$2.00
incl. tax

UC Master Food Preserver
University of California
Agriculture & Natural Resources

UC Master Food Preservers of El Dorado County
Website: https://link.ucanr.edu/mfp-cs
Ask a Master Food Preserver: https://link.ucanr.edu/mfp-cs-ask
Visit us on Facebook and Instagram!

"Preserve today, Relish tomorrow"

Introduction to Food Safety

Part 1: PREVENTING FOODBORNE ILLNESSES

There are many factors involved in ensuring that food is safe to eat, including good sanitation practices, proper food handling and preparation, and storing and serving food safely.

Kitchen Sanitation

The first step in food safety, whether you're cooking or preserving, is sanitation. Cleaning and sanitizing (or disinfecting) are actually two separate processes, and both steps are necessary for reducing pathogens that could cause foodborne illness. **Cleaning** is the act of physically removing dirt and debris from surfaces, usually with water, soap/detergent, and scrubbing. Cleaning alone is not sufficient to remove pathogens. **Sanitizing** is the process of reducing pathogens to a safe level so that illness, contamination or spoilage is unlikely to occur. **Disinfecting** is destroying most pathogenic and other microorganisms. Disinfectants destroy or irreversibly inactivate the specific microorganisms listed on their labels (but they may not inactivate spores).

Sanitizing is generally considered the acceptable level for treating home kitchen surfaces. However, if there are vulnerable persons in the home (elderly; pregnant women; children under age 5; or severely ill or immune-compromised individuals), then disinfecting would be appropriate.

For complete details on cleaning and sanitizing the home kitchen, including step-by-step procedures, how to make and use a generic bleach solution, and much more, see our publication, *Cleaning & Sanitizing the Home Kitchen*, available to download for free from our website: https://link.ucanr.edu/mfp-cs-foodsafety.

Hand Washing

Washing your hands is another important step in ensuring food safety. Wash hands properly, and repeat as often as necessary: when changing tasks, after touching pets or your phone or door handles, if you've sneezed or gone to the bathroom, etc.

HOW TO WASH YOUR HANDS: Wet your hands, apply soap, lather and then scrub for at least 20 seconds. Rinse well and dry with paper towels or a clean cloth.

If using food handling gloves, first wash your hands and then put on gloves. Just as with your hands, wash gloves in between tasks or after touching surfaces that could introduce pathogens, or put on a new pair. Dispose of gloves after use.

Image Source: FDA

Preparing Food

Proper food handling is a critical step in food safety. Prepare food carefully: Do not wash raw seafood, meat and poultry – doing so can spread pathogens and potentially cross-contaminate other foods. Wash **all** fresh produce, even if the skin or rinds won't be eaten. To wash produce, rinse under cool running water in a clean sink – do not soak.

QUICK TIPS

- clean produce right before using
- gently rub soft fruits and vegetables (such as tomatoes) with your hands under running water to remove dirt
- scrub firm fruits and vegetables (such as potatoes, carrots, and melons) with a vegetable brush (don't forget to clean the brush!)
- remove outer leaves of lettuce and cabbage before washing
- rinse herbs and sprouts, then shake to remove excess water
- use a kitchen sink sprayer to rinse berries in a colander, gently turning and shaking the colander to remove dirt and excess water

It's also important to not re-contaminate food. Use clean cutting boards and kitchen utensils, and wash them thoroughly before switching from one food type to another, or use separate boards and utensils for different types of foods (e.g., use one board for raw fish or meat and another board for vegetables, herbs, etc.). Wipe up spills promptly, and re-clean your work area as often as necessary to avoid cross-contamination.

When grilling or barbecuing, always use a clean plate to put the cooked meat on. And consider that ice is food! Be sure to use clean ice to avoid contaminating food.

Store raw meat, fish and poultry on the bottom shelf in the refrigerator or on a plate to prevent juices from dripping onto other food items.

