

# The Basics of Safe Canning

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Canning preserves food by using heat to destroy the microorganisms that cause spoilage. Heat forces air out of the jar. As the jar cools, a seal (vacuum) forms. The processing times and temperatures in University of Missouri Extension publications have been set through scientific research. For safe, high-quality home-canned food, it's important that you follow these directions carefully.



## How canning preserves foods

Fresh foods spoil for a variety of reasons. Bacteria, molds and yeasts cause damage, and so do food enzymes and contact with the air. Microorganisms live and multiply quickly on the surfaces of fresh food and inside bruised, insect-damaged and diseased food. Proper canning techniques will stop the growth and activity of microorganisms and can prevent spoilage and quality loss. Use these techniques to get safe food and high-quality results:

- Carefully select and wash fresh food.
- Prepare foods according to MU Extension recommendations — you may need to peel some fresh foods, add acids (lemon juice, citric acid or vinegar), or use hot packs. See MU Extension publications listed on Page 4 for specific instructions.
- Use recommended jars and self-sealing, two-piece lids.
- Process jars in a boiling water bath, steam canner or pressure canner for the correct period of time, according to research-based recommendations.

Only use tested recipes from Cooperative Extension, the U.S. Department of Agriculture (USDA) or the National Center for Home Food Preservation (NCFHP) dated 2009 or later. Unresearched recipes create a high food safety risk.

## Safety basics

### Examine foods carefully

Don't taste foods that show any signs of spoilage, and never taste food from a jar with an unsealed lid. Some types of spoilage are easier to detect in jars stored without screw bands. When bacteria and yeast grow, they produce a gas that swells lids and breaks jar seals. Examine lids for tightness and vacuum. Lids with concave (curved inward) centers have good seals.

Next, hold the jar at eye level. While rotating the jar, look for streaks of dried food that have dripped down the exterior. Also, check for rising air bubbles and unnatural color in the food.

While opening the jar, try to smell unnatural odors, but do not actually sniff the jar contents. Look for spurting liquid and cottonlike mold growth (white, blue, black or green) on the food surface and underside of lid.

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Canning is an important, safe method of food preservation, if practiced properly. The canning process involves placing foods in jars or cans and heating them to a temperature that destroys microorganisms that could be a health hazard or cause the food to spoil. Canning also inactivates enzymes that could cause the food to spoil. Air is driven from the jar or can during heating and, as it cools, a vacuum seal is formed. This vacuum seal prevents air from getting back into the product, bringing with it microorganisms to recontaminate the food.

There are three safe ways of canning, depending on the type of food being canned. These are the boiling water canner method, the steam canner method and the pressure canner method. The boiling water bath and steam canner methods are safe for acidic foods, such as fruits, tomatoes and pickles as well as jams, jellies and other fruit preserves. In these methods, jars of food are heated while completely covered with boiling water (212 degrees F at sea level) or steam.

Pressure canning is the only safe method of canning low-acidic foods, such as meats, poultry and seafood. Jars of food are placed in 2 to 3 inches of water in a pressure canner heated to a temperature of at least 240 degrees F. This temperature can only be reached in a pressure canner.

*Clostridium botulinum*, a common soil bacterium that causes botulism food poisoning, is destroyed in low-acid foods when they are processed at the correct time and temperature in pressure canners. Canning low-acid foods in boiling-water canners or steam canners is absolutely unsafe, because the botulinum bacteria can survive this process. If *Clostridium botulinum* bacteria survive and grow inside a sealed jar of food, they can produce a deadly toxin or poison. Even a taste of food containing this toxin can be fatal. Before eating canned foods, be sure of the following:

- Food was processed following current recommendations from Cooperative Extension, the USDA or the NCFHP.
- Low-acid food was processed in a pressure canner with a gauge that was checked at the beginning of the canning season. (Most local MU Extension centers can check pressure gauges.)
- Acid foods were processed in a boiling water bath or steam canner.
- Time and pressure were adjusted for altitude, according to research-based recommendations.
- Process times and pressures matched the size of jar, style of pack and kind of food being canned, according to research-based information.
- Jar lid is firmly sealed and concave (curved inward).
- Nothing has leaked from the jar.
- No liquid spurts out when jar is opened.
- No unnatural or "off" odors can be detected.

## Product acidity affects processing methods

Whether you should process food in a pressure, boiling water or steam canner to control botulinum bacteria depends on the amount of acid in the food. The term "pH" is a measurement of the acid level in a food. PH is measured on a scale from 1 to 14. The closer the pH value is to 1, the more acid the food contains. A pH of 7 is neutral.

Boiling water or steam canning is used for canning acidic foods. Pressure canning may also be used to process acidic foods, but the high heat and length of processing time can produce an overcooked product that lacks attractive color. Acid foods contain enough acidity to either stop the growth of botulinum bacteria or destroy the bacteria more rapidly when heated.

