



Food Safety Recommendations for Food Preservation Exhibits

Food safety is very important for food preservation exhibits at county fairs and the Kansas State Fair. The following practices, products, methods, and materials are categorized as being either acceptable or non-acceptable for fair exhibition.

For any fair entry, **always** read the rules in the fair book for details on what and how food preservation exhibits should be entered. Paying attention to details can reduce many judging issues.

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 for growth exist, the spores produce vegetative cells that multiply rapidly and can produce a deadly toxin within 3 to 4 days of growth in an environment that consists 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. Acid foods contain enough acidity to block their growth, or destroy them more rapidly when heated.

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

Botulinum spores are difficult 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

Reliable, tested recipes are written with processing instructions for sea level locations. Instructions to adjust for altitude are either within the instructions or in the general information.

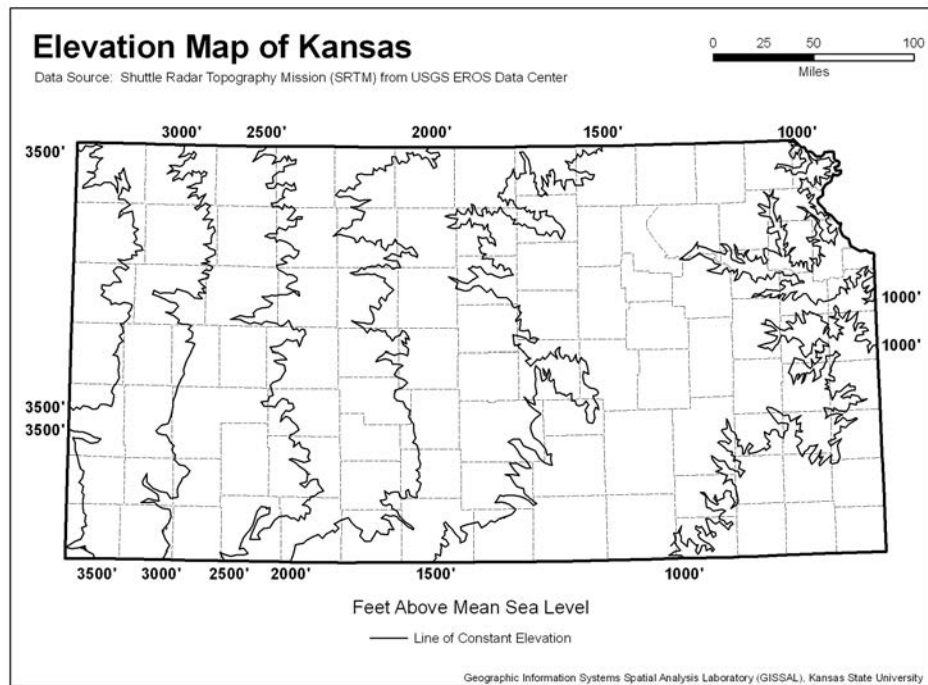
Using the process time for canning food at sea level may result in spoilage if you live at altitudes of 1,000 feet or more. Water boils at lower temperatures as altitude increases. Lower boiling temperatures are less effective for killing bacteria. An increase of the process time or canner pressure compensates for lower boiling temperatures. If you do not know the altitude, contact your local research and extension agent, refer to the map above, or do an internet search for the altitude in your area.

Acceptable Canning Methods

- Pressure canning for meat, poultry, seafood, and vegetables (low acid foods). See "How-to Guide to Pressure Canning" at <https://www.bookstore.ksre.ksu.edu/pubs/MF3242.pdf>.
- 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, vinegar, or citric acid). Steam canners can be used in place of a water bath canner for any acidic food with a total process time of 45 minutes or less. See "How-to Guide to Water Bath Canning and Steam Canning" at <https://www.bookstore.ksre.ksu.edu/pubs/MF3241.pdf>.

Canning Equipment Recommended

- Mason-type, clear, threaded, home-canning jars.



- Use new, common brand, self-sealing lids (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. Pressure cookers not designed for pressure canning should not be used.

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
- Electric multi-cooker appliances such as electric pressure cookers
- Microwave oven
- Conventional or convection ovens, gas or electric
- Slow cooker

- Crock pot
- Dishwasher
- Canning powder or aspirin
- 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. These jars should not be used for fair exhibits.
- 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.

Unacceptable 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.

Headspace Recommendations

In general, these are the headspace recommendations. Follow tested recipes and their recommendations.