Image Source: Partnership for Food Safety Information

Cook to the Correct Temperatures

All foods should be cooked to the correct internal temperature to be safe. Use a calibrated food thermometer to be sure. Instructions for how to calibrate a food thermometer can be found in our food safety poster here: https://ucanr.edu/sites/default/files/2021-11/360678.pdf.

- Fish and shellfish: 145°F (cook shellfish until the shells open)
- Steaks, chops and roasts (beef, pork, lamb and veal): 145°F & allow to rest for at least 3 minutes before carving
- Ground meat (beef, pork, veal and lamb), sausages, and bacon: 160°F
- Eggs: 160°F internal temperature
- Poultry, including ground poultry and stuffing (cooked alone or in bird): 165°F
- Casseroles: 165°F
- Leftovers: reheat to 165°F

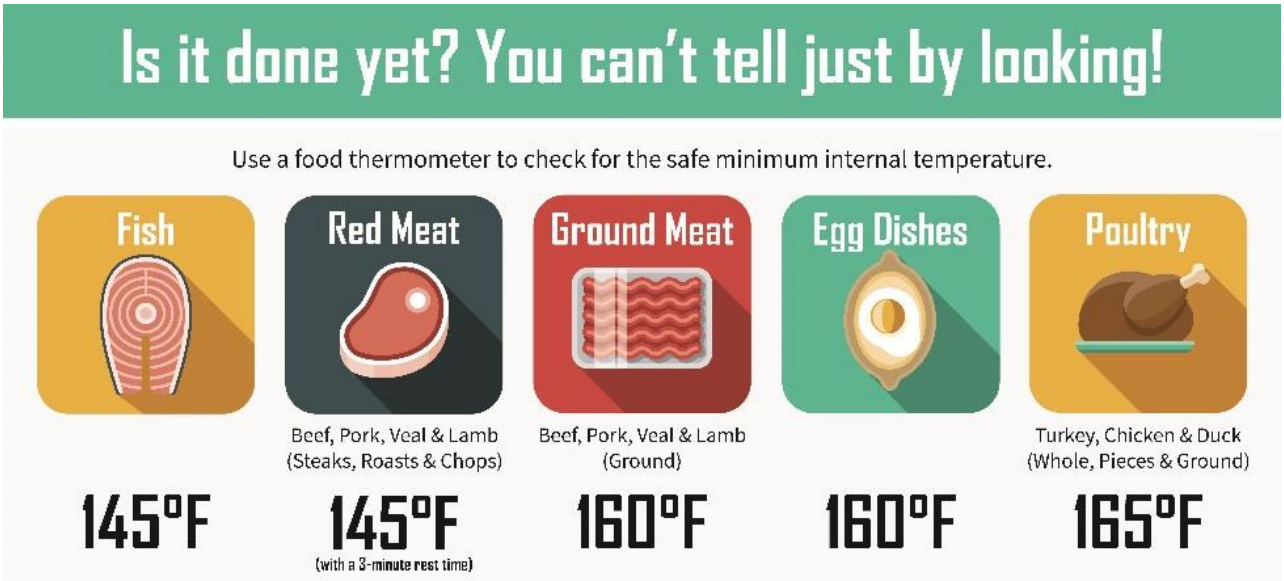


Image Source: USDA Food Safety and Inspection Service

The 2-Hour Rule

One of the basic maxims of food safety – besides cooking to proper temperatures of course – is to **keep hot foods hot and cold foods cold**. Not keeping perishable food cold enough (at or below 40°F) or hot enough (at or above 140°F) allows bacteria to multiply quickly, causing the food to become unsafe. This temperature range between 40°F to 140°F is known as the "**Danger Zone**." Thus, when preparing or serving perishable food, it's important that it not be left at room temperature for more than two hours. If the temperature is above 90°F (such as when you're entertaining outdoors), don't leave food out for more than one hour. Food left out for more than these time limits should be discarded.

Care should also be taken when defrosting frozen foods, as pathogenic bacteria can multiply as the food begins to defrost when left at room temperature. Thaw frozen foods in the fridge or under cold running water, not at room temperature.

