

## General Canning Information

This document was extracted from the "Complete Guide to Home Canning," Agriculture Information Bulletin No. 539, USDA (Revised 2009).

[http://nchfp.uga.edu/how/general/ensuring\\_safe\\_canned\\_foods.html](http://nchfp.uga.edu/how/general/ensuring_safe_canned_foods.html)

### Ensuring Safe Canned Foods

Growth of the bacterium *Clostridium botulinum* in canned food may cause botulism—a deadly form of food poisoning. These bacteria exist either as spores or as vegetative cells. The spores, which are comparable to plant seeds, can survive harmlessly in soil and water for many years. When ideal conditions exist for growth, the spores produce vegetative cells which multiply rapidly and may produce a deadly toxin within 3 to 4 days of growth in an environment consisting of:

- a moist, low-acid food
- a temperature between 40° and 120°F
- less than 2 percent oxygen

Botulinum spores are on most fresh food surfaces. Because they grow only in the absence of air, they are harmless on fresh foods.

Most bacteria, yeasts, and molds are difficult to remove from food surfaces. Washing fresh food reduces their numbers only slightly. Peeling root crops, underground stem crops, and tomatoes reduces their numbers greatly. Blanching also helps, but the vital controls are the method of canning and making sure the recommended research-based process times found in the USDA's Complete Guide to Home Canning are used.

The processing times in this book ensure destruction of the largest expected number of heat-resistant microorganisms in home-canned foods. Properly sterilized canned food will be free of spoilage if lids seal and jars are stored below 95°F. Storing jars at 50° to 70°F enhances retention of quality.

[Temperatures for Food Preservation](#)

### Food acidity and processing methods

Whether food should be processed in a pressure canner or boiling-water canner to control botulinum bacteria depends on the acidity of the food. Acidity may be natural, as in most fruits, or added, as in pickled food. Low-acid canned foods are not acidic enough to prevent the growth of these bacteria. Acid foods contain enough acid to block their growth, or destroy them more rapidly when heated. The term "pH" is a measure of acidity; the lower its value, the more acid the food. The acidity level in foods can be increased by adding lemon juice, citric acid, or vinegar.

Low-acid foods have pH values higher than 4.6. They include red meats, seafood, poultry, milk, and all fresh vegetables except for most tomatoes. Most mixtures of low-acid and acid foods also have pH values above 4.6 unless their

recipes include enough lemon juice, citric acid, or vinegar to make them acid foods. Acid foods have a pH of 4.6 or lower. They include fruits, pickles, sauerkraut, jams, jellies, marmalades, and fruit butters.

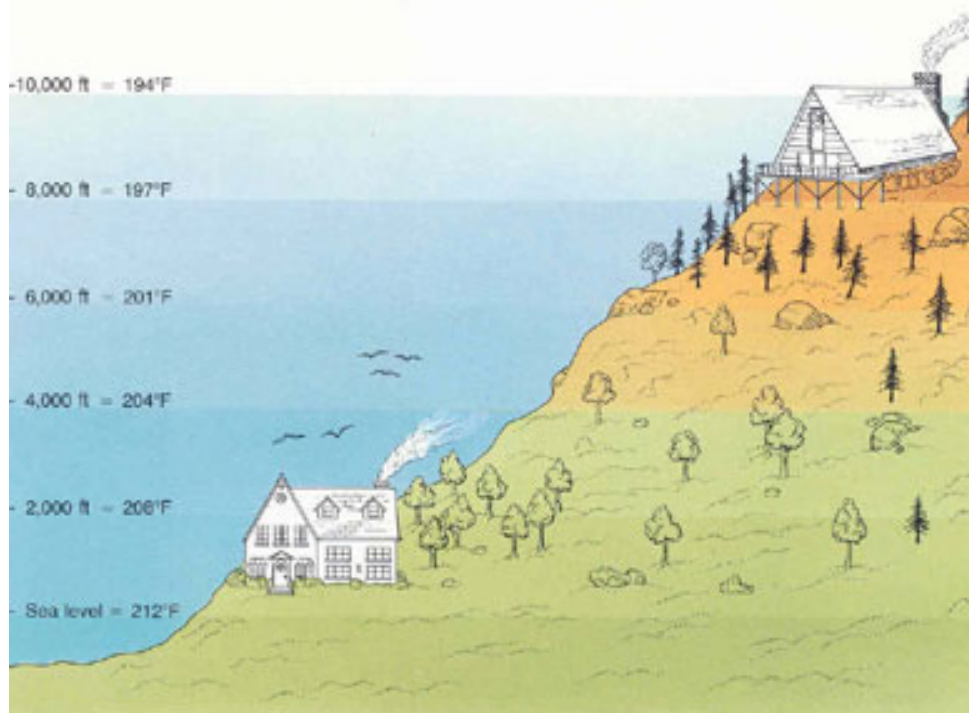
Although tomatoes usually are considered an acid food, some are now known to have pH values slightly above 4.6. Figs also have pH values slightly above 4.6. Therefore, if they are to be canned as acid foods, these products must be acidified to a pH of 4.6 or lower with lemon juice or citric acid. Properly acidified tomatoes and figs are acid foods and can be safely processed in a boiling-water canner.

