milk over direct heat and place thermometer and metal spoon in the milk. DO NOT USE a glass thermometer to stir milk, and be careful not to strike thermometer with spoon during stirring. Heat milk, with constant stirring, until it reaches 165 F (73.9 C). Continuous stirring is necessary to achieve even heating and to prevent formation of a scorched film.

2. When milk reaches 165 F (73.9 C), place the pan of milk into a larger pan which contains cold water. Discard the water when the temperature of milk and surrounding water are within a few degrees.

3. When the temperature has been lowered as far as possible with cold tap water, place ice in the water and cool, with occasional stirring, until the temperature of the milk is 40 F (4.4 C) or below.

Double boiler, indirect heat. A double boiler requires more time to achieve the proper temperature during heating. However, one is less likely to scorch the milk than when heating in a saucepan in direct contact with the heater. Using a two-piece double boiler, with lid, follow the procedure given below.

1. Place enough water in the lower-outer part in boiler pan to reach the bottom of the inner-top pan. Heat water to a rolling boil. Place top pan with milk over the water in the boiler pan. Cover the top pan.

2. Keep water boiling and keep covered until the temperature reaches 165 F (73.9 C). Check the temperature occasionally. It is possible, with experience, to learn and estimate the time required for the desired temperature to be achieved, making it necessary to make only a final temperature check.

3. When the temperature of the milk reaches 165 F, remove the pan containing the milk and place it in cold water. As the cooling water becomes warm, replace it, or put ice in the water. Continue to cool the milk until the temperature is 40 F (4.4 C) or below.

Electrically-heated pasteurizers. Several makes of home-type pasteurizers are manufactured and available for easing the task of home pasteurizing milk. Even though these are electrically heated, their cost of operation is not prohibitive. Busy households may have the convenience of a "plug-in" appliance which has automatic temperature control and timing, and requires only minimum attention.

Electrical home pasteurizers may be classified into two types. One type heats milk in a bucket-like container; when heating is complete, cooling is done by flowing cold water through the jacket which surrounds the container of milk. After cooling, the pasteurized, cooled milk is placed in thoroughly cleaned bottles or jars, capped, and stored under refrigeration until consumed.

Another type permits heating milk in heat-resistant glass bottles or jars. After pasteurization, the milk is cooled in the glass container, and then placed in refrigerated storage.

Information on the availability of home pasteurizing units can be obtained from farm supply dealers or from rural hardware stores.

Storing the Milk

Regardless of the method used to pasteurize milk, it should always be cooled as quickly as possible to 40 F (4.4 C) or less. It is then placed in thoroughly cleaned bottles or jars that have tightly fitting caps or lids which also have been thoroughly cleaned. One should always use caution to NOT CONTAMINATE milk by touching any surface which might later contact the milk. Store the containers of milk at a temperature below 40 F (4.4 C), but do not freeze.

Care of Milk in the Home

Proper pasteurization destroys all disease producing organisms, however, some other types which can affect flavor and keeping quality may survive pasteurization. Bacteria entering milk after pasteurization can also cause spoilage or disease. Therefore, it is important to guard against recontamination and to maintain storage conditions not favorable to bacterial growth.

In order to preserve the goodness of milk and other similar foods, the following precautions should be taken.

1. Never permit milk to remain exposed to sunlight for any extended period of time. If milk is delivered to your doorstep, take it into the house immediately or provide some protection from the sun and warm air. Sunlight causes undesirable flavors, particularly in homogenized milk packaged in transparent containers.
2. Place milk in the refrigerator as soon as possible. Never permit the milk to stand at room temperature. Temperatures over 40 F (4.4 C) hasten spoilage. When serving milk, pour the amount needed and return the unused portion immediately to the refrigerator.
3. When milk is in the refrigerator, keep the container tightly closed to prevent absorption of off-flavors from other foods.

4. When any milk is left unused on the table, do not pour it back into its original container. Place the unused milk in the refrigerator in its secondary container.

5. Allow no one to drink directly from the container.

6. When re-useable milk containers are used, never use them for anything other than milk.

7. When a glass container is empty, rinse it in cold or warm water; then wash it. Rinsing in very hot water will cause the milk proteins to adhere to the surface of the container, making the final wash more difficult.

Beliefs and Facts about Pasteurization

BELIEF. Pasteurization is unnecessary in rural areas because milk goes directly and promptly from producer to consumer.

FACTS. Pasteurization is necessary in rural areas. A large proportion of the milk-borne disease epidemics in the past have occurred outside of cities. Of these, practically all have had their sources on farms.

BELIEF. Pasteurization encourages careless handling of raw milk; farmers and other milk handlers, knowing milk is to be pasteurized, relax their efforts to keep raw milk clean.

FACTS. Contrary to this, the trend has been more careful handling of raw milk as the practice of pasteurization has increased. The present high standards for sanitary handling of raw milk to be pasteurized at processing plants are prescribed and enforced by law in most states. In addition, most states prohibit any person who has a transmissible disease from handling milk.

BELIEF. Pasteurization destroys much of the food value of milk.

FACTS. Only two of the many vitamins of milk are affected by pasteurization. One of the B-complex vitamins, thiamine, and ascorbic acid (vitamin C) are reduced by pasteurization. These vitamins are abundantly supplied by other foods. When milk is used as the main food, as in infant feeding, it should be supplemented with a source of vitamin C, such as orange juice.

BELIEF. Pasteurized milk has a cooked taste.

FACTS. Proper pasteurization alters the flavor of milk only slightly. If a cooked taste occurs, it is due to heating at too high a temperature, or to local overheating caused by insufficient stirring, especially when heating directly on a heat source.

Other facts to remember about pasteurized milk are given in summary.

1. Pasteurized milk can be used for cooking in the same manner as raw milk. In certain bread recipes, milk **MUST** be heated to scalding before use.

2. Pasteurized milk has better keeping quality than raw milk, because the pasteurization procedure when properly done destroys most of the bacteria that cause souring and off-flavors. Pasteurization should be performed as soon as possible after milking, because pasteurization cannot restore the quality after raw milk begins to spoil. When raw milk cannot be pasteurized immediately after milking, it should be cooled immediately to 40 F or less and maintained at such temperature until it can be pasteurized.
3. Pasteurized milk is a good growth media for microorganisms, especially bacteria. Take special care to see that milk is not recontaminated after it has been pasteurized.
4. Pasteurization usually causes a slight reduction in the creaming ability. In raw milk, the butterfat particles clump and separate more readily than in pasteurized milk. Therefore, when it is desired to recover cream by hand skimming, do the following:
 - a. Cool the raw milk and store cold, without agitation, for at least 24 hours.
 - b. Carefully skim the cream.
 - c. Separately pasteurize the cream and skimmed milk and cool prior to use.

Of course, if a mechanical separator is available, the raw milk is separated warm and then the cream and skim milk are pasteurized separately. When special care is taken to keep milk clean and safe, bacteria and other microorganisms may get into raw milk from many sources.

It is not always possible for health authorities to see that all persons who handle milk are free from the germs that cause the milk-borne diseases that can be transmitted by them. Hence, the possibility exists that a person, called a carrier, may harbor the germs without being aware of it. He, the carrier, is usually

found to be a carrier of germs that will produce disease only accidentally when the milk supply is contaminated. These germs may enter the milk from other sources, and enter the milk

from the udder of the source of contamination. The germs may also be introduced by bacteria that are introduced by the milk when the conditions are not favorable, and the germs may enter the milk from the air and cause flavor and other changes in the milk.

The risk of contracting disease from raw milk is greatly increased by pasteurization. A simple procedure of heating the milk to 160 F for 30 minutes, or heating to 145 F for 30 minutes, or heating to 135 F for 30 minutes, will destroy the germs that cause disease. The pasteurized milk will still contain the germs that cause spoilage, but it will be free from the germs that cause disease. The pasteurized milk will keep longer than the raw milk, and it will be free from the germs that cause disease.

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