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THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

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Canning Basics

Methods for canning foods at home have changed greatly since the procedure was first introduced almost two centuries ago. Since then, research has enabled home canners to simplify and safely preserve higher quality foods. Knowing why canning works and what causes food to spoil underscores the importance of following directions carefully.

How Canning Preserves Foods

Invisible microorganisms are all around us. Many are beneficial; others are harmful. All foods contain microorganisms, the major cause of food spoilage. Using heat to destroy microorganisms, proper canning techniques stop this spoilage. During the canning process, air is driven from the jar and a vacuum is formed as the jar cools and seals, preventing microorganisms from entering and recontaminating the food.

It does not take long at 212 degrees Fahrenheit (F), the temperature at which water boils, to force air out, create a vacuum, and seal a jar. *It does, however, take a specific amount of heat for a specific amount of time to kill certain bacteria.* Although a jar is "sealed," all bacteria are not necessarily killed.

Adequate acid (as in pickled products and fruits) or sugar (as in jams and jellies) protects against the growth of some microorganisms. In low-acid foods, however, some microorganisms are not destroyed at 212 degrees F. *Low-acid foods, therefore, must be heated to higher temperatures that can be reached only with a pressure canner.*

Low-acid foods, such as vegetables, meat, poultry, and fish, must be pressure canned at the recommended time and temperature to destroy *Clostridium botulinum,* the bacterium that causes botulism food poisoning. *Canning low-acid foods in boiling water canners is absolutely unsafe because 212 degrees F is not high enough to destroy botulinum bacteria.* If botulinum bacteria survive and grow inside a sealed jar, they can produce a deadly toxin. Even a taste of food containing this toxin can be fatal. Boiling food 10 minutes at altitudes below 1,000 feet destroys the toxin. For altitudes above 1,000 feet, boil foods 11 minutes. Spinach and corn should be boiled for 20 minutes.

Food Acidity

The acidity level, or pH, of foods determines whether they should be processed in a boiling water canner or pressure canner. The lower the pH, the more acidic the food.

Acidic foods have pH values below 4.6. These foods include pickles, most fruits, and jams and jellies made from fruit. (In pickling, the acid level is increased by adding lemon juice, citric acid, or vinegar.) Acidic foods contain enough acidity either to stop the growth of botulinum bacteria or destroy the bacteria more rapidly when heated. Acidic foods may be safely canned in a boiling water canner.

Low-acid foods have pH values higher than 4.6. They do not contain enough acid to prevent the growth of botulinum bacteria. These foods are processed at temperatures of 240 degrees F to 250 degrees F, attainable with pressure canners operated at 10 to 15 pounds per square inch (psi) of pressure. The exact time depends on the kind of food being canned, the way it is packed in jars, and the size of jars. *When you mix low-acid and high-acid foods, assume the mixture remains low-acid.*

Although tomatoes used to be considered an acidic food, some are now known to have pH values slightly above 4.6, which means they are low acid. To safely can them as acidic foods in a boiling water canner, you must add lemon juice or citric acid.

Adjust for Altitude to Ensure a Safe Product

When canning, you must know your altitude—even in Ohio. Do not use process times recommended for canning food at sea level if you live at an altitude above 1,000 feet. Water boils at lower temperatures as altitude increases. Lower boiling temperatures are less effective for killing bacteria. You must increase either the process time or canner pressure to make up for lower boiling temperatures. Use publications based on United States Department of Agriculture (USDA) approved guidelines to select the proper processing time and canner pressures for your altitude.

Using Boiling Water Canners

Most boiling water canners are made of aluminum or porcelain-covered steel. They have removable racks and fitted lids. The canner must be deep enough so that at least one inch of briskly boiling water will be over the tops of jars during processing. Some boiling water canners do not have flat bottoms. A flat

bottom is more energy efficient on an electric range. A ridged bottom can be used more efficiently on a gas burner. To ensure uniform processing of all jars with an electric range, the canner should be no more than 4 inches wider in diameter than the element on which it is heated. If you have a ceramic top range, check the manufacturer's instructions before you begin to can.

Steps for Successful Pressure Canning

1. Put 2 to 3 inches of hot water in the canner. Place filled jars on the rack, using a jar lifter. Fasten canner lid securely.
2. Leave weight off vent port or open petcock. Heat at the highest setting until steam flows from the petcock or vent port.
3. While maintaining high heat setting, vent the canner by allowing steam to escape for 10 minutes, then place weight on vent port or close petcock. The canner will pressurize during the next 3 to 5 minutes.
4. *Start timing the process when the pressure reading on the dial gauge indicates that the recommended pressure has been reached, or when the weighted gauge begins to jiggle or rock.*
5. Regulate heat under the canner to maintain a steady pressure at, or slightly above, the correct gauge pressure. Quick or large pressure variations during processing may cause unnecessary liquid losses from jars. One type of weighted gauge should jiggle 2 or 3 times per minute, while another type should rock slowly throughout the process—check the manufacturer's directions.
6. When the timed process is completed, turn off the heat, remove the canner from heat if possible, and let the canner depressurize. *Do not force-cool the canner. Forced cooling will cause liquid loss from the jars and may result in food spoilage*. Forced cooling may warp the canner lid and cause seal failure.

