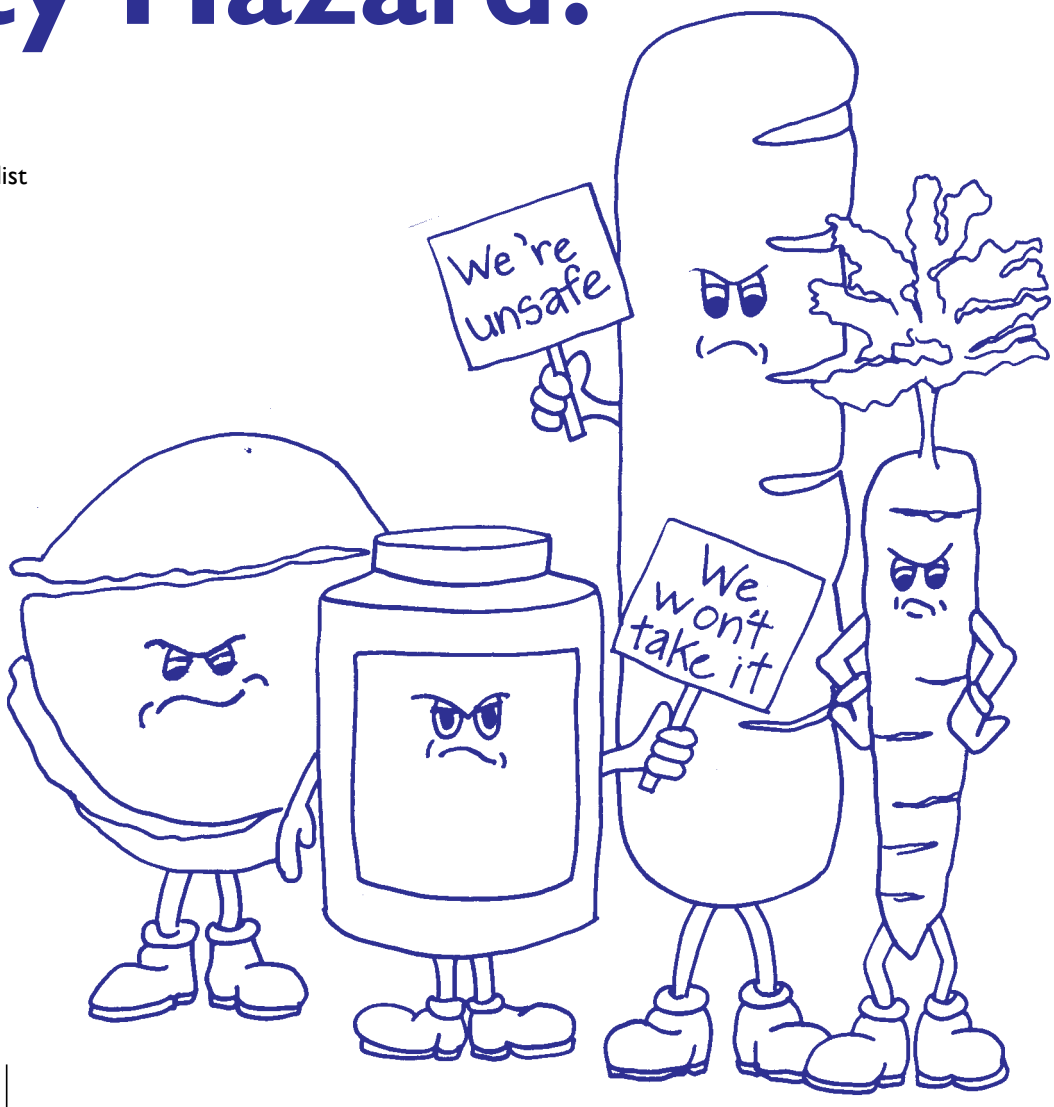
FN492 (Reviewed October 2026)

Is Food In My Kitchen a Safety Hazard?

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Many consumers and others who handle food on a regular basis seem to take a casual approach to microbiological causes of foodborne illnesses.

The Centers for Disease Control and Prevention (CDC) estimates that about 76 million Americans every year suffer from bouts with food poisoning and about 5,000 victims die. The Food and Drug Administration (FDA) has estimated that as many as one in four Americans suffers from some form of food poisoning each year. Estimates vary because many cases of food poisoning from microorganisms go undiagnosed or unreported because symptoms may be similar to flu.

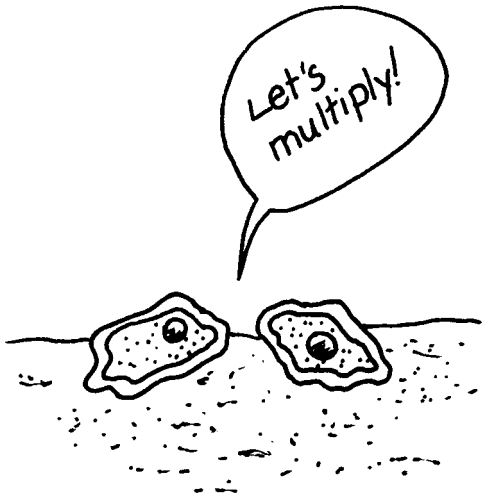
The economic impact of foodborne disease is staggering, with costs of medical care and lost productivity estimated at $6.5 to $35 billion annually.

Foodborne illness is a more comprehensive and accurate term than food poisoning. Food poisoning refers more specifically to those illnesses caused by toxins or poisons produced by microorganisms. Ptomaine poisoning was another term used in the past that does not describe illnesses accurately.