To recap:

- **Do not leave perishable food at room temperature for more than two hours (one hour if the temperature is above 90°F).**
- This goes for food that is freshly cooked, or leftovers remaining after serving a meal or entertaining. Store foods in shallow containers and refrigerate or freeze promptly.
- Defrost frozen food safely in the refrigerator – not at room temperature.

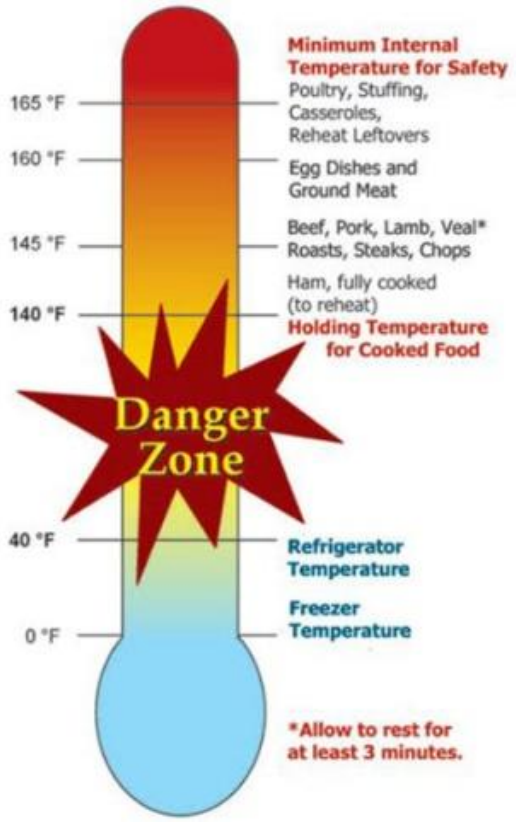


Image Source: U.S. Department of Agriculture

Leftovers

Leftovers can be a lifesaver when you need a meal in a hurry, but unfortunately they don't last forever. Or even a long time. And no, turning leftovers into another kind of leftover does not extend the life of the original food. Keeping food at proper temperatures and storing it for limited times is paramount for food safety. Label and date your leftovers, and check your fridge often and purge as required.

Most leftover foods will last in the refrigerator for **3 to 4 days**. After that time, leftovers should be tossed. And it should go without saying that any food that is obviously spoiled (it smells unpleasant, or is discolored or moldy or abnormally soft) should be immediately thrown out, no matter how long it has been stored. If there is any doubt, throw it out.

For more information on storing food and beverages, visit **The FoodKeeper page** at https://www.foodsafety.gov/keep-food-safe/foodkeeper-app, where you can browse by category or use the search function to look up something specific. There's also a **FoodKeeper mobile app** available for Android and Apple devices.

When In Doubt, Throw It Out

Never taste food that looks or smells strange to see if it can still be eaten. **Just discard it.** Most bacteria that cause foodborne illness are odorless, colorless, and tasteless. If there is any doubt, just throw it out.

For general information on food safety, here are some good websites to visit:
http://www.foodsafety.gov
http://www.fightbac.org
https://www.cdc.gov/food-safety/about/what-cdc-is-doing.html?CDC_AAref_Val=https://www.cdc.gov/foodsafety/cdc-and-food-safety.html

Refrigerator and Freezer Temperatures

Cold storage slows the growth of microorganisms, enzyme activity, and physical and chemical changes, thus extending the shelf life of food. Keeping your refrigerator and freezer set to safe temperatures, and handling food going into as well coming out of these devices, helps to prevent spoilage and ensure that your food remains safe to consume.

REFRIGERATION: This cold storage process retards the growth of microorganisms and slows the action of enzymes.

- Keep your refrigerator set at 40°F or below.
- Refrigerate all perishable foods.
- Divide leftover hot food into shallow containers to accelerate cooling, then refrigerate within 2 hours after preparation.

FREEZING: Freezing prevents the *growth* of microorganisms, but it does not necessarily kill them. It slows, but does not stop, enzymatic activity. Therefore, enzymes in most fresh vegetables must be inactivated by blanching before freezing.

