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CANNING • METHODS

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Proper canning practices in the home insure a safe, high-quality product every time. However, it is vital to carefully follow guidelines for preparation, packing and processing foods to achieve a wholesome, safe canned food product.

Reasons for Spoilage

Microorganisms

The major cause of food spoilage is microbial growth. Canning is a method of food preservation involving heat. Canning a food increases the length of time that a food can be stored at room temperature. During the heating process certain microorganisms that cause food spoilage are destroyed.

The types of microorganisms that cause spoilage in foods are bacteria, yeasts and molds. They contaminate food through air, soil, water or via the food handler. The growth of microorganisms is affected by temperature, amount of water, amount of acid in the food and the presence of oxygen (air).

Canned foods provide a moist, yet oxygen-free environment that favors the growth of certain microorganisms. While most microorganisms are destroyed in the heating process, the organism that can survive in a moist, oxygen-free environment and which is of most concern in home canning is *Clostridium botulinum*. This organism causes the often fatal disease known as botulism.

C. botulinum is able to grow without oxygen (air) and thrives where there is little acid available. This particular microorganism exists as a bacterial vegetative cell under favorable growth conditions, but reverts to a spore stage under unfavorable conditions. The spores are very heat-resistant, yet can be destroyed during the canning process. If the temperatures reached during the canning process are inadequate, the spores will change into cells, begin to grow inside the closed jar and produce the toxin that can be fatal. Times and temperatures for canning are based on those needed for the destruction of botulinum spores in the specific food product.

Enzymes

Chemical changes in food can also cause food spoilage. Such changes in canned foods are often caused by the action of enzymes which are not destroyed during heating.

Enzymes are proteins which are naturally present in plants and animals. In living plants or animals they are important because they help speed up the ripening and maturing processes. However, when plants have been harvested or animals slaughtered, enzyme reactions often continue causing undesirable

changes in a food product. Most enzymes deteriorate a food product under the same conditions which promote microbial growth. Canning, or an equivalent heat treatment, stops enzymes from causing undesirable chemical changes in a food.

Food Acidity Affects Canning Method

Foods are divided into two groups for canning based on the amount of acid they contain. Most foods have a neutral pH or are slightly acidic. In food preservation, a food with a pH of 4.6 or lower is considered to be a *high-acid* food, while one with a pH above 4.6 is a low-acid food.

Directions for proper canning have been developed on the basis of low- and high-acid foods. Because microorganisms are easily destroyed by heat when acid is present, high-acid foods can be canned in boiling water at a temperature of 212 degrees F. High-acid foods include fruit and fruit juices; jams, jellies and preserves; and pickles and pickled products. Tomatoes were once considered to be a high-acid food; however, because of problems in recent years with botulism in home-canned tomato products, new recommendations have been made. For more information, see publication B2605, *Tomatoes Tart and Tasty*.

Temperatures higher than 212 degrees F are required to destroy the spores of *Clostridium botulinum* in low-acid foods, which include vegetables, red meat, poultry, fish and wild game. To reach temperatures higher than the boiling point of water (212°F), use a pressure canner. A temperature of at least 240 degrees F is needed for the destruction of *C. botulinum* spores. Therefore, canning of low-acid foods is done in a pressure canner at 10 or 11 pounds of pressure (240° F) or at 15 pounds of pressure (250°F). Adjustments in canner pressure are made according to elevation above sea level.

Practices to avoid

The only safe way to can food at home is to match the food product to the correct method, use safe recipes and follow recommended procedures. Here are some practices and procedures to avoid:

DO NOT open-kettle can

This method involves pouring hot food into jars and sealing without further heat processing. As the jar and its contents cool, a vacuum forms to seal the product. This method is **NOT RECOMMENDED** for home canning of fruits, vegetables or meats. Without sufficient heat to destroy bacteria, molds and yeasts in food, microbial growth is likely and the product will spoil, even though it is sealed.

Open-kettle canning directions are still included in some recipes for jellies. In Wisconsin, the method is **NOT RECOMMENDED** for any product, including jelly.