New knowledge and technology have provided us with the means to keep food safe. At the same time, other new and modified technologies may introduce additional opportunities for foodborne illness to enter the picture. Some of these concerns are discussed under Food Safety Tips on page 10.

Today more causes of foodborne illness have been identified and have become concerns. In 1958, a leading food microbiology textbook listed only three agents of foodborne illness. In recent years, means of detecting certain organisms, such as *Campylobacter jejuni, Listeria monocytogenes, Yersinia enterocolitica,* etc., have added many more to the list.

Proper food handling practices in the home can help prevent foodborne illnesses. Homemakers should examine their kitchen environment for hazards, and they can do this only if they are aware of foodborne hazards.



Foodborne Illness and Foodborne Disease are terms used when a disease or injury occurs as a result of eating a contaminated food. Contaminated foods are foods in which microorganisms are present and will grow, or foods which merely serve as a carrier for a microbial agent, virus or toxin.

A hazard is a source of danger. It is a place where food safety problems can begin if foods are not handled properly.

Know the Hazards

Foods don't cause illness;
disease-causing microorganisms (pathogens) do.

All foods are subject to spoilage that may make them undesirable for eating. However, not all foods can cause foodborne illness. For example, an overripe pear is soft, mushy and very unappealing, but it would not be unsafe to eat.

Some microorganisms are used for a desirable change in foods. Yeasts are used in bread and wine making. Certain bacteria are required to make sauerkraut or to sour milk. Molds are a part of ripening of some cheeses.

Foodborne illnesses are caused by pathogenic microorganisms, which include viruses, yeasts, molds and bacteria, including *Salmonella sp.* and *Staphylococcus aureus.* Some parasites that may be dangerous, such as *Trichinella spiralis,* also can be found in some foods.

Certain conditions need to be present before a food can carry a foodborne illness:

- The food is a potentially hazardous food.
- Pathogenic (disease-causing) microorganisms need to be present.
- Inappropriate food handling practices are used.
- Time-temperature combinations are such that microorganisms will grow in foods.
- Environmental conditions permit the maintenance and transfer of pathogenic foodborne microorganisms.

Potentially Hazardous Foods

"Potentially hazardous" foods sound to many of us like something we don't want to eat. In reality, this descriptive phrase has been used for many years by food regulators such as FDA and health departments. Food regulators can ***require*** proper refrigeration and cooking for foods designated as "potentially hazardous."

As interest and concern about food safety have increased, the designation has appeared in popular papers and magazines. The designation "potentially hazardous food" simply identifies food for which time/temperature management is necessary for safety. For example, an apple pie is not considered a potentially hazardous food because it may be kept at room temperature and remain safe to eat. A banana cream pie, on the other hand, is a potentially hazardous food because it must be kept under refrigeration to maintain its safety.

Potentially hazardous food includes a wide range of perfectly wholesome, nutritious food commonly found in home refrigerators, including most meats, poultry, fish, dairy products, cooked pastas and cooked vegetables. The term does not imply that a food is naturally unhealthful. Rather, it means that the food needs to be stored under proper refrigeration and must be handled and cooked properly to maintain its safety.

Any food that supports or allows the growth of pathogenic microorganisms needs to be handled with special care to be kept safe for human consumption. Foods with protein (amino acids), low acidity and high moisture (available water) are likely to support microorganism growth. (See Table 1.)

Table 1: Characteristics of Foods

Characteristic	Foods
Protein Foods (Amino Acids)	meat, poultry, fish, dairy products, eggs
Low Acid	protein foods listed above vegetables except tomatoes
Moisture	
High (above 40%)	protein foods listed above fruits and vegetables
Intermediate (20-40%)	soft candies; jams; jellies; honey; many dried fruits; some bakery items; some meat products such as pepperoni, country ham, jerky and some dried fish
Low (Below 20%)	dry milk; dry eggs; flour; cereals; dehydrated vegetables and meats

Water in food is one of the most important factors influencing microbial growth. The moisture must be available — that is, not tied up in any way. Sugars and salts will tie up moisture. This means that the moisture is not available for microorganisms to use for growth. Syrups and honey are examples of foods that appear to have a lot of moisture but do not spoil without refrigeration because their moisture is bound by the high sugar concentration. Another example is ketchup, which is high moisture but also contains enough acid to be safe at room temperature.

Certain foods are involved repeatedly in cases of foodborne diseases. Foods that have been identified in the United States as vehicles from 1977-1984 are listed below:

Item	Number
Roast Beef	155
Raw Shellfish (mostly Norwalklike virus illnesses)	128
Turkey	86
Chicken	69
Ham	65
Pork, Unspecified	57
Mexican-style Foods (beans, ground/shredded meat)	56
Chinese Food (mostly rice)	51
Potato Salad	41
Rice	27
Chicken Salad	22
Cream-filled Pastry	17
Meat Tacos/Enchiladas	14
Shrimp	14
Macaroni Salad	12
Pizza	11
Turkey Salad	10
Tuna Salad	9
Ground Meat	9
Barbecue Meat	9
Egg Salad	7

Surveillance data from Centers for Disease Control (Bryan, 1988a).

These Foods Require Special Care:

Meat, poultry, fish, shellfish, meat-and-seafood salads, potato salad, milk products, eggs, cream pies, custards, eclairs, cream puffs, cake fillings, gravies, cooked pasta, cooked vegetables, mushrooms, rice and refried beans.