- For the highest quality, lower the food temperature to 0°F as rapidly as possible and maintain 0°F food temperatures.
- Freeze only the amount you can use before its shelf life expires. Use packaging that is moisture proof, sealable, and oxygen impermeable to retain quality.

POWER OUTAGES: In the event the power goes out, the best thing to do is to avoid opening the refrigerator or freezer in order to maintain cold temperatures. Food will remain safely cold in a refrigerator for about 4 hours if the door is kept closed. Food in a freezer will remain safely cold for about 24 hours in a half-full freezer, or 48 hours in a full freezer (again, with the door remaining closed).

- Perishable food that has been at 40°F or above for 2 hours or more should be discarded.
- Frozen food that has thawed can be safely refrozen if it still has ice crystals (although the quality may be lower).

For further information on keeping food safe during power outages, what food is safe to keep or should be discarded, and planning ahead for emergencies, visit these websites:

https://www.foodsafety.gov/food-safety-charts/food-safety-during-power-outage

https://www.fsis.usda.gov/food-safety/safe-food-handling-and-preparation/emergencies/keep-your-food-safe-during-emergencies

Part 2: MICROORGANISMS & FOOD SAFETY

Factors That Affect the Growth of Microorganisms

Several factors enable microorganisms to grow and potentially cause foodborne illness or spoilage.

TEMPERATURE: Foodborne pathogens grow best under the same conditions that allow people to thrive. Most foodborne bacteria grow fastest at temperatures from 90° to 110°F. However, foodborne bacteria will grow in the temperature range known as the ***Danger Zone***, 40° to 140°F; some grow at temperatures below this range.

ACIDITY OR ALKALINITY (PH): Most organisms grow best under conditions that have a neutral pH, rather than highly acid or alkaline (few foods are highly alkaline). High acid foods generally do not support bacterial growth.

MOISTURE: Microorganisms require moisture for growth. Dehydration preserves foods by removing moisture.

OXYGEN: Most microorganisms require oxygen to grow; a few pathogens do not, or may require limited oxygen. However, controlling oxygen content is not useful for controlling bacterial growth for home food preservers.

TIME: It takes time for microorganisms to grow or multiply in foods. The time required is affected by temperature, acidity, moisture and oxygen levels. Under ideal conditions bacteria can double in number every 10 to 20 minutes.

FOOD: Bacteria require nutrients to reproduce. Foods provide proteins and carbohydrates for growth.

INHIBITORS: Some natural compounds/food additives are bacterial inhibitors (sugar, acid).

Potentially Dangerous Microorganisms

There are several categories of pathogenic organisms that can potentially cause foodborne illness; these include bacteria, viruses, and parasites. Molds can also cause foodborne illness, although they are primarily spoilage organisms. There are 31 pathogens currently known to cause foodborne illness; the top five are: 1) Norovirus; 2) Salmonella; 3) Clostridium perfringens; 4) Campylobacter; and 5) Staphylococcus. Other pathogens which are big contributors to foodborne illness include E. coli, Listeria, Clostridium botulinum, Shigella, and Hepatitus A. The specific symptoms caused by these organisms can vary, however there are many common ones, primarily gastroenteritis (abdominal cramps, diarrhea, and nausea and/or vomiting). Other signs of foodborne illness include fever, chills, fatigue, and loss of appetite. In severe cases, such as botulism, people may experience difficulty with speaking or swallowing, facial weakness or paralysis, blurred or double vision, or respiratory failure.

Note that food that is contaminated with pathogenic organisms generally does not have any identifying characteristics, such as bad odor, appearance, or taste.