Low-acid foods are foods that do not contain enough acid to prevent the growth of the bacteria that cause botulism poisoning. Foods are considered to be low-acid foods if they have a pH level greater than 4.6. This category includes vegetables, meats, poultry, seafood, soups and other mixtures of both acid and low-acid ingredients (e.g., tomato-based spaghetti sauce with onions and green peppers). Process these low-acid foods at temperatures of 240–250 degrees F. To reach these high temperatures, you must use a pressure canner 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 into jars and the size of the jars.

It is important to note that mixtures of acid and low-acid foods cannot just be put in jars and canned as you desire. It is important to use a tested recipe from a reputable source or the type of recipe you wish to can. Contact your local MU Extension center for more assistance if needed.

## Adjust for altitude to ensure safety

It's important that you know your altitude — even in Missouri. Don't use process times recommended for canning food at sea level if you live at altitudes above 1,000 feet (Figure 1). 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. MU Extension publications provide processing altitude adjustments.

## Handling suspected spoilage

Do not taste or use food from a jar with an unsealed lid or food that shows signs of spoilage. You can more easily detect some types of spoilage in jars stored without screw bands. Look closely at all jars before opening them. A bulging lid or leaking jars may be signs of spoilage. When you open the jar, look for other signs, such as spurting liquid, an off odor or mold.

Improperly canned low-acid foods can contain the toxin that causes botulism without showing signs of spoilage. Low-acid and tomato foods not canned according to USDA-endorsed recommendations present a high risk of botulism.

At altitudes lower than 1,000 feet above sea level (Figure 1), boil suspect foods for 10 minutes. Add an additional minute of boiling time for each additional 1,000 feet above sea level. **Note that these guidelines do not apply to foods known to be significantly underprocessed according to current standards and recommended methods.** Not all possible defects and hazards associated with nonrecommended methods can be overcome by this boiling method.

Spoiled canned foods should be discarded in a place where they will not be eaten by humans or pets. Spoiled jars of low-acid vegetables, meats and seafood with unsealed lids should be detoxified to destroy any poisons that might be present before being discarded. If the suspect glass jars or swollen metal cans are still sealed, place them in a heavy garbage bag. Close the bag and place it in a regular trash container or dispose of it in a nearby landfill.

When detoxifying canned low-acid foods that have spoiled, and are unsealed, open or leaking, be extremely careful not to splash or come in contact with the suspect food or liquid. Contact with botulinum toxin can be fatal whether it is ingested or enters through the skin. Wear disposable rubber or heavy-duty plastic gloves. Carefully place the suspect containers and lids on their sides in an 8-quart volume or larger stockpot, pan or boiling-water canner. Wash your still-gloved hands thoroughly. Carefully add water to the pot and avoid splashing the water. The water level should be at

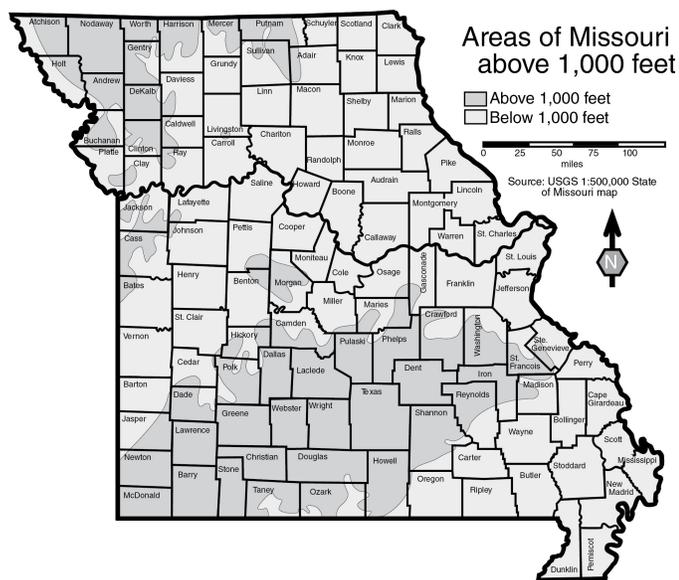


Figure 1. A map depicting the altitudes in Missouri relative to 1,000 feet above sea level.

least 1 inch above the containers. Place a lid on the pot, and heat the water to boiling. Boil 30 minutes to ensure containers and the food therein are detoxified. Cool and discard the containers, their lids and food in the trash, or dispose of them in a nearby landfill. If the 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 dispose of it in a nearby landfill.

Improperly canned low-acid foods can contain the toxin that causes botulism without showing signs of spoilage. They should also be discarded or detoxified and discarded as previously explained. Low-acid foods are considered improperly canned if any of the following are true:

- The food was not processed in a pressure canner.
- The gauge of the canner was inaccurate.
- The processing times and pressures used for the size of the jar, style of pack and kind of food were not in line with the most up-to-date recommendations.
- Ingredients were added that were not in an approved recipe.
- Proportions of ingredients were changed from the approved recipe.
- The processing time and pressure were not correct for the altitude at which the food was canned.