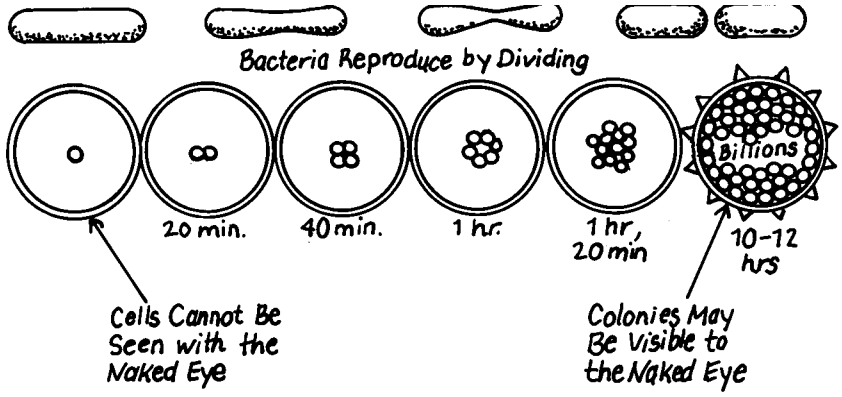
Where Do Pathogenic Microorganisms Come From?

Microorganisms are abundant in nature and the cause of most foodborne illness. Bacteria usually are found on all agricultural and fishery products. People and animals, including pets, are another major source of bacteria. In essence, the microorganisms are almost everywhere.

These microorganisms do not increase in size but increase in numbers. Limited numbers in food are not enough to cause illness. Therefore, control lies not only in reducing contamination, but in preventing conditions that would allow microorganisms to multiply.

Raw foods brought into the kitchen sometimes bring pathogenic microorganisms with them. For example, raw meat and poultry often carry *Clostridium perfringens, Staphylococcus aureus* and *Salmonella* bacteria. Eggs, when laid, may harbor salmonellae. Fish, shellfish and marine crustaceans sometimes are contaminated with *Vibrio parahaemolyticus*. Raw vegetables and spices often are contaminated with *C. perfringens* and *Bacillus cereus*.

Figure 1: Bacteria reproduce by dividing.



Eliminating all of these microorganisms is not feasible. However, when we know they may exist, almost all cases of bacterial foodborne illness can be prevented by proper food handling.

Molds

Molds grow under a wide range of conditions but are most likely to spoil acidic foods such as fruits, or low-moisture foods such as bread. Under these conditions, molds outgrow bacteria.

If only a small area of mold is found on a piece of hard block cheese, hard salami or a dry-cured country ham, the food can be salvaged by cutting out an inch of the product surrounding and below the moldy area. Keep the knife out of the mold itself and re-cover the food in fresh wrap.

Some foods, such as blue cheese, get their flavor from mold growth. Any visibly moldy foods that should not have mold growth, such as other cheeses, sour cream, hot dogs, lunch meats, baked chicken, soft fruits and vegetables, bread, cake, flour, rice, peanut butter and jelly, should be discarded. To avoid spreading mold spores, gently wrap the food or place it in a bag before discarding. Be sure to examine other items that the moldy food may have contacted. With hot, soapy water, clean the refrigerator or the container that held the item.

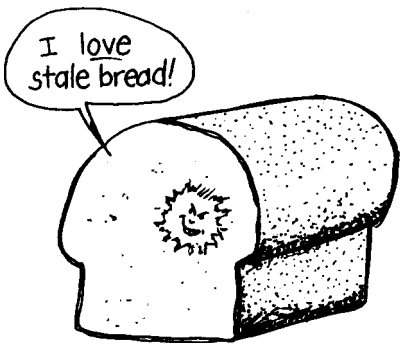
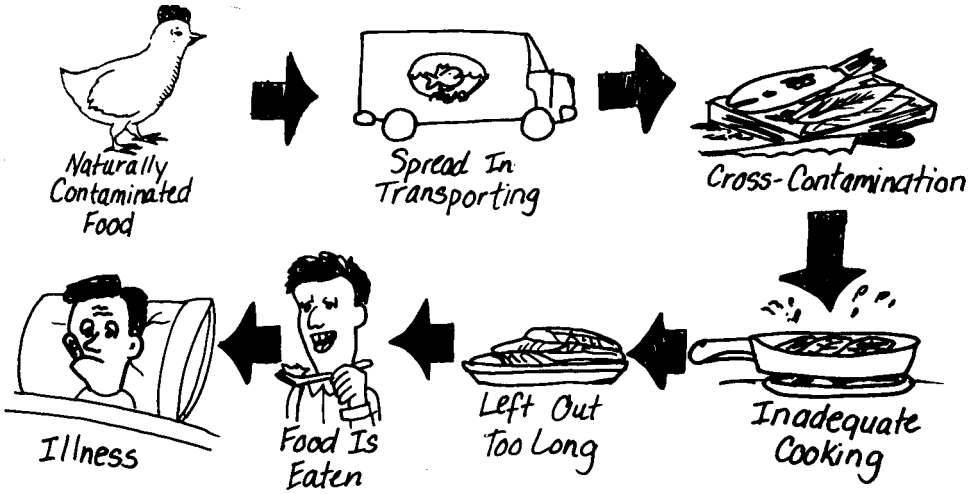


Figure 2: Salmonella — From Microorganism to Illness



Some molds produce toxins (poisons), and determining which do and which don't is difficult. The most toxic molds grow on grains. The visible mold may not be all the mold that developed. The threadlike hyphae (the equivalent of roots) may have penetrated the food.

Practice the following to keep foods from molding:

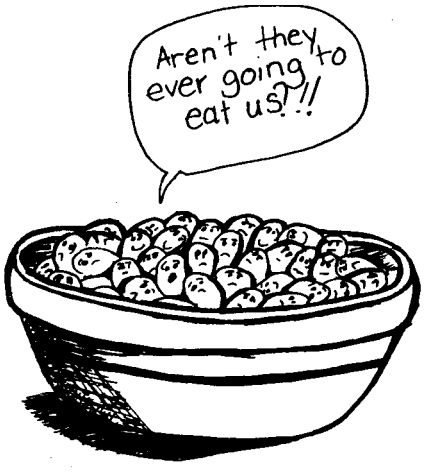
- Protect fruits and vegetables from damage.
- Wash fruits and vegetables only when you are ready to eat them. This is especially true for berries.
- If larger fruits are washed before storage, dry them well.
- Refrigerate produce to prevent or slow mold growth.