   Depressurization of older canner models should be timed. Standard size, heavy-walled canners require about 30 minutes when loaded with pints and 45 minutes when loaded with quarts. Newer thin-walled canners cool more rapidly and are equipped with vent/cover locks. These canners are depressurized when their vent lock piston drops to a normal position.
7. After the canner is depressurized, remove the weight from the vent port or open the petcock. Wait two minutes, unfasten the lid, and remove it carefully. Lift the lid away from you so that the steam does not burn your face.
8. Remove jars with a lifter and place on towel away from drafts, leaving at least 1 inch between jars during cooling.

Using Pressure Canners

Newer models of pressure canners have been extensively redesigned. Those made before the 1970s were heavy-walled kettles with clamp-on or turn-on lids. They were fitted with a dial gauge, a vent port in the form of a petcock or counterweight, and a safety fuse. Modern pressure canners are lightweight, thin-walled kettles; most have turn-on lids. They have a removable jar rack, gasket, dial or weighted gauge, and automatic vent/cover lock, a vent port (steam vent) to be closed with a counter weight or weighted gauge, and a safety fuse. *A pressure canner must be used for all low-acid foods.*

Two serious canning errors can occur when pressure processing.

1. *Internal canner pressures are lower at higher altitudes.* Canners must be operated at increased pressures as the altitude increases.
2. *Air trapped in a canner lowers the temperature obtained at 5, 10, or 15 psi and results in underprocessing. To be safe, vent all pressure canners 10 minutes before they are pressurized.*

Dial gauges should be checked for accuracy each year before use. Check with your locl Extension Office for information on this service. If your gauge reads high or low by more than 1 pound at 5, 10, or 15 psi, replace, or have it repaired.

Clean lid gaskets and other parts according to the manufacturer's directions. Use only canners approved by the Underwriter's Laboratory (UL).

Steps for Successful Boiling Water Canning

1. Fill the canner halfway with water.
2. Preheat the water to 140 degrees F for raw-packed foods and to 180 degrees F for hot-packed foods.
3. Load filled jars, fitted with lids, into the canner rack and use the handles to lower the rack into the water, or fill the canner, one jar at a time, with a jar lifter.
4. Add more hot water, if needed, so the water level is at least 1 inch above jar tops.Cover with the canner lid.
5. Turn heat to its highest position until the water boils vigorously.
6. Set a timer for the minutes required for processing the food.
7. Lower the heat setting to *maintain a gentle boil* throughout the process schedule.
8. Add more *boiling* water, if needed, to keep the water level above the jars.
9. When jars have been processed for the recommended time, turn off the heat and remove the canner lid.
10. Using a jar lifter, remove the jars and place them on a towel, leaving at least 1 inch of space between the jars during cooling.

Stay Clear of Unsafe Canning Methods

Never open-kettle can or process jars of food in conventional ovens, microwave ovens, or dishwashers. These practices do not prevent all risks of spoilage.

Steam canners and electric water bath canners are not recommended because safe processing times have not been adequately researched. Using boiling-water canner processing times with either of these canners may result in spoilage. So-called "canning powders" are useless as preservatives and do not replace the need for proper heat processing.

Lids

The common self-sealing lid consists of a flat metal lid held in place by a metal screw band, which secures the jar shut during processing. The flat lid is crimped around the circumference of its bottom surface to form a trough, which is filled with a colored gasket compound. When jars are processed, the lid gasket softens and flows slightly to cover the jar-sealing surface, yet allows air to escape from the jar. The gasket then forms an airtight seal as the jar cools. The shelf life of unused lids is about 5 years from date of manufacture. The gasket compound in older unused lids may fail to seal on jars. Buy only the quantity of lids you will use in one year.

To ensure a good seal, carefully follow the manufacturer's directions in preparing lids for use. Examine all metal lids carefully. Do not use old, previously used, dented, or deformed lids, or lids with gaps or other defects in the sealing gasket.

Filling and Processing

After filling jars with foods, release air bubbles by inserting a flat, plastic spatula between the food and the jar. Slowly turn the jar, and move the spatula up and down to allow air bubbles to escape. Adjust the headspace, and clean the jar rim (sealing surface) with a clean, damp paper towel.