DO NOT oven can

This method involves placing filled jars in the oven set at a specific temperature and “processing” for a certain period of time. This method **HAS NEVER BEEN RECOMMENDED** as a safe procedure for a variety of reasons. There are no safe and reliable processing times or temperature settings established for home canning in an oven. Also, dry heat, or hot air, is not as efficient as steam or boiling water for the transfer of heat to the center of the

food in the jar. Oven temperatures vary considerably between the “on” and “off” cycles, so heating is uneven. Also, the temperature of the food does not correspond to the oven setting. In an oven, excess pressure can build up inside the jar, causing it to explode. The sudden temperature changes that occur when the oven is opened and the jars are removed could also cause the jars to break.

Finally, besides the fact that oven canning can be dangerous, the end product would be underprocessed and thus could allow the growth of dangerous spoilage organisms, particularly *C. botulinum*.

DO NOT can in the microwave or dishwasher

Canning in the microwave oven or dishwasher is not NOT RECOMMENDED. Microwave ovens do not provide temperatures above 212 degrees F for long enough periods of time to make certain the *C. botulinum* spores are destroyed. Similarly, temperatures in dishwashers are not high enough to sterilize food. (Jams and jellies can be cooked in a microwave, but must then be processed in a boiling water-bath canner after jars are filled.)

DO NOT steam can

There are several brands of steam canners available on the market. These *are not the same as steam pressure canners* used for canning low-acid foods. They are also different from the water-bath canners. In the steam canner, the jars are not immersed in water as they are in the water-bath canner; therefore, heat flow inside the steam canner may be uneven. The end result would be underprocessed food that would be susceptible to microbial spoilage and chemical changes. Use of the steam canner is NOT RECOMMENDED by the University of Wisconsin -Extension because there is not enough information available about safe processing times.

DO NOT use chemicals or preserving powders unless recommended

Chemicals such as aspirin should NEVER be used as a substitute for heat treatment in home canning of food and CANNOT be relied upon to prevent spoilage or yield a satisfactory product. There is no safe ingredient that could destroy microorganisms and extend the shelf life of a food as heat processing does.

The use of aspirin in food products is prohibited by state and federal laws. There is no evidence of its acceptability for use in protecting against hazardous spoilage. However, crystalline citric acid monohydrate, lemon juice from concentrate, tomato acidification tablets and ascorbic/citric acid mixtures can be added to tomato products prior to processing. The addition of these chemicals has been shown to cause an increase in acidity. Adding any chemical to a food product and omitting the heat treatment totally will result in the growth of spoilage organisms and the possible production of toxin by *C. botulinum*.

DO NOT take shortcuts or experiment in home canning

Use only tested, currently approved methods. The only safe canning method is a boiling water-bath for high-acid foods and a pressure canner for low-acid foods. Use *only* tested recipes and FOLLOW PROCESSING TIMES EXACTLY.

DO NOT use jars, cans and lids which are not made especially for home canning

Jars designed for commercial products such as peanut butter, coffee, pickles or vegetables may not withstand the heat treatment without breaking or may not accommodate standard two-piece canning lids. Mayonnaise or salad dressing jars that accommodate standard canning lids can be used for foods processed in boiling water canners but should not be used in a pressure canner.

- DO NOT re-use or use zinc lids** Rubber rings used with zinc lids are not manufactured today. Old ones should not be used. Get new metal two-piece lids with sealing compound for safe products.
- DO NOT use overripe food** Products change in chemical composition with age and lose acidity. Make sure the food is of good quality, with no bruises or soft spots.
- DO NOT overpack foods** Trying to get too much food into one jar may result in underprocessing and spoilage. Leave recommended amount of headspace when jars are filled.
- DO NOT use canned foods showing signs of spoilage** Watch for bulging lids, leaks, off-odors or mold. If in doubt, DON'T TASTE. Dispose of the food so that it cannot be consumed by humans or animals.

Summary

Spoilage can be prevented in home-canned products by adequately heat processing foods in a boiling water-bath or steam pressure canner for a specified period of time. The method used for processing depends on whether the food is high- or low-acid. For safety, use approved recipes that are based on scientific principles. Any practice that does not involve adequate processing may be potentially dangerous and should be avoided.

Other extension publications on food preservation, safety and storage:

Canning Fruits Safely (1991) B0430
Canning Meat and Poultry, B3345
Canning Salsa Safely (1992), B3570
Canning Vegetables Safely, B1159
Food Safety News, B3516
Freezing Fruits and Vegetables, B3278
Tomatoes Tart and Tasty, B2605
Wisconsin's Wild Game: Enjoying the Harvest (1992), B3573

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