



# Food Safety Recommendations for Acceptable Fair Exhibits

In this publication, several food safety issues dealing with acceptable food exhibits at county fairs and the Kansas State Fair will be addressed. While the main focus will be on herbs and vegetables in vinegar and oil, home-style canned quick breads and cakes, and dried meats, other topics related to food safety will be discussed in less detail.

The following practices, products, methods and materials are categorized as being either acceptable or non-acceptable for fair exhibition.

## Acceptable Canning Methods

- Pressure canning for meat, poultry, seafood and vegetables (low acid foods); utilizing United States Department of Agriculture (USDA) guidelines for pressure and time.
- Boiling-water canner for acid foods, such as fruits, pickles, sauerkraut, jams, jellies, marmalades, fruit butter and properly acidified tomatoes and figs (acidified to pH of 4.6 or lower with lemon juice or citric acid); utilizing USDA guidelines for time.

## Canning Materials Recommended

- Mason-type, threaded, home-canning jars with matching self-sealing lids are the only choice, and must be used for low-acid foods that are pressure canned. (Use Ball lids on Ball jars; Kerr lids on Kerr jars, etc.)
- Use only new, common, self-sealing lids (consists of flat metal lid held in place by a metal screw band during processing); removal of screw bands is permitted before storage of canned goods. (For exhibit purposes, replace the screw band so the flat lid will remain sealed during transportation and judging.)

- Modern pressure canner with accurate dial gauge or weighted gauge.

## Acceptable Jar Seals

- After cooling jars for 12 to 24 hours, remove screw bands and test seals with following options: Concave lid (curved down slightly in center); the lid should not spring up when pressed in the center; tapping the lid with a spoon will produce a ringing sound.

## Non-Acceptable Canning Methods

- Steam canning
- Open kettle canning
- Microwave oven
- Electric oven
- Slow cooker
- Crock pot
- Dishwasher
- Canning powders
- The sun

## Canning Materials Not Recommended

- Mayonnaise-type (salad dressing) jars are not recommended for use with foods to be processed in a pressure canner because of excessive jar breakage.
- Other commercial jars with mouths that cannot be sealed with two-piece canning lids are not recommended for canning any food at home.
- Jars with wire bails and glass caps.
- One-piece zinc porcelain-lined caps.

## **Non-Acceptable Jar Seals**

- If lid is flat or bulging, it may not be sealed.
- Unnatural odors, spurting liquids, rising air bubbles, unnatural color, cotton-like mold growth on top of food and underside of lid.
- Paraffin or wax seals for sweet spreads.

## **County Fair and State Fair Requirements**

**Canned Foods.** Should be prepared and processed according to the USDA Guide and/or K-State Research and Extension publications.

**Home-canned low-acid foods.** Meats, corn, beans, peas, potatoes, carrots, etc., must be pressure canned. Label must include canning method and processing time.

**Home-canned acid or acidified foods.** Fruits, pickled products, tomatoes, jams and jellies, may be water-bath processed.

Tomatoes must be acidified. (To ensure a safe acid level in whole, crushed, or juiced tomatoes, add 2 tablespoons of bottled lemon juice or ½ teaspoon of citric acid per quart of tomatoes. For pints, use 1 tablespoon of bottled lemon juice or ¼ teaspoon of citric acid. Acid can be added directly to the jars before filling the jars with product. Add sugar to offset acid taste, if desired. Four tablespoons of a 5-percent acidity vinegar per quart may be used instead of lemon juice or citric acid. However, vinegar may cause undesirable flavor changes.\*) All products must be labeled with canning method and processing time. Oven canned, open-kettle, steam canner and other non-standard methods are unsafe and products will not be accepted for judging.

**Jerky.** All meat jerky must be cooked to 160°F (internal temperature using a metal stem-type thermometer) either before or after drying. Products must be labeled with preparation steps (recipe). Products not heated to 160°F are not deemed safe and will not be accepted for judging. For additional information on making jerky, see the Dried Meats section of this publication.

**Herbs, Vegetables and Garlic in Oil.** These products are safe only if prepared fresh and kept refrigerated. Products may be accepted for judging at the county fair if the fair has refrigerated space for exhibits. These products are not suitable as state fair entries, or as gift basket items intended for room temperature display and storage.

**Canned Bread and Cakes in Jars.** Some quick breads and other jarred breads and cakes may provide an environment favorable to *C. botulinum* growth. Thus, they are not suitable for fair exhibits.

**Perishable Foods.** Perishable foods are those with custard and cream cheese type fillings and frostings, or foods that require refrigeration. They will not be allowed at the state fair due to a lack of refrigeration. County fairs with adequate refrigeration may allow perishable type items. (Check fair guidelines.) Fruit and pecan pies are acceptable.