- ¼ inch for jams and jellies
- ½ inch for most fruits, tomatoes, pickles
- 1 to 1¼ inch for most low-acid foods

County Fair and State Fair Requirements for Canned Foods

Canned foods. All canned foods should be prepared and processed according to tested recipes from the *USDA Complete Guide to Home Canning* (2015), *So Easy to Preserve* (University of Georgia, 6th edition), K-State Research and Extension Food Preservation publications, other extension publications, or the *Ball Blue Book*. All entries must include a recipe. All recipes must include the source and publication date that is later than 1994.

Home-canned, low-acid foods. Meats, corn, beans, peas, potatoes, carrots, etc., must be pressure

canned properly for the altitude where the canning takes place. Label must include canning method, processing time, altitude, date processed, and amount of pressure (psi) when pressure canning method is used.

Home-canned acid or acidified foods. Fruits, pickled products, tomatoes, jams, and jellies may be water-bath processed properly for the altitude where the canning takes place. Some fruits and tomato products have an option to be pressure canned.

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 them with tomatoes. Add sugar to offset acid taste, if desired. Two tablespoons of a 5 percent acidity vinegar per pint or 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.¹ Label must include canning method, processing time, altitude, date processed, and amount of pressure (psi) when pressure canning method is used.

Jerky. All meat jerky must be heated to 160°F (internal temperature using a metal stem-type thermometer) either before or after drying. Products must be labeled with preparation steps, including the 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 beginning on page 5 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.²

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

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 for human consumption, and food safety precautions taken during and after preparation. Entries will count as non-perishable food products, not as an educational exhibit.

¹ *So Easy to Preserve*, 6th edition. The University of Georgia Cooperative Extension.

² Kendall, P.; Rausch, J. Preparation, *Flavored Vinegars and Oils*, *Foods and Nutrition Series*. Rev May 2012. No. 9.340, Colorado State University Cooperative Extension.

Disposing of Unsafe Canned Foods

Proper canning methods must be used to preserve low-acid foods. Pressure processing is necessary to obtain the temperatures required to destroy the *Clostridium botulinum* spore. When the bacteria grows, it can produce a gas that causes canned items to bulge. Never taste food from leaking, bulging, or damaged cans; from cracked jars or those 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 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.³

³ *USDA Complete Guide to Home Canning*. USDA-ES Agricultural Information Bulletin No. 539. 2015

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 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.⁴ 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 leftovers for use within three weeks, freeze, or discard.

The reason for concern is that unrefrigerated garlic-in-oil mixtures lacking antimicrobial agents have been shown to permit 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 and stored in the refrigerator for use within 10 days. Dried tomatoes-in-oil are less 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.⁴

⁴ Kendall, P.; Rausch, J.. Preparation, *Flavored Vinegars and Oils*, *Foods and Nutrition Series*. 1996, revised 5/12. 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. A canning lid and ring are then screwed onto the jar for storage at room temperature.

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.⁶

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.

⁶ 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

Pumpkin Butter

Home canning is NOT recommended for pumpkin butter or any mashed or pureed pumpkin or winter squash. The only directions for canning pumpkin and winter squash are for cubed flesh.

Source: *Home Preserving Pumpkins*. 2015. National Center for Home Food Preservation, University of Georgia Cooperative Extension. <http://nchfp.uga.edu/tips/fall/pumpkins.html>.

Fancy Packs

Many types of fancy packs produce potentially unsafe products. In many events, they are not allowed. The adequacy of process times is dependent on using specified preparation procedures. For example, if the preparation instructions specify cutting into pieces, the vegetable should not be left whole. Fancy packs that allow for dense pack-

ing of food pieces may not have received adequate heat penetration to kill harmful microorganisms. This kind of practice also allows the food temperature to cool down too much if a hot pack process is intended and used. Process times are dependent on an expected initial temperature of the food as it goes into the canner. At the least, packs of this type are not considered practical or representative of recommended jar filling practices. Only use a fancy pack method, such as vertically packing asparagus, if the recipe states to do so.

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 the last century when electricity became more widely available. Food drying technology is both simple and readily available to most of the world’s cultures.

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* O157:H7 from homemade jerky raise 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 and poultry to 165 °F 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 or 165°F. It is not recommended to make jerky from raw poultry.

After heating to 160°F or 165°F, maintaining a constant dehydrator temperature of 130°F 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.

According to research conducted at the University of Georgia, jerky can also be heated to 160°F after the jerky has been dehydrated. Simply remove the jerky from the dehydrator, place on a baking sheet and heat in the oven at 275°F for 10 minutes.