BACTERIA: These microscopic, one-celled microorganisms can multiply quickly. Not all bacteria are harmful; those that can cause illness are known as pathogenic bacteria. They can come from human, animal, or soil reservoirs. Bacteria that are of particular concern include:

- *Salmonella species.* The leading cause of foodborne illness, this bacteria is found in raw meats, poultry, eggs, fish, milk/milk products, and raw fruits and vegetables. It multiplies rapidly at room temperature. The disease state is known as salmonellosis.
- *Campylobacter jejuni.* Commonly found in raw or undercooked poultry, meats, seafood, and produce. People can also become infected by contact with animals or untreated water. It is a leading cause of foodborne illness.
- *Clostridium perfringens.* This bacteria can double very quickly – under ideal conditions, every 15 minutes. Spores of *C. perfringens* can survive the cooking process, and they can grow and produce toxin in unrefrigerated food.
- *Staphylococcus aureus.* This bacteria grows in meats, poultry, egg products, milk, salads with protein, macaroni and potato salads, tuna, puddings, custards, cream pies and pastries, and other high protein food is left too long at room temperature. It produces a toxin that is not killed by cooking temperatures. At least 25% of people carry *S. aureus* on their noses, throats, hair, and skin.
- *Clostridium botulinum.* Spores from this bacteria are widespread in the environment. Inadequate processing of vegetables and meats, which are low-acid foods, can result in the spores germinating and releasing a toxin which is known to cause botulism. This toxin is only produced in anaerobic (oxygen free) environments with low acidity, which is why following proper canning recipes and methods is imperative.
- *E. coli 0157:H7*. This common bacteria is found in all animal and human digestive systems. As few as 10 bacterial cells may be enough to cause illness from the toxin it produces. Sources include undercooked meats, unpasteurized juices and milk, and sprouts. E. coli can grow in the refrigerator if temperatures are above 40°F.
- *Listeria monocytogenes*. This widespread bacteria is found in soil, vegetation and water, and is frequently carried by humans and animals. It can survive for a long periods of time under adverse conditions and can grow at refrigerator temperatures. The foods it is most commonly found in include raw milk, soft cheese and processed foods (i.e. deli meats).

VIRUSES: Viruses are smaller than bacteria. They cannot grow in food; they need living host. Some viruses can survive cooking and freezing. Viruses can be transmitted to humans through food and contaminated water. Examples include: **Hepatitis A**, **Rotavirus**, and **Norwalk Virus (Norovirus)**. Norovirus is now considered to be the leading cause of foodborne illness and is highly contagious. Infection can be contracted from contaminated food, other infected persons, and contaminated surfaces.

MOLDS: Molds are primarily spoilage organisms, however there are some health concerns. The mold you see on food is only the "tip of the iceberg," indicating colonies of mold under the surface. Molds produce can produce toxins, known as mycotoxins; some of these toxins are carcinogenic. Moldy foods should be discarded (except for hard cheese which do not have excessive mold; in such case trim off the mold, removing at least 1" below the moldy area).

Another type of mycotoxin, patulin, can produce serious illness in humans and animals. It is associated with windfalls (fruit that comes in contact with the ground). Patulin is heat stable, even at pasteurization temperatures. Fruit contaminated with mold is more likely to spoil when canned. For these reasons, consuming or preserving windfall fruit is not recommended.

PARASITES: Parasites live on or in another living host. Intestinal worms and protozoa parasites (protozoa parasites are the smallest and most primitive form of animal life) are the major classes of foodborne parasites. Common infections include:

- *Trichinosis* (from *Trichinella* roundworms in pork, bear, and other game meat.
- *Cysticercosis (*from beef tapeworm).
- *Anisakiasis* (from fish roundworms).
- *Giardiasis* (from Giardia *lamblia*, obtained from fecal contamination of toys, food, and water [such as untreated water from mountain streams]).
- *Toxoplasmosis* (from *Toxoplasma gondii*, by consuming raw or undercooked meat, unwashed or uncooked fruits and vegetables, and in the feces of infected cats).

Part 3: FOOD PRESERVATION

Major Methods of Food Preservation

There are seven major methods of food preservation.

REFRIGERATION AND FREEZING (COLD STORAGE): Keeping food cold slows the growth of microorganisms, enzyme activity, and physical and chemical changes, thus extending the shelf life of food. Freezing is more effective than refrigeration in preventing food deterioration, and can extend shelf life up to one year.