**Gift Baskets.** All items exhibited within the gift basket must conform to the rules and regulations of the foods division. The entry form must include the recipe, the intended use, and food safety precautions taken during and after preparation. Entries will count as non-perishable food products, not as an educational exhibit. Any herb, vegetable or garlic in oil type products and/or canned bread and cakes in jars will not be suitable in gift baskets exhibited at county fairs or the state fair.

\* Preserving Tomatoes. 1995. K-State Research and Extension. MF-1185.

## **Food Safety Guidelines for Fair Exhibits**

### **Home Canning: Ensuring Safe Canned Foods**

Growth of the bacterium *Clostridium botulinum* in canned food may cause botulism—a deadly form of foodborne illness. 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°F 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.

### 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 foods and tomatoes. Low-acid canned foods contain too little acidity to prevent the growth of these bacteria. Acid foods contain enough acidity 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

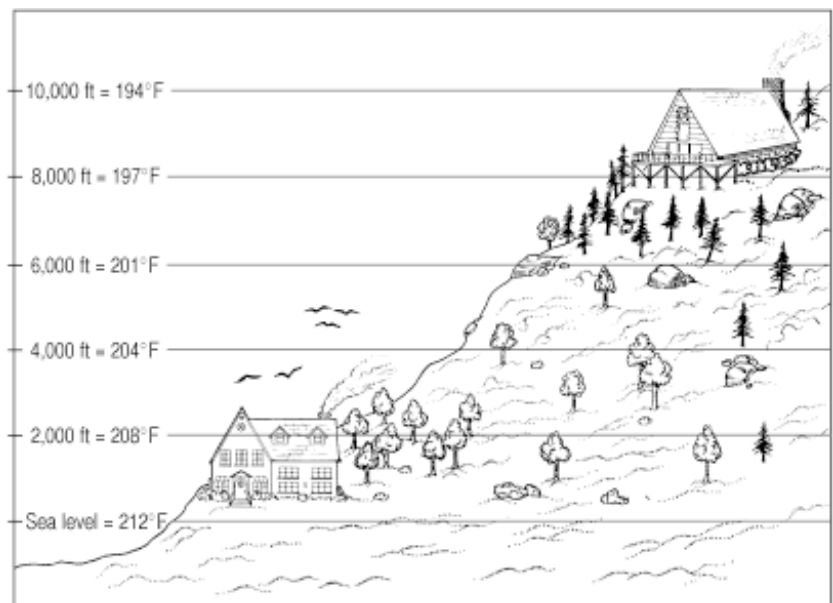
juice or citric acid. Properly acidified tomatoes and figs are acid foods, and can be safely processed in a boiling-water canner.

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 processed to temperatures of 240°F to 250°F, attainable with pressure canners operated at 10 to 15 PSIG (pounds per square inch pressure as measured by gauge).

At temperatures of 240°F to 250°F, the time needed to destroy bacterial spores 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 the jars, and the size of jars. The time needed to safely process acid foods in boiling water (212°F) varies from 5 to 85 minutes.

### 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. An increase of the process time or canner pressure compensates for lower boiling temperatures. Correct process time at higher elevations for water bath and pressure canning



by adding 1 additional minute per 1,000 feet above sea level. Therefore, when following canning directions in this series, select the proper processing time or canner pressure for the altitude where you live. If you do not know the altitude, contact your local county Research and Extension agent. (An alternative source of information would be the local district conservationist with the Natural Resources Conservation Service.)

### **Equipment and Methods Not Recommended**

Open kettle canning and the processing of freshly filled jars in conventional ovens, microwave ovens, and dishwashers are not recommended, because these practices do not prevent all risks of spoilage. Steam canners are not recommended because processing times for use with current models have not been adequately researched. Because steam canners do not heat foods in the same manner as boiling-water canners, their use with boiling-water process times may result in spoilage. It is not recommended that pressure processes in excess of 15 PSI be applied when using new pressure canning equipment. So-called canning powders are useless as preservatives and do not replace the need for proper heat processing. Jars with wire bails and glass caps make attractive antiques or storage containers for dry food ingredients but are not recommended for use in canning. One-piece zinc porcelain-lined caps also are no longer recommended. Both glass and zinc caps use flat rubber rings for sealing jars, but too often fail to seal properly.

\* USDA Guide to Home Canning. USDA-ES Agricultural Information Bulletin No. 539. 1994.