Handle Those Foods Safely

Most foodborne illnesses result from mishandling of food either in the home or in food service establishments.

If food is prepared properly and eaten shortly after preparation, the likelihood of foodborne illness is low. But as the time between cooking and eating increases, temperature control during the interim becomes of greater concern. Preparing foods a day before serving, improper cooking, inadequate reheating and improper hot-holding usually are identified as contributing factors to foodborne illness outbreaks, and these things often are done when large groups are fed for family reunions or a community gathering.

Cooking can destroy natural barriers to contamination in some foods from plant sources and can free nutrients needed for microorganisms to grow in these foods. Outbreaks of foodborne illness have been associated with bean curd (tofu), corn, lima beans, mushrooms, refried beans, rice, squash and sweet potatoes that were cooked and then held for some time before eating.



Botulism — The Deadly Toxin

Fortunately, botulism cases are few, but they can be deadly or have long-lasting effects. The *Clostridium botulinum* bacteria grow in low-acid foods (see Table 1) that are in a reduced-oxygen or oxygen free (anaerobic) environment and produce a toxin. It is the toxin that causes the illness.

When foods are canned, a vacuum is formed, and the can, jar or package becomes a low-oxygen environment. Therefore, making sure that all *C. botulinum* spores are destroyed by the heat treatment during processing of low-acid foods is important so the botulism toxin is not produced. Low-acid foods are listed on Table 1.

Mixing acid and low-acid foods changes the acidity of the product and the canning procedures. The salsas, hot sauces and picante sauces that have become so popular today are mixtures of acidic (tomato) and low-acid (green pepper, hot peppers, onion, celery, etc.) ingredients. These generally are eaten without reheating. **Caution: These products can be unsafe if not canned properly.**

Use only tested canning recipes from a reliable source, such as the U.S. Department of Agriculture, when home canning these products. Many of these mixtures will require pressure processing to assure safety. These products also can be frozen safely.

Foods that are vacuum packaged, either at home or commercially, are in an oxygen-reduced environment. Many meat products are on the market in vacuum packages. Potentially hazardous products packaged in this manner maintain a high quality for longer periods of time but must be kept refrigerated and should be used within the recommended time to assure safety. Using home vacuum packaging equipment does not take the place of heat processing foods for preservation.

Food Preservation

Home food preservation can be safe when current, tested recommendations are followed. Consider the following:

- Current recommended processing times should be used.
- All low-acid foods (see Table 1) must be pressure processed, frozen or dried.
- All canned foods need a heat treatment — that is, pressure processing or hot-water bath — after they are placed in the jars.
- Any unsealed product must be reprocessed, frozen or refrigerated within 24 hours.

Do not assume that all boxed and canned goods may be held at room temperature. Read labels!

Most food poisoning bacteria are odorless, colorless and tasteless. Therefore, the only sense protecting you against foodborne illness is common sense. *If in doubt, throw it out!*

Raw Milk Caution

Almost all milk is pasteurized these days. Yet some people still use raw (unpasteurized) milk and should be aware that it can be a food safety hazard.

Pasteurization is a mild heating process that kills pathogenic microorganisms in milk. Pasteurization has little effect on the nutrients — only a slight decrease in thiamine, vitamin B12 and vitamin C.

Milk is an excellent vehicle for bacterial infection. While immunization and testing of cows in this country virtually has eradicated many diseases, bacteria, viruses and other microorganisms; however, they still have many avenues by which they enter milk. Pasteurization is by far the most reliable safeguard.

Several serious disease outbreaks in recent years have been traced to raw milk or raw milk products. Some of the pathogenic microorganisms involved were *Campylobacter jejuni, Salmonella sp.* and *Listeria monocytogenes*.

HACCP

HACCP stands for Hazard Analysis Critical Control Point. Very simply, this system is designed to ensure food safety by reducing the likelihood of foodborne illness. This is accomplished by identifying the places and procedures in which food could become unsafe during food handling, preparation and storage. Then steps are taken to control these points to assure the safety of the food.

This method is used by the food industry and regulatory agencies. As both manager and regulator of your own home food supply, you can use some of these concepts to make sure eating at home does not become a safety hazard.

The following tips are provided to help home kitchen managers be aware of items to consider when examining their home food practices for food safety hazards. The articles supply more detail to help increase your understanding of the reasons for some of these tips.



SHOPPING

Container Condition

Swollen or dented cans may be an indication that food spoilage has occurred or is possible. The swelling is caused by gases produced by spoiling foods or microorganisms. Dents that occur from handling may affect the seals.

Soiled or torn packages and labels may indicate careless handling, old products, tampering or spoilage. Streaks on containers may indicate leakage at some point. Punctures or broken seals in packaging will allow for outside contamination.

Cross Contamination

Raw meats, poultry and fish, which are safe to eat when properly cooked, can contaminate foods that will be eaten without further cooking. To prevent cross-contamination, position packages of raw meat, poultry and fish in your shopping cart so their juices cannot drip on other foods. You may wish to enclose individual packages in plastic bags.

Ask store baggers to keep the raw meats separate from the ready-to-eat foods.