Place the lid, gasket down, onto the cleaned jar rim. Uncleaned jar-sealing surfaces may cause seal failures. Then fit the metal screw band over the flat lid. Follow the lid manufacturer's guidelines for tightening the jar lids properly.

As jars cool, the contents in the jar contract, pulling the self-sealing lid firmly against the jar to form a vacuum. If screw bands are too loose, liquid may escape from the jars during processing, and seals may fail. If screw bands are too tight, air cannot vent during processing, and food will discolor during storage. Over tightening also may cause lids to buckle and jars to break, especially with raw-packed, pressure-processed food.

After Processing

After removing hot jars from a canner, do not retighten their lids. Retightening hot lids may cut through the gasket and cause seal failures. Cool the jars at room temperature for 12 to 24 hours on towels or racks. The food level and liquid volume of raw-packed jars will be noticeably lower after cooling. Air is exhausted during processing, and food shrinks. If a jar loses excessive liquid during processing, do not open it to add more liquid.

After jars have cooled, remove screw bands. Wash and dry bands, then store them in a dry area. If bands are left on stored jars, they become hard to remove and often rust, making them unsuitable for further use.

Seals on cooled jars can be tested by one of these methods:

- Press the middle of the lid. If it springs up when released, the lid is not sealed.
- Tap the lid with the bottom of a teaspoon. If the jar is sealed correctly, it will make a ringing, high-pitched sound. A dull sound means the lid is not sealed. Food touching the underside of the lid, however, also will cause a dull sound. Test seal by another method to make sure it is sealed.
- Hold the jar at eye level and look across the lid. The lid should be concave (curved down slightly in the center). If the center of the lid is either flat or bulging, it may not be sealed.

Unsealed Jars: What to Do

If a lid fails to seal, you must reprocess within 24 hours. Remove the lid, and check the jar-sealing surface for tiny nicks. If necessary, change the jar. Always use a new, properly prepared lid, and reprocess using the same processing time. The quality of reprocessed food is poor.

Instead of reprocessing, unsealed jars of food also can be frozen. Transfer food to a freezer-safe container and freeze. Single, unsealed jars can be refrigerated and used within several days.

Storing Canned Foods

Tightly sealed, cooled jars are ready to be stored. Wash the lid and jar to remove food residue; rinse and dry jars. Label and date jars, and store them in a cool, dark, dry place (50–70 degrees F is ideal). Do not store jars above 95 degrees F or near hot pipes, a range, a furnace, in an uninsulated attic, or in direct sunlight. Under conditions such as these, food will lose quality rapidly and may spoil. Dampness may corrode metal lids, break seals, and allow contamination and spoilage. Plan to use home-canned food within one year for optimum quality and nutritional value.

How to Identify and Handle Spoiled Canned Food

Never taste food from a jar with an unsealed lid or food that shows signs of spoilage. As you use jars of food, examine the lid for tightness and vacuum; lids with concave centers have good seals.

Before opening the jar, examine the contents for rising gas bubbles, and unnatural color. While opening the jar, smell for unnatural odors and look for spurting liquid and mold growth (white, blue, or green) on the top food surface and underside of lid.

Spoiled acidic food should be discarded in a place where it will not be eaten by humans or pets.

Treat all jars and cans of spoiled low-acid foods, including tomatoes, as though they contain botulinum toxin and handle in one of two ways:

1. If suspect glass jars are still sealed, place them in a heavy garbage bag. Close the bag, and place it in a regular trash container or bury it in a landfill.
2. If the suspect glass jars are unsealed, open, or leaking, detoxify (destroy the bacteria) as follows before disposal:

   Carefully place the containers and lids on their sides in an eight-quart or larger pan. Wash your hands thoroughly. Carefully add water to the pan until it is at least one inch above the containers. Avoid splashing the water. Place a lid on the pan, and heat the water to boiling. Boil 30 minutes to ensure that you have destroyed all toxins. Cool and discard the lids and food in the trash, or bury in soil. Sanitize all counters, containers, and equipment that may have touched the food or containers—don't forget the can opener, your clothing, and hands. Place any sponges or washcloths used in the cleanup in a plastic bag and discard.

Recommended Books for Canning

Complete Guide to Home Canning. United States Department of Agriculture, Agriculture Information Bulletin No. 539.

Ball Blue Book (Vol. 1) (1995). Ball/Alltrista Corporation. Muncie, Indiana.

So Easy to Preserve (Third Ed.) (1993). Cooperative Extension Service. The University of Georgia, Athens.

Kerr Home Canning and Freezing Guide (1996). Published by Kerr Glass Manufacturing Corporation. P.O. Box 76961. Los Angles, California 90076

References

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Steps to Successful Home Canning. GH 1415. University of Missouri, Columbia, Extension Division, College of Home Economics.

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