### **Clostridium Botulinum—The Disease**

A toxin produced by the bacteria, *Clostridium botulinum*, can result in a disease called botulism. This toxin is called a neurotoxin because it affects the nervous system. Symptoms appear 12 to 48 hours after eating a food containing the toxin. The symptoms include double vision, droopy eyelids, trouble with speaking and

swallowing, and difficulty with breathing. Without treatment, death may result from suffocation because the nerves can no longer stimulate breathing. Antitoxins have been used to reduce the fatality rate of the disease but persons may recover slowly and suffer from nerve damage.

### **Control of Clostridium Botulinum**

Proper canning methods must be used for preserving low-acid foods. Pressure processing is necessary to obtain the temperatures required to destroy the *Clostridium botulinum* spore. The toxin can be destroyed by boiling for 10 minutes at sea level (add 1 minute for every 1,000 feet above sea level). When the bacteria grows, it can produce a gas which causes canned items to bulge. Never taste food from leaking, bulging or damaged cans; from cracked jars or with loose or bulging lids; from containers that spurt liquid when opened; or any canned food that has an abnormal odor or appearance. Discard any suspected canned foods by placing the container in a heavy garbage bag marked "POISON" and place the bag in a trash container that is not accessible to people or animals. Clean all surfaces that leaky containers may have contaminated with a chlorine/water solution (1 tablespoon regular chlorine bleach, not scented or oxygenated bleach, per gallon of warm water). Discard any sponges or cloths used for cleanup.

\* Penner, Karen P. *Clostridium Botulinum and Foodborne Illness*. 1995. Food and Nutrition - 5. Kansas State University Research and Extension.

### **Herbs and Vegetables in Vinegar and Oil**

Flavored vinegars and oils add excitement to salads, marinades and sauces. They also make special gifts, provided a few simple precautions are followed. Of the two, flavored vinegars are easiest and safest to make. Because vinegar is high in acid, it does not support the growth of *Clostridium botulinum* bacteria. However, some vinegars may support the growth of *Escherichia (E.) coli* bacteria. Infused oils have the potential to support the growth of *C. botulinum* bacteria; therefore, these products may cause great harm if

not made and stored properly. By following approved procedures, both types of products can be safely prepared and used.

The safety concern with flavored oils is simple: Infused oils and oil-based mixtures of garlic, herbs or dried tomatoes can pose a health hazard if not kept refrigerated. There have been a number of cases of botulism foodborne illness traced to commercially and home-prepared mixtures of garlic-in-oil that were not refrigerated. Refrigeration is necessary because all other conditions that favor growth of *C. botulinum* are met: low acid environment with pH higher than 4.6, anaerobic conditions (oil), food and moisture source (garlic), not boiled before eating.

For added safety with garlic in oil, the Food and Drug Administration (FDA) now requires that all commercial garlic-in-oil products contain specific levels of microbial inhibitors or acidifying agents such as phosphoric or citric acid<sup>1</sup>. Although most garlic products do contain these additives, some boutique, restaurant or specialty mixes may not. Always check the label to be sure.

As for home-prepared mixtures of garlic-in-oil, the FDA recommends that these “be made fresh for use and not left out at room temperatures.” Refrigerate left-overs, for use within three weeks, freeze or discard.

The reason for the concern is that unrefrigerated garlic-in-oil mixtures lacking antimicrobial agents have been shown to permit the growth of *C. botulinum* bacteria and its toxins, without affecting the taste or smell of the products.

Less has been documented on the dangers of storing whole chiles, fleshy vegetables or herbs in oil, but they, too, are best made fresh with leftovers stored in the refrigerator for use within three weeks. Dried tomatoes-in-oil are less of a safety concern than other mixtures in oil because the pH of tomatoes is generally 4.6 or lower, and the water activity is less than 0.85. However, to ensure safety, it is recommended that all tomato-in-oil and herb-in-oil products be stored at refrigerator temperatures.

<sup>1</sup>Garlic in Oil, Press release, April 17, 1989, Food and Drug Administration, Washington, D.C.

\* Kendall, P.; Rausch, J.. Preparation, Flavored Vinegars and Oils, Foods and Nutrition Series. 1996. No. 9.340, Colorado State University Cooperative Extension.

### **Home-Style Canned Quick Breads**

Home-style canned quick breads have been featured in popular magazines and promoted through mail order brochures and specialty shops. They are typically manufactured by small “home-based” operations and the process consists of oven-baking a batter in a wide mouth glass jar.

From a food safety standpoint, inadequate heat treatment of this type of product coupled with favorable storage conditions could lead to development of botulinum toxins.

In a K-State study on the survival of inoculated *C. sporogenes* PA 3679, canned banana bread was baked at a temperature of 177°C (350°F). Even though this resulted in a highly desirable product appearance, it did not result in a safe product (totally free of inoculated *Clostridium* after storage) for human consumption, especially when baked products were stored under conditions (35°C or 95°F) which favor spore germination. When baked at higher temperatures to enhance food safety, it formed an excessive crust which made an undesirable consumer product.