Botulinum spores are very hard to destroy at boiling-water temperatures; the higher the canner temperature, the more easily they are destroyed. Therefore, all low-acid foods should be sterilized at temperatures of 240° to 250°F, attainable with pressure canners operated at 10 to 15 PSIG. PSIG means pounds per square inch of pressure as measured by gauge. The more familiar "PSI" designation is used hereafter in this publication (the Complete Guide to Home Canning). At temperatures of 240° to 250°F, the time needed to destroy bacteria in low-acid canned food ranges from 20 to 100 minutes.

The exact time depends on the kind of food being canned, the way it is packed into jars, and the size of jars. The time needed to safely process low-acid foods in a boiling-water canner ranges from 7 to 11 hours; the time needed to process acid foods in boiling water varies from 5 to 85 minutes. [Acidity of Foods](#)

### Process adjustments at high altitudes

Using the process time for canning food at sea level may result in spoilage if you live at altitudes of 1,000 feet or more. Water boils at lower temperatures as altitude increases. Lower boiling temperatures are less effective for killing bacteria. Increasing the process time or canner pressure compensates for lower boiling temperatures. Therefore, when you use the



Complete Guide to Home Canning, select the proper processing time or canner pressure for the altitude where you live. **Add 1 minute of time for each 1000 feet above sea level.** (At 7000 feet add 7 minutes of processing time).

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## Ensuring High-Quality Canned Foods

Begin with good-quality fresh foods suitable for canning. Quality varies among varieties of fruits and vegetables. Examine food carefully for freshness and wholesomeness. Discard diseased and moldy food. Trim small diseased lesions or spots from food.

Can fruits and vegetables picked from your garden or purchased from nearby producers when the products are at their peak of quality—within 6 to 12 hours after harvest for most vegetables. For best quality, apricots, nectarines, peaches, pears, and plums should be ripened 1 or more days between harvest and canning. If you must delay the canning of other fresh produce, keep it in a shady, cool place.

Fresh home-slaughtered red meats and poultry should be chilled and canned without delay. Do not can meat from sickly or diseased animals. Ice fish and seafoods after harvest, eviscerate immediately, and can them within 2 days.

## Maintaining color and flavor in canned food

To maintain good natural color and flavor in stored canned food, you must:

- Remove oxygen from food tissues and jars,
- Quickly destroy the food enzymes,
- Obtain high jar vacuums and airtight jar seals.

Follow these guidelines to ensure that your canned foods retain optimum colors and flavors during processing and storage:

- Use only high-quality foods which are at the proper maturity and are free of diseases and bruises.
- Use the hot-pack method, especially with acid foods to be processed in boiling water.
- Don't unnecessarily expose prepared foods to air. Can them as soon as possible.
- While preparing a canner load of jars, keep peeled, halved, quartered, sliced, or diced apples, apricots, nectarines, peaches, and pears in a solution of 3 grams (3,000 milligrams) ascorbic acid to 1 gallon of cold water. This procedure is also useful in maintaining the natural color of mushrooms and potatoes, and for preventing stem-end discoloration in cherries and grapes. You can get ascorbic acid in several forms:  
*Pure powdered form* —seasonally available among canners' supplies in supermarkets. One level teaspoon of pure powder weighs about 3 grams. Use 1 teaspoon per gallon of water as a treatment solution.  
*Vitamin C tablets* —economical and available year-round in many stores.