Additionally, safe handling and preparation methods must always be used, including:

- Always wash hands thoroughly with soap and water before and after working with meat products.
- Use clean equipment and utensils.
- Keep meat and poultry refrigerated at 40°F or slightly below; use or freeze ground beef and poultry within 2 days; whole red meats, within 3 to 5 days.
- Defrost frozen meat in the refrigerator, not on the kitchen counter.
- Marinate meat in the refrigerator. Don't save marinade to re-use. Marinades are used to tenderize and flavor the jerky before dehydrating it.
- Steam or roast meat to 160°F and poultry to 165°F as measured with a food thermometer before dehydrating it.
- Dry meats in a food dehydrator that has an adjustable temperature dial and will maintain a temperature of at least 130 to 140 °F throughout the drying process.

Source: *Dry Meat Safely at Home*, <https://www.bookstore.ksre.ksu.edu/pubs/MF3173.pdf>.

When preparing jerky from wild game, it is important to remember that the wound location and skill of the hunter can affect the safety of the meat. If the animal is wounded in such a way that the contents of its gut come in contact with the meat or the hunter's hands while dressing the meat, fecal bacteria can contaminate the meat. It is best to avoid making jerky from this meat and use it only in ways that it will be thoroughly cooked. Deer carcasses should be rapidly chilled to avoid bacterial growth.

Source: *Drying Jerky*. 2006. National Center for Home Food Preservation, University of Georgia Cooperative Extension. <http://nchfp.uga.edu/how/dry/jerky.html>

Preparing the Meat

Partially freeze meat to make slicing easier. The thickness of the meat strips will make a difference in the safety of the methods recommended in this book. Slice meat no thicker than ¼ inch. Trim and discard all fat from meat because it becomes rancid quickly. If a chewy jerky is desired, slice with the grain. Slice across the grain if a more tender, brittle jerky is preferred. A tenderizer can be used according to package directions, if desired. The meat can be marinated for flavor and tenderness. Marinade recipes may include oil, salt, spices and acid ingredients such as vinegar, lemon juice, teriyaki, or soy sauce or wine.

Jerky Marinade

- 1½ to 2 pounds of lean meat (beef, pork or venison)
- ¼ cup soy sauce
- 1 tablespoon Worcestershire sauce
- ¼ teaspoon each of black pepper and garlic powder
- ½ teaspoon onion powder
- 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. If you choose to heat the meat prior to drying to decrease the risk of food-borne illness, do so at the end of the marination time. To heat, bring strips and marinade to a boil and boil for 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 with a metal stem-type thermometer to determine that 160°F has been reached.

Drying the Meat

Remove meat strips from the marinade and drain on clean, absorbent towels. Arrange strips on dehydrator trays or cake racks placed on baking sheets for oven drying. Place the slices close together, but not touching or overlapping. Place the racks in a dehydrator or oven preheated to 140°F.

Dry until a test piece cracks but does not break when it is bent (10 to 24 hours for samples not heated in marinade). Samples heated in marinade will dry faster. Begin checking samples after 3 hours. Once drying is completed, pat off any beads of oil with clean, absorbent towels and cool. Remove strips from the racks. Cool. Package in glass jars or heavy plastic food storage bags. Vacuum packaging is also a good option.

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.)

Making Jerky from Ground Meat

Jerky can be made from ground meat using special presses to form or shape the product. Disease-causing microorganisms are more difficult to eliminate in ground meat than in whole meat strips. (If ground meat is used, follow the general tips for safe handling of meat and poultry, above.) Be sure to follow the dehydrator manufacturer's directions when heating the product at the end of drying time. Again, an internal temperature of 160°F is necessary to eliminate disease-causing bacteria such as *E. coli* O157:H7, if present.

Source: *Preserving Food: Preparing Safe Jerky*, March 2011, https://nchfp.uga.edu/publications/uga/prep_safe_jerky.pdf

Revised by Karen Blakeslee, M.S., Extension Associate,
K-State Department of Animal Sciences and Industry.

Revised from an earlier edition of this fact sheet by
Tom B. Lindquist, retired, and Fadi Aramouni Ph.D., professor, K-State Research and Extension,
Department of Animal Sciences and Industry

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended,
nor is criticism implied of similar products not mentioned.

Publications from Kansas State University are available at: <http://www.ksre.ksu.edu>

Date shown is that of publication or last revision. Contents of this publication may be freely reproduced for educational purposes. All other
rights reserved. In each case, credit Karen Blakeslee, *Food Safety Recommendations for Food Preservation Exhibits*, Kansas State University,
March 2019.