The standard procedure (which people would use at home) for home-canned quick bread recommends baking at 191°C ( 375°F) for 50 minutes. Even though this treatment resulted in non-detectable levels of sporeformers in uninoculated breads after 8 hours of storage at room temperature, the practice of making canned breads and cakes is not recommended.

\* Aramouni, F.M.; K.K. Kone; J.A. Craig and D.Y.C. Fung. Growth of *Clostridium sporogenes* PA 3679 in Home-Style Canned Quick Breads. *Journal of Food Prot.* 57:882-886

## Dried Meats

Drying is the world's oldest and most common method of food preservation. Canning technology is less than 200 years old and freezing became practical only during this century when electricity became more available to people. Drying technology is both simple and readily available to most of the world's culture.

The scientific principal of preserving food by drying is that by removing moisture, enzymes cannot efficiently contact or react with the food. Whether these enzymes are bacterial, fungal, or naturally occurring enzymes from the raw food, preventing this enzymatic action preserves the food from biological action. Illnesses due to Salmonella and E. coli 0157:H7 from homemade jerky raised questions about the safety of traditional drying methods for making beef and venison jerky. The USDA Meat and Poultry Hotline's current recommendation for making jerky safely is to heat meat to 160°F (internal temperature using a metal stem-type thermometer) before the dehydrating process. This step assures that any bacteria present will be destroyed by wet heat. But most dehydrator instructions do not include this step, and a dehydrator may not reach temperatures high enough to heat meat to 160°F.

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### Method to heat meat to 160°F. From the University of Georgia Cooperative Extension Service.

Prepare a Jerky Marinade using 1 to 2 pounds of lean meat (beef, pork or venison); ¼ cup soy sauce, 1 tablespoon Worcestershire sauce; ¼ teaspoon each of pepper and garlic powder; ½ teaspoon onion powder; and 1 teaspoon hickory smoke-flavored salt. Combine all ingredients. Place strips of meat in a shallow pan and cover with marinade. Cover and refrigerate 1 to 2 hours or overnight. Products marinated for several hours may be more salty than some people prefer. To heat, bring the marinade and strips to a boil and boil strips 5 minutes before draining and drying. If strips are more

than ¼ inch thick, the length of time may need to be increased. If possible, check the temperature of several strips (through the side on thicker strips, or a stack for thinner strips) with a metal stem-type thermometer to determine that 160°F has been reached. When the strips are heated in a marinade before drying, drying times will be reduced. Color and texture will differ from traditional jerky.

If the strips were not heated in marinade prior to drying, they can be heated in an oven after drying as an added safety measure. Place strips on a baking sheet, close together, but not touching or overlapping. For strips originally cut ¼ inch thick or less, heat 10 minutes in an oven preheated to 275°F. (Thicker strips may require longer heating to reach 160°F.)<sup>2</sup>

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After heating to 160°F, maintaining a constant dehydrator temperature of 130 to 140°F during the drying process is important because:

- the process must be fast enough to dry food before it spoils; and
- it must remove enough water that microorganisms are unable to grow.

Why is it a food safety concern to dry meat without first heating it to 160°F? The danger in dehydrating meat and poultry without cooking it to a safe temperature first is that the appliance will not heat the meat to 160°F—a temperature at which bacteria are destroyed—before it dries. After drying, bacteria become much more heat resistant.

Within a dehydrator or low-temperature oven, evaporating moisture absorbs most of the heat. Thus, the meat itself does not begin to rise in temperature until most of the moisture has evaporated. Therefore, when the dried meat temperature finally begins to rise, the bacteria have become more heat resistant and are more likely to survive. If these surviving bacteria are pathogenic, they can cause foodborne illness to those consuming jerky.

There have been several scientific studies of meat dehydrating and lab tests on jerky samples by professionals. In the jerky studies, some samples showed total bacterial destruction and other samples showed some bacterial survival—especially the jerky made with ground beef. Further experiments with lab-inoculated venison showed that pathogenic *E. coli* could survive drying times of up to 10 hours and temperatures of up to 145°F.

For ground beef jerky made at home, scientist concluded that safety concerns related to *E. coli* 0157:H7 are minimized if the meat is pre-cooked to 160°F prior to drying.

<sup>2</sup>Harrison, Judy A. *Drying Jerky*. Cooperative Extension Service. University of Georgia.

\* *Food Safety Of Jerky*. Food Safety and Inspection Service, United States Department of Agriculture. 1998.



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