Buy 500-milligram tablets; crush and dissolve six tablets per gallon of water as a treatment solution. *Commercially prepared mixes of ascorbic and citric acid* —seasonally available among canners' supplies in supermarkets. Sometimes citric acid powder is sold in supermarkets, but it is less effective in controlling discoloration. If you choose to use these products, follow the manufacturer's directions.

- Fill hot foods into jars and adjust headspace as specified in recipes.
- Tighten screw bands securely, but if you are especially strong, not as tightly as possible.
- Process and cool jars.
- Store the jars in a relatively cool, dark place, preferably between 50° and 70°F.
- Can no more food than you will use within a year.

### Advantages of hot-packing

Many fresh foods contain from 10 percent to more than 30 percent air. How long canned food retains high quality depends on how much air is removed from food before jars are sealed.



**Raw-packing** is the practice of filling jars tightly with freshly prepared, but unheated food. Such foods, especially fruit, will float in the jars. The entrapped air in and around the food may cause discoloration within 2 to 3 months of storage. Raw-packing is more suitable for vegetables processed in a pressure canner.

**Hot-packing** is the practice of heating freshly prepared food to boiling, simmering it 2 to 5 minutes, and promptly filling jars loosely with the boiled food. Whether food has been hot-packed or raw-packed, the juice, syrup, or water to be added to the foods should also be heated to boiling before adding it to the jars. This practice helps to remove air from food tissues, shrinks food, helps keep the food from

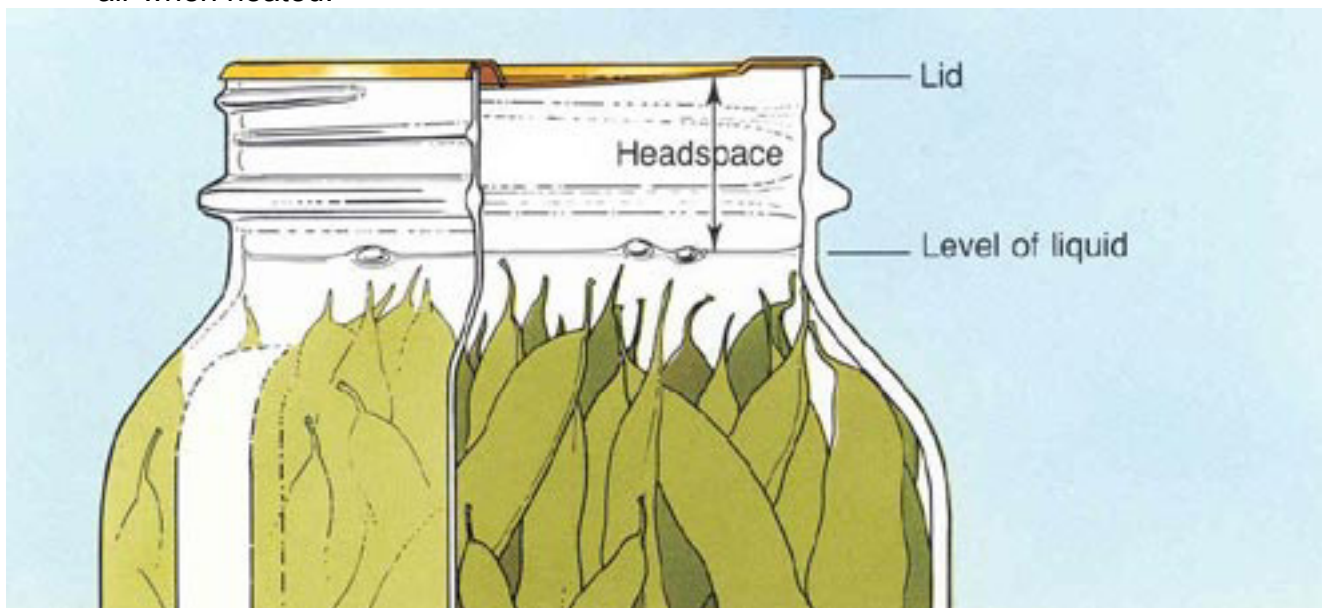
floating in the jars, increases vacuum in sealed jars, and improves shelf life. Preshrinking food permits filling more food into each jar.

Hot-packing is the best way to remove air and is the preferred pack style for foods processed in a boiling-water canner. At first, the color of hot-packed foods may appear no better than that of raw-packed foods, but within a short storage period, both color and flavor of hot-packed foods will be superior.