Shopping Tips

- ✔ **Buy only foods in good condition and with sound packaging.**
- ✔ **Shop just before going home.**
- ✔ **Shop for perishable foods last.**
- ✔ **Buy products labeled "Keep Refrigerated" only if they are stored in a refrigerated case.**
- ✔ **Buy eggs only from refrigerated cases.**
- ✔ **Buy unpackaged meat or poultry from refrigerated cases in the deli only if it has not been in contact with other foods.**
- ✔ **Keep refrigerated and frozen items together so they remain cold.**
- ✔ **Buy only foods that can be used before the use-by date.**
- ✔ **Buy only the amount of shaved deli meats that can be used in one or two days.**
- ✔ **Buy frozen foods that are frozen solid without frost buildup on the package.**
- ✔ **Avoid cross-contamination.**
- ✔ **Report problems with packaging, product, storage or sanitation to store management. If you still are unsatisfied, report the problem to local health authorities.**

TRANSPORTING

Transporting Tips

- ✔ **Place perishables in an ice chest if the store-to-home trip is longer than one hour.**
- ✔ **If you buy hot food items, take them home immediately and eat or hold no longer than two hours at 140 degrees Fahrenheit or hotter.**
- ✔ **Never leave food in a hot car. A rule of thumb: If ice cream melts, food has been temperature-abused too long.**
- ✔ **Avoid dropping and crushing packages.**
- ✔ **Make sure perishable foods carried to a picnic are kept cold until eaten. Foods that tend to spoil easily without refrigeration should not be exposed to warm temperatures for more than one hour before eating.**

STORING

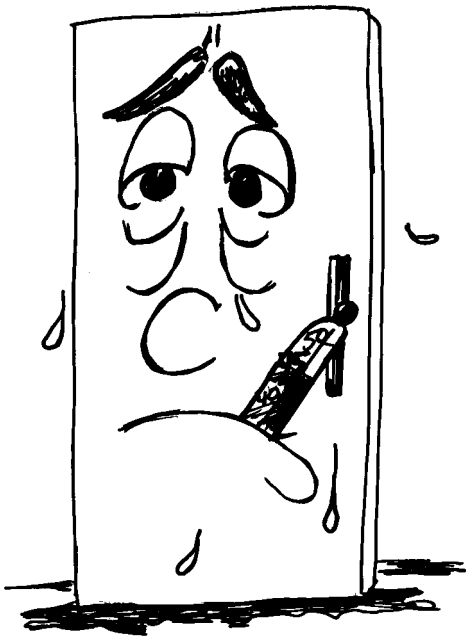
Storing Tips

- ✔ **Check the temperature of your refrigerator and freezer.**
- ✔ **Freeze fresh meat, poultry or fish immediately if you can't use it within two days.**
- ✔ **Put packages of raw meat, poultry or fish on a plate before refrigerating or when defrosting so their juices won't drip on other food. Raw juices often contain microorganisms.**
- ✔ **Refrigerate products with "Keep Refrigerated" labels.**
- ✔ **If your refrigerator fails, keep the door closed and hold food at 40 degrees Fahrenheit or cook perishable food within a few hours.**
- ✔ **Buy clean eggs and refrigerate them in their original carton without washing.**
- ✔ **Promptly refrigerate all dairy products, including mixtures made from dry mixes such as reconstituted dry milk or prepared puddings.**

Refrigerator/ Freezer Temperatures

A survey showed that most homeowners were unaware of the importance of proper refrigerator temperature ranges and the negative effects of improper temperatures. Temperatures checked in 14 homes ranged from 32 to 55 degrees Fahrenheit in refrigerators and from 5 to 20 degrees Fahrenheit in freezers.

To keep microorganisms in check, the refrigerator should run at a maximum of 40 degrees. A freezer temperature of 0 degrees or lower will maintain food at top quality for the longest period of time. Check the temperature of your refrigerator and freezer with an appliance thermometer.



Food Safety Tips

Refrigerated fresh prepared foods and hot ready-to-eat foods are common not only in delis but also in supermarkets. Foods found in this category include everything from pasta and vegetables to fish, chicken and beef, and they range from salads and soups to complete dinners.

Innovative processing and packaging, including partial cooking of fresh food, vacuum packaging or modified atmosphere packaging (MAP) and tightly controlled refrigeration, characterize recent technology. These foods offer more of a just-cooked flavor than canned or frozen foods and have a longer shelf life than traditional refrigerated foods.

The shelf life of these foods may be extended two, three or even four weeks, depending on the specific food. **These foods must be kept cold during all stages of their shelf life.** Inappropriate temperatures could make them unsafe to eat because these refrigerated foods are not heated to sufficient temperatures for a long enough time during precooking to destroy all microorganisms.

The minimal processing some of these foods receive will kill some harmless spoilage microorganisms that might warn consumers that spoilage has taken place by causing odors. But dangerous microorganisms, such as certain strains of botulism bacteria, that survive may not make the food taste or smell bad. In other words, refrigerated foods can look or smell fine but be hazardous.

Once these foods are opened, they must be stored and used within a period of time that reflects the perishable nature of the product. For example, the date on a package of vacuum-packed luncheon meat may be four weeks from the date you

purchase it. However, once you open the package, the meat should be used within three to five days, even if the date on the package has two weeks to go.