Surfaces that come in contact with spoiled or questionable food should also be cleaned up, again taking care to avoid contact with suspect foods or liquids. Wear rubber or heavy-duty plastic gloves when cleaning contaminated work surfaces and equipment. A fresh solution of 1 part unscented liquid household bleach (5 to 6 percent sodium hypochlorite) to 5 parts clean water should be used to treat work surfaces, equipment or other items, including can openers and clothing, that might have come in contact with suspect foods or liquids. Spray or wet contaminated surfaces with the bleach solution, and let stand for 30 minutes. Wearing gloves, wipe up treated spills with paper towels while taking care to minimize the spread of contamination. Dispose of these paper towels by placing them in a plastic bag before putting them in the trash. Next, apply the bleach solution to all surfaces and equipment again, and let stand for 30 minutes before rinsing. Lastly, thoroughly wash all detoxified counters, containers, equipment and clothing. Discard gloves when you have finished cleaning, and wash your hands thoroughly.

Note that bleach is an irritant itself and should not be inhaled or allowed to come in contact with the skin.

## Stay clear of unsafe canning equipment and methods

**Using a propane gas burner on an outside grill or a portable camp stove** – These methods are not recommended because any wind or breeze tends to increase the amount of time needed to bring the water in the pressure canner to a boil and therefore the pounds per pressure can drop easily, which disrupts consistent time processing. A drop in water temperature will also interfere with boiling water or steam canning. Another issue is that the pressure canner cannot be too big or it will not set properly over the flame of the camp stove. Some camp stoves have metal baffles on the sides so a canner can't center over the flame.

**Pressure cookers** – Pressure cookers have less metal, are smaller in diameter and use less water than pressure canners. The result is that the heat-up and cool-down times for the canning process is much less than for the standard pressure canner. The heat-up and cool-down times are part of the total processing time that was used to establish a reasonable margin of safety. USDA recommends that a pressure cooker must be large enough to hold at least four quart jars to be considered a pressure canner.

NOTE: Pressure cooking in a pressure canner is not recommended. Pressure cooking in a pressure canner may leave food residue in the lid vents, causing issues when the pressure canner is later used for its intended purpose. A pressure canner CAN BE used to cook in as long as the lid is not attached (i.e. chili, spaghetti sauce, deep frying, etc.)

**Multicooker/canner** – This appliance DOES NOT meet the appliance standards for home pressure canning, even if it is marketed as safe for pressure canning. It will only hold up to four pint jars, and the National Center for Home Food Preservation’s guidelines are that a pressure canner MUST be able to hold four quart jars in order to have the volume necessary to process low-acid foods. The heat-up and cool-down time would be much less in a smaller appliance (than a traditional pressure canner), making the entire processing time in this appliance LESS than is needed for low-acid home canning processing times.

**Solar canning** – Heat generated by captured sunlight does not reliably process foods, and should never be used to home can low-acid or acid foods.

**Oven canning** – Oven canning is extremely hazardous. The oven canning method involves placing filled jars in an oven and heating to 200 degrees F. In oven canning, product temperatures never exceed the boiling point; it therefore is not a safe method for either acid or low-acid foods. Keep in mind that low-acid products (i.e., meats, vegetables) require temperatures higher than 212 degrees F. Because this process fails to destroy the spores of *Clostridium botulinum*, it can cause the food to become toxic during storage. Also, canning jars are not designed for intense dry heat and may explode, resulting in serious cuts or burns.

**Microwave canning** – Microwave ovens should not be used for home canning. Microwaved food may reach 212 degrees F, but heating is not uniform throughout the product. Keep in mind that low-acid products (i.e., meats, vegetables) require temperatures much higher than 212 degrees F. There also is a danger that jars may explode within the microwave oven or as the food is being removed from the oven.

**Dishwasher canning** – Processing home-canned foods in a dishwasher cycle is dangerous. The temperature of the water during the cleaning and rinsing cycle is far below that which is required to kill harmful microorganisms, so a product prepared that way will be underprocessed and unsafe to eat. Note: It is fine to use the dishwasher to clean and sterilize empty jars for the home canning process, especially if the dishwasher has a “sterilize” setting.

**Open-kettle canning method** – This method of processing food involves placing and sealing hot packed food and liquid in canning jars with no further heat treatment or processing. It is not recommended for any type of home canning, because the amount of heat it applies is insufficient to destroy bacteria. The final product may spoil quickly or cause illness when consumed.

**Jars with wire bails and glass caps** – These make attractive storage containers for dry foods, but don’t use them for canning. One-piece zinc, porcelain-lined caps are also no longer recommended.

## References

- Andress, E.L., and J. A. Harrison. 2014. *So easy to preserve*, 6th ed. Bulletin 989. Athens, GA: University of Georgia Cooperative Extension Service.
- This material was adapted from the Complete Guide to Home Canning, United States Department of Agriculture, Agriculture Information Bulletin No. 539.