CANNING: With proper canning practices, air is forced from the jars, leaving a vacuum. Heat destroys most heat-resistant microorganisms capable of growing in food stored at room temperature. Molds and some yeasts are unable to grow in a vacuum. However, there is a very healthy growth environment for anaerobic bacteria in sealed, home-canned foods. Such foods must be heat processed until a commercially sterile product is achieved, or they must have salts, sugars, acids or other preservatives added. Yeasts and molds are destroyed when food temperatures reach about 190°F, whereas most bacterial vegetative cells are destroyed in foods heated to a boiling temperature. Bacterial spores can survive for a long period at the temperature of boiling water.

The method of processing depends on the type of food to be canned. High-acid foods, such as most fruits and pickles, may be processed in a boiling water or atmospheric steam canner. Low-acid foods, such as meat, poultry and vegetables, are processed in a pressure canner. For safety, *always* follow the method specified in a research-based recipe.

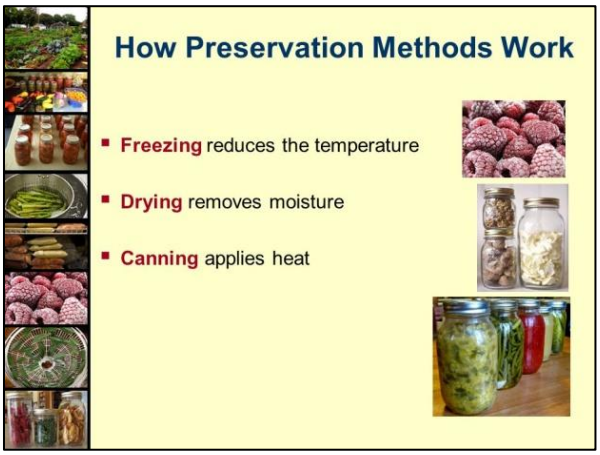
Some canning methods have been shown to be unsafe and are NOT recommended by the USDA or the NCHFP. These include the **open kettle** method (in which hot food is put into jars, lids are applied and the jars inverted, with no heat processing done); the **oven, dishwasher, microwave, or solar methods** (jars of hot food are heated in these ovens, which cannot properly sterilize the food); and the **dry canning** method (where dry food is processed without liquid, either in a canner or in an oven). Also ***not* recommended is inverting jars** when they are removed from the canner. This can allow food to get between the rim of the jar and the lid, resulting in a weakened seal.

SWEETENING AND ACIDIFYING JAMS & JELLIES: Sugar ties up free water, and acids (whether naturally occurring or added) lower pH to safe levels.

PICKLING AND FERMENTING: Naturally produced and/or added acids inhibit or prevent the growth of *Clostridium* botulinum as well as molds and other pathogens. Fermenting uses bacteria to produce lactic acid, which lowers the pH in products such as fermented pickles and sauerkraut.

DRYING: Dehydrating removes water from food, preventing the growth of microorganisms and controlling enzyme activity.

SALTING: Salt chemically bonds water, inhibiting the growth of some bacteria.



Packaging

The success of all preservation methods depends on using appropriate packaging. Airtight packages prevent recontamination of foods and are ideally suited for most preserved foods.

When canning, use standard canning jars, lids and rings. Paraffin, as a sealing agent, is not recommended. When freezing, use freezer-safe plastic or glass containers, leaving an appropriate amount of headspace. Freezer bags may also be used. Dried foods should be packaged in air-tight containers so that moisture is not re-introduced to the food.

Resources

Further information on food safety and food preservation is available from these sources:

National Center for Home Food Processing https://nchfp.uga.edu/
USDA Complete Guide to Home Canning https://nchfp.uga.edu/resources/category/usda-guide
So Easy to Preserve https://setp.uga.edu/
Ball Blue Book Guide to Preserving. ©2024. Newell Brands Inc.
Ball Complete Book of Home Preserving. ©2024. Newell Brands Inc.
All New Ball Book of Canning and Preserving. ©2023. Newell Brands Inc.
Ball website: https://www.ballmasonjars.com/
Bernardin website: https://www.bernardin.ca/