To Use Vacuum-packaged Refrigerated Foods Safely, Follow These Tips:

- **Recognize the package.** Sometimes fresh refrigerated foods are sold in glass jars, reheatable pouches and even metal cans that may give the impression they can be stored at room temperature. These foods frequently are found in the dairy, deli or refrigerated meats sections of the supermarket. If you buy them, refrigerate them at home as quickly as you would traditional refrigerated foods such as milk and eggs.
- **Keep Foods Refrigerated.** Select these foods last on your trip through the supermarket. Get them home and refrigerate immediately in the colder areas of your refrigerator. Avoid storing vacuum-packaged foods in the refrigerator door because the temperature is warmer there.
- **Follow label directions.** Pay special attention to "keep refrigerated," "sell-by" or "use-by" dates. Throw away vacuum-packaged foods not used by the expiration date. You can't rely on your nose to tell if the food has spoiled.
- **Heat thoroughly.** Follow the Follow the package instructions for time and temperature. When microwaving foods, always stir food well to distribute heat evenly. Allow standing time as directed.

✔ If your freezer fails, keep the door closed. You may refreeze foods that still have ice crystals and feel as cold as if refrigerated, but quality will be affected. Frozen dairy products including ice cream or frozen yogurt are an exception and should be discarded.

✔ If the freezer compartment of your refrigerator fails, keep the door closed and find another freezer within a few hours or cook and serve the contents.

Cupboard Storage

- Store foods in cool cabinets and away from appliances that produce heat.
- Many staples and canned foods have a relatively long shelf life, but buy only what you expect to use within the time recommended in the chart. Date food packages and use the oldest first. Foods stored for longer than recommended times or beyond the date on the package may change quality, color and flavor.
- Buy fresh-looking packages. Dusty cans or torn labels can indicate old stock. Do not purchase dented or bulging cans.

Storing Breast Milk

* *Laboratory studies have found that refrigerated human milk may be good for up to five days. However, conditions in homes and laboratories are not the same. Two days is a safe guideline for home use of refrigerated human milk.*

Can Your Kitchen Pass the Test?

Your Cupboards:

Are your cupboards clean?

Inside ❑ yes ❑ no

Outside ❑ yes ❑ no

Is contact paper, if used, in good condition? ❑ yes ❑ no

Your Kitchen Cloths:

Are kitchen cloths clean? ❑ yes ❑ no

Are cloths laundered and sanitized often? ❑ yes ❑ no

Your Dishwasher:

Do you wipe out the inside of the dishwasher and sanitize it periodically?* ❑ yes ❑ no

Your Refrigerator:

Is your refrigerator clean? ❑ yes ❑ no

Have you moved and scrubbed under it? ❑ yes ❑ no

Is it clean on top? ❑ yes ❑ no

Is the defrost pan clean? ❑ yes ❑ no

Do you know what is in all the containers? ❑ yes ❑ no

Your Stove:

Do you clean the smoke hood and filters? ❑ yes ❑ no

Is the stove clean? ❑ yes ❑ no

Drip trays? ❑ yes ❑ no

Knobs? ❑ yes ❑ no

Miscellaneous:

Is your floor clean? ❑ yes ❑ no

Are the can opener blades spotless? ❑ yes ❑ no

Do you clean the crumb tray of the unplugged toaster periodically? ❑ yes ❑ no

Are countertops clean? Are corners and edges clean

(a clean toothbrush works well)? ❑ yes ❑ no

***1 teaspoon of household bleach in 1 quart of warm water can be used to sanitize.**

PREPARATION

What are the Issues?

Food safety is seen as an important issue among consumers, yet they continue certain unsafe food handling practices. According to a USDA survey of factors related to buying food, 88% of women and 79% of men rated food safety as the top issue related to buying food. Taste and nutrition came in second and third, respectively.

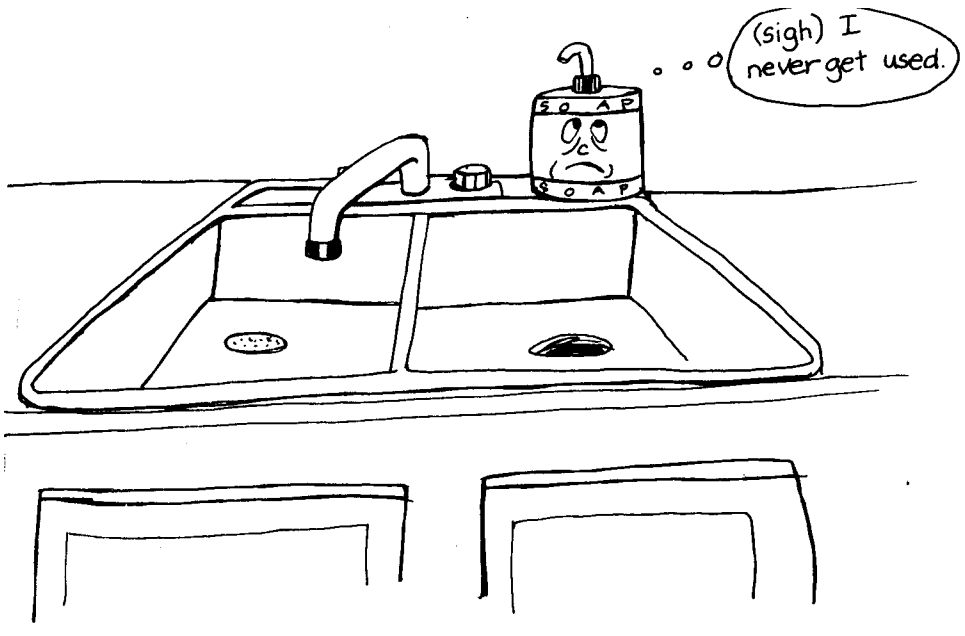
Despite the concern for food safety, a 1997 survey by the Food and Drug Administration indicated that 50% of consumers will eat raw or uncooked eggs, 26% don't wash cutting boards after cutting raw meat, 23% will eat undercooked hamburger and 17% will eat raw clams or oysters.

In outbreaks that occurred in homes, undercooking and improper cooling were the most common factors involved.

