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Extension Extra

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Food Safety

COLLEGE OF AGRICULTURE & BIOLOGICAL SCIENCES / SOUTH DAKOTA STATE UNIVERSITY / USDA

Home Pasteurization of Raw Milk

*by Joan Hegerfeld, Extension food safety assistant,
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and Carol Pitts, Extension food and nutrition specialist,
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What is pasteurization?

Pasteurization is heating raw milk to a specified temperature within a time period that destroys most of the bacteria in milk (95 - 99%) and then cooling the milk very quickly. The bacteria in raw (unpasteurized) milk can cause diseases in humans, spoil milk resulting in off flavors, and decrease the length of time that milk can be stored in the refrigerator. Bacteria sometimes found in milk that can cause disease are *E.coli 0157:H7*, *Salmonella* and *Listeria monocytogenes*.

To learn more about the health risks involved with drinking unpasteurized milk, refer to Extension Extra 14047, Health Risks of Drinking Raw (Unpasteurized) Milk, March 1998, produced by the South Dakota State University Cooperative Extension Service. This publication is available in printed form at your county Extension office or electronically through the SDSU CES food safety homepage.

How does pasteurization affect the nutritional value of milk?

Pasteurization has a minimal effect on the nutritional value of the milk. The nutrients in milk -- protein, fat, carbohydrate, minerals (calcium, phosphorous, potassium and others), riboflavin, niacin, pantothenic acid, and vitamins B6, A, and E are not affected by pasteurization. A slight loss has been reported for vitamin K and approximately 10 percent losses for thiamin and vitamin B12. Even though thiamin and vitamin B12 are reduced slightly, milk still provides significant amounts of these nutrients.

The loss of ascorbic acid (vitamin C) in milk may be severe, depending on factors such as the time-temperature conditions during pasteurization and the presence of air

and light. But, the amount of ascorbic acid in milk, even before pasteurization, is not significant in a varied diet.

Milk that is pasteurized at the processing plant is fortified with vitamin D. Therefore, if milk is pasteurized at home, it is important to obtain vitamin D from other sources.

What is the preferred method of home pasteurization?

Using a purchased home pasteurization machine is the recommended and preferred method to pasteurize milk at home. The other method of home pasteurization is on the stovetop. It is very difficult to pasteurize milk on the stovetop because a specific temperature needs to be maintained for a specific period of time. This can be difficult to do without risking incomplete pasteurization or overcooking of the milk.

Where can I purchase a home pasteurization machine?

Home milk pasteurization machines may be available from a dairy or farm supply store in your local area. Other sources may be farm supply catalogs. The Nasco company has home pasteurization machines. The phone number is 1-800-558-9595. Or write for a catalog at: Nasco; 901 Janesville Ave., P.O. Box 901; Fort Atkinson, WI 53538-0901.

I do not have a home pasteurization machine, so how do I pasteurize milk on my stove?

There are two different methods of pasteurization using the stove top: the batch method and the continuous high-temperature, short-time (HTST) method. Essential to the process is that the milk be held at the specific temperature for a given amount of time. Table 1. explains the two methods of home pasteurization.

What do I need to pasteurize milk in my home?

To begin with, the following requirements must be met:

- Potable (safe) water supply for cleaning equipment and cooling the pasteurized milk
- Clean and healthy animals (free from debris/dirt and obvious disease)
- Clean hands
- Refrigerator that maintains a temperature of 35 to 40F.

The following equipment is needed:

- Large pan or sink for cooling
- Double boiler of adequate size (using a regular saucepan may contribute to scorching or a burnt flavor)
- Floating dairy or candy thermometer
- Clean and sanitized utensils and containers

Pasteurized milk is not sterile and some recontamination may occur during cooling and serving. Therefore, it is important to keep milk refrigerated after pasteurization.

Table 1. Pasteurizing milk at Home -- Two Different Methods

(Read the entire procedure before beginning the pasteurization process.)

	Batch Method	Continuous High-Temp Short-time Method (HTST)
STEP 1	Prepare a 50/50 ice-water bath in a cooling pan or sink to be used for cooling. Keep the icebath in the refrigerator until ready for use. Or, very cold water can be used. Change it often.	Prepare a 50/50 ice-water bath in a cooling pan or sink to be used for cooling. Keep the icebath in the refrigerator until ready for use. Or, very cold water can be used. Change it often.
STEP 2	Place the desired amount of raw milk into the top pan of a double boiler. (<i>Pasteurize 1 qt. to 1 gallon of milk at a time.</i>)	Place the desired amount of raw milk into the top pan of a double boiler. (<i>Pasteurize 1 qt. to 1 gallon of milk at a time.</i>)
STEP 3	Heat the milk to 145F. Maintain this temperature for 30 min. (<i>If the temperature falls below 145F, the 30-minute process needs to start over.</i>) ----- <i>Take temperature constantly. If the thermometer is not left in the milk, it needs to be cleaned and sanitized before placing it back into the milk. Stir continually.</i>	Heat milk quickly until it reaches 165F. Remove from heat source. OR Heat milk quickly to 161F and maintain for 15 seconds. Remove from heat source. ----- <i>Take temperature constantly. If the thermometer is not left in the milk, it needs to be cleaned and sanitized before placing it back into the milk. Stir continually.</i>
STEP 4	Cool using one of the following methods: 1. Cool the milk from 140 to 40F within four hours. After the milk has reached 40F, place cooled milk in sanitized container and place in the refrigerator. OR 2. Cool the milk from 140 to 70F within two hours in the icebath, then place in sanitized milk container and continue to cool from 70 to 40F in the refrigerator within 4 hours. <i>Cool milk as quickly as possible.</i>	Cool using one of the following methods: 1. Cool the milk from 140 to 40F within four hours. After the milk has reached 40F, place cooled milk in sanitized container and place in the refrigerator. OR 2. Cool the milk from 140 to 70F within two hours in the icebath, then place in sanitized milk container and continue to cool from 70 to 40F in the refrigerator within 4 hours. <i>Cool milk as quickly as possible.</i>

What are some special tips to maintain the quality of the final product?

- Start with fresh raw milk that is clean (free of debris). Pasteurization does not improve the freshness or flavor, but only insures its safety and prolongs its shelf-life.
- Be sure all containers to be used for storage of the pasteurized milk are thoroughly cleaned and sanitized. Containers in which vegetables or fruits have been cooked may leave an "off" flavor in milk.
- Quantities of milk from one quart to a gallon can be pasteurized satisfactorily by using a double boiler.
- Watch the thermometer carefully and do not cook beyond the required temperature (165F). At 165F pasteurization is complete with no cooked flavor. A slightly cooked flavor will be noticed if heated to 175F. Heating above 175F will leave a definite cooked taste in the milk. The added heat is unnecessary to insure pasteurization.
- Keep the stirring spoon and the thermometer in the milk continuously while heating to avoid contamination of the spoon or thermometer.
- Stir milk frequently while heating so all of the milk is the same temperature and to prevent milk from burning on the bottom of the pan. Using a double boiler minimizes the chance of this occurring. In a pan directly on top of the heat source, it takes 10 to 15 minutes to heat a gallon of milk.
- Cool the milk as rapidly as possible. A 50-50 ice-water bath works best, but you can use cold water in the cooling pan; change often.
- Use a clean, sanitized container for storing pasteurized milk. A few drops of raw (unpasteurized) milk in a container defeats the purpose of pasteurizing.

How do I clean and sanitize the milk container?

Cleaning is the physical removal of soil and food matter from a surface, and sanitizing decreases the number of bacteria to safe levels. Sanitizing is not a substitute for thorough cleaning.

A surface is not ready to be sanitized until it has been thoroughly cleaned and rinsed. Clean and wash the milk containers thoroughly by using a dishwashing detergent and removing all visible soils and foods. The recommended water temperature for washing and rinsing is at least 120F. Follow the cleaning step by thoroughly rinsing the container. If the container is not cleaned and rinsed thoroughly, the sanitizing is ineffective. After washing and rinsing, two methods of sanitizing can be used -- heat or chemical.

- **Heat Sanitizing** - Immerse the container for 30 seconds in hot water that has a temperature of 170 to 195F.
- **Chemical Sanitizing** - Combine 1 tablespoon of household bleach (5.25%) with 4 gallons of water. The water should have a temperature of 75 to 120F. The closer to 75 degrees the longer the sanitizing solution will maintain its effectiveness. After cleaning and rinsing containers thoroughly, immerse them in the sanitizing solution for 1 minute.

AIR DRY THE CONTAINERS. Do not use cloth towels to dry as bacteria may be reintroduced to the pasteurized milk.

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<http://www.abs.sdstate.edu/flcs/foodsafety/foodsafe.htm>

National Food Safety Database

<http://www.foodsafety.org>

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