### **Controlling headspace**

The unfilled space above the food in a jar and below its lid is termed headspace. Directions for canning specify leaving 1/4-inch for jams and jellies, 1/2-inch for fruits and tomatoes to be processed in boiling water, and from 1- to 1 1/4-inches in low acid foods to be processed in a pressure canner. This space is needed for expansion of food as jars are processed, and for forming vacuums in cooled jars. The extent of expansion is determined by the air content in the food and by the processing temperature. Air expands greatly when heated to high temperatures; the higher the temperature, the greater the expansion. Foods expand less than air when heated.



### **Cooling Jars and Testing Jar Seals**



## Cooling jars

When you remove hot jars from a canner, do not retighten their jar lids. Retightening of hot lids may cut through the gasket and cause seal failures. Cool the jars at room temperature for 12 to 24 hours. Jars may be cooled on racks or towels to minimize heat damage to counters. 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. Check for sealed lids as described below.

### Testing jar seals

After cooling jars for 12 to 24 hours, remove the screw bands and test seals with one of the following options:

- Option 1. Press the middle of the lid with a finger or thumb. If the lid springs up when you release your finger, the lid is unsealed.
- Option 2. Tap the lid with the bottom of a teaspoon. If it makes a dull sound, the lid is not sealed. If food is in contact with the underside of the lid, it will also cause a dull sound. If the jar is sealed correctly, it will make a ringing, high-pitched sound.
- Option 3. Hold the jar at eye level and look across the lid. The lid should be concave (curved down slightly in the center). If center of the lid is either flat or bulging, it may not be sealed.



### Reprocessing unsealed jars

If a lid fails to seal on a jar, remove the lid and check the jar-sealing surface for tiny nicks. If necessary, change the jar, add a new, properly prepared lid, and reprocess within 24 hours using the same processing time. Headspace in unsealed jars may be adjusted to 1-½ inches and jars could be frozen instead of reprocessed. Foods in single unsealed jars could be stored in the refrigerator and consumed within several days.

## **Identifying and Handling Spoiled Canned Food**

**Do not taste 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. Growth of spoilage bacteria and yeast produces gas which pressurizes the food, swells lids, and breaks jar seals. As each stored jar is selected for use, examine its lid for tightness and vacuum. Lids with concave centers have good seals.

Next, while holding the jar upright at eye level, rotate the jar and examine its outside surface for streaks of dried food originating at the top of the jar. Look at the contents for rising air bubbles and unnatural color.

While opening the jar, smell for unnatural odors and look for spurting liquid and cotton-like mold growth (white, blue, black, or green) on the top food surface and underside of lid.

Spoiled low-acid foods, including tomatoes, may exhibit different kinds of spoilage evidence or very little evidence. Therefore, all suspect containers of spoiled low-acid foods, including tomatoes, should be treated as having produced botulinum toxin and handled carefully in one of two ways:

- If the swollen metal cans or suspect glass jars are still sealed, place them in a heavy garbage bag. Close and place the bag in a regular trash container or dispose in a nearby landfill.
- If the suspect cans or glass jars are unsealed, open, or leaking, they should be detoxified before disposal.

**Detoxification process:** Wear disposable rubber or heavy plastic gloves. Carefully place the suspect containers and lids on their sides in an 8-quart volume or larger stock pot, pan, or boiling-water canner. Wash your hands with gloves thoroughly. Carefully add water to the pot and avoid splashing the water. The water should completely cover the containers with a minimum of a 1-inch level above the containers. Place a lid on the pot and heat the water to boiling. Boil 30 minutes to ensure detoxifying the food and all container components. Cool and discard the containers, their lids, and food in the trash or dispose in a nearby landfill.

**Cleaning up the area:** Contact with botulinum toxin can be fatal whether it is ingested or enters through the skin. Take care to avoid contact with suspect foods or liquids. Wear rubber or heavy plastic gloves when handling suspect foods or cleaning up contaminated work surfaces and equipment. A fresh solution of 1 part unscented liquid household chlorine bleach (5 to 6% sodium hypochlorite) to 5 parts clean water should be used to treat work surfaces, equipment, or other items, including can openers and clothing, that may 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 being careful 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 and rinse. As a last step, thoroughly wash all detoxified counters, containers, equipment, clothing, etc. Discard gloves when cleaning process is complete. (Note: Bleach is an irritant itself and should not be inhaled or allowed to come in contact with the skin.)