Handwashing

Before handling foods, wash your hands with soap and warm water for 20 seconds, even if you plan to wear plastic gloves. Work soap into your hands, including the fingernail area and between the fingers.

Repeat this process after you handle raw meat, poultry, fish or eggs; touch animals; use the bathroom; change diapers; or handle garbage. Consumer survey results showed that about 25% of home food handlers would rinse or wipe their hands only after handling raw meat or poultry.



Preparation Tips

- ✔ **Wash your hands with warm, soapy water thoroughly before handling foods as well as after handling pets; after handling raw meats, poultry and fish; after changing diapers; after wiping noses; after handling garbage and doing other related tasks.**
- ✔ **Teach children to wash their hands before handling food.**
- ✔ **Always wash kitchen countertops, utensils, dishes and cutting boards thoroughly with soap and hot water after contact with raw meat, poultry, fish and other raw foods.**
- ✔ **Use separate cutting boards for raw and cooked food. Different colored cutting boards can help keep them separate.**
- ✔ **Use acrylic cutting boards rather than wooden ones, where bacteria can hide in grooves and cracks.**
- ✔ **Thaw foods in the refrigerator rather than on the countertop or thaw in a microwave oven followed by immediate cooking.**
- ✔ **Marinate foods in the refrigerator. Do not reuse marinade.**

Cooking Tips

- ✔ **Cook ground beef to 160 degrees Fahrenheit. Cook poultry to 165 degrees. Use a meat thermometer to check that it's thoroughly cooked in the thickest part.**
- ✔ **In addition to using a calibrated thermometer, note visual clues. Ground meat usually is done when it's brown or gray inside. Poultry juices run clear. Fish flakes with a fork.**
- ✔ **Cook eggs until the yolk and white are firm, not runny. Scramble eggs to a firm texture.**
- ✔ **Recipes in which eggs remain raw or only partially cooked should not be used.**
- ✔ **Use only clean, unbroken eggs for egg dishes that are more lightly cooked, such as scrambled, poached or soft cooked eggs; French toast; cream pies and soft meringues; and cooked ice cream mixes.**
- ✔ **Dirty or leaking eggs should not be used.**

USE COOKING METHODS SAFELY

A cooking method cannot make food safe if the food has been handled improperly.

Microwave Ovens

The microwave is a standard appliance in more than 90% of U.S. households. Microorganisms may pose a problem to microwave users when food that is stored improperly, cooked inadequately or heated unevenly harbors pathogenic microorganisms. Because microwave ovens often heat foods unevenly, microorganisms, especially parasites, may survive.

The microwave can get food hot enough to kill microorganisms that may be present in foods, but it may not cook evenly. Therefore, the cook should arrange, cover, rotate, stir and turn foods so they reach a safe temperature throughout.

Foods cook differently by microwaves than by conventional heat. Microwaves cause food molecules to vibrate and the resulting friction creates heat. The microwaves do not penetrate more than 1 inch into most foods. The heat then is conducted slowly inward, similar to cooking in the conventional oven. Moist areas in foods will heat more quickly than dry areas.

Food continues to cook after the microwave is turned off. Allow the food to stand for an additional one-third of the original cooking time, or as the recipe directs.

This carry-over heat can raise the internal temperature by several degrees and helps equalize the temperature throughout the food, both of which are important. For food to be safe, its temperature must be hot enough for long enough to kill microorganisms.

The microwave is a safe way to defrost foods quickly. However, since the food can become warm as it defrosts, it must be cooked immediately after defrosting.

- Follow package directions for foods.
- Rotate, stir or check all foods at least once during cooking. If the item is on a rotating turntable, the center location remains the same, so reposition the item on it for even cooking.
- Cover the item with a lid or heavy-duty plastic wrap (not touching the food) turned back at one corner to provide escape for steam.
- Let roasts stand covered for a few minutes after cooking them, or use an oven cooking bag. Cook large pieces of meat at lower settings for longer times than small pieces.
- Use a meat thermometer to measure the temperature of meats in several places after cooking in the microwave. Temperatures near the center should be above 165 degrees in leftovers and poultry (juices run clear), 145 degrees in beef roasts or steaks and 160 degrees in ground beef (lack of pink), and fish should be flaky.

Slow Cookers

Because the slow cooker heats slowly, foods are at low temperatures for long periods of time. Foodborne illness can result from food held at low temperatures too long. The following can help assure the safety of foods cooked in the slow cooker:

- Thaw frozen foods before cooking.
- Follow the recipe carefully. Instructions (preheat, brown, scald) often are included to speed the heating process. Browning also kills surface bacteria.
- Cook at the recommended temperature setting (instructions such as **cover and set to high for one hour, then reduce to low**).
- Follow recommendations of the amount of food to prepare in your cooker. Most operate best at one-third to one-half full.
- Foods cooked in the slow cooker must be in liquid.
- If the amount of a recipe is increased, a thermometer is the best way to check doneness.
- All foods should reach an internal temperature of at least 165 degrees to control bacteria and should reach 150 degrees within one hour.
- Don't raise the lid unnecessarily during cooking.

The Barbecue

- Always marinate meat in the refrigerator and do not use the marinade for a dip or sauce later unless it has been brought to a rolling boil. The unheated marinade contains juices from the raw meat.
- Don't use the same plate for cooked meat that carried raw meat unless you've washed it with warm soap and water first.
- Remember that an unwashed cutting board or knife may be a reservoir of harmful microorganisms and carry them from one food to another.

Points to Keep In Mind When Cooking

Thawing: Thaw foods in the refrigerator, in cold water (changing the water every 30 minutes) or as a part of conventional cooking. The microwave oven may be used to thaw foods only if the food will be cooked immediately following the thawing process.

When thawing at room temperature, the outside of the food may be between the danger zone (40 to 140 degrees) while the inside still is thawing. This time and temperature combination allows for a large buildup of microorganisms.

A situation has been produced in which microorganisms may be transferred to and from work areas and equipment (cross-contamination). This large number of microorganisms means that if subsequent cleaning, cooking and further preparation are not done with extreme care, a dangerous dose of disease-causing microorganisms will be served with your food.

- ✔ **Eggs with cracked shells, but the contents are not leaking, may be used in dishes that are cooked thoroughly, such as baked goods, hard-cooked eggs, custards and casseroles where internal temperatures reach 160 degrees Fahrenheit.**
- ✔ **Avoid tasting raw food preparations containing meat or eggs, such as cookie dough.**
- ✔ **Dogs, cats and other pets should be kept out of food preparation areas.**
- ✔ **Pet feeding dishes, toys or bedding should not be allowed in the kitchen or near items in contact with the family's food.**
- ✔ **Avoid using recipes that ask you to leave perishable food at room temperature for more than two hours. This includes thawing and marinating.**
- ✔ **Avoid interrupted cooking. Never partially cook products to be fully grilled or roasted later.**

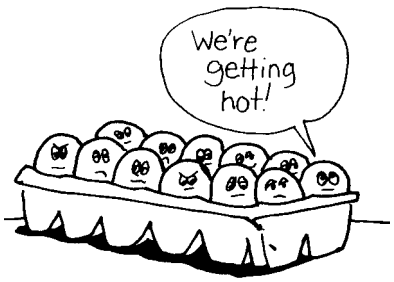
- ✔ **Make sure you have a constant heat source when cooking. For example, do not preheat an oven, turn it off and then put a roast in it.**
- ✔ **Use a minimum oven temperature of 325 F for cooking.**
- ✔ **If you have a cut or infection, avoid handling food or at least wear clean plastic gloves, particularly when handling cooked products.**

Heating and Cooking: Cooking temperatures can be so low that, just as in thawing, the food remains in the danger zone long enough for microorganisms to multiply. Follow manufacturers' instructions for slow cookers and see suggestions on page 15. The USDA recommends oven temperatures no lower than 325 F for cooking meat. How fast a product heats depends not only on size, but on shape, other ingredients, method of heating used and the treatment (such as stirring or rotating) while heating.

Dressing in poultry acts as an insulator and needs to be cooked to 165 F. The temperature of the stuffing and bird must be measured. One recorded case notes that the turkey thigh temperature was 200 F (overcooked) while the stuffing was still at 90 F. This is one reason why food safety experts frequently suggest that the poultry and stuffing be cooked separately.

Let's look at beef stew to see how safety concerns can be managed. The meat, a potentially hazardous food, has been cut up, thus handled several times. This increases the likelihood of microbial contamination. Vegetables are added; often these are fresh, so they must be cleaned thoroughly because they may be contaminated with *C. perfringens* microorganisms. Both cubed meat and cleaned vegetables should be kept under refrigeration until ready to use.

If you are dealing with a larger volume of stew, thorough heat penetration can be a problem. The interior parts never may reach temperatures sufficient to destroy microorganisms. The best remedy for this is frequent stirring.



SALMONELLA

Eggs

Salmonellosis, the number one cause of foodborne illness in the U.S., is an infection that occurs when someone eats a sufficient number of the *Salmonella* microorganisms in raw, undercooked, poorly handled or inadequately refrigerated food. *Salmonella enteritidis,* a strain of *Salmonella,* frequently appears to be associated with eggs.

In the 1960s, cracked and dirty eggs were identified as a source of *Salmonella* (not *Salmonella enteritidis*), but industrywide programs to wash, sanitize and grade eggs were successful in reducing the problem. For more than 15 years, Grade A shell eggs were not associated with *Salmonella* infection of any kind.

However, in recent years, an increasing number of *Salmonella enteritidis* infection outbreaks have been tied to clean, uncracked, Grade A eggs. This started in the northeastern part of the U.S. and spread to other parts of the country.

The number of intact eggs that contain *Salmonella enteritidis* is small, estimated at one in 10,000. Consequently, foods containing raw or undercooked eggs, such as homemade eggnog or ice cream, hollandaise sauce and Caesar salad dressing, pose an occasional risk of infection.

The very young, elderly or immunocompromized people, such as some patients with cancer or AIDS, are at greatest risk for *Salmonella enteritidis* infection. These people should be especially careful not to eat foods containing raw or undercooked eggs.

Eggs are an economical, versatile and nutritious food. They also are a safe food when properly handled. Clean hands, countertops and utensils; sanitary food handling practices; proper cooking temperatures; and

adequate refrigeration are essential in safely preparing any food or egg product.

The following cooking times should provide adequately cooked eggs:

Scrambled: Cook until firm throughout, one minute at medium stove-top setting (250 F for electric frying pan).

Poached: Five minutes in boiling water.

Sunny side: Seven minutes at 250 F or four minutes at 250 F covered.

Fried, over easy: Three minutes at 250 F (medium setting) on one side, then two minutes after turning.

Hard cooked: Seven minutes in boiling water.

Eat eggs promptly after cooking. Avoid holding them at a warm temperature for more than one hour. Consider using pasteurized eggs or an egg substitute to serve a large group or to take on a trip.

Other Animal Products

Just as with eggs, heating other animal products destroys *Salmonella* microorganisms that may be present. Adequate cooking makes these foods perfectly safe to eat. Cook meat, poultry and seafood thoroughly. This means:

- Cook beef, pork, veal and lamb roasts, chops and steaks to 145 F and allow to rest for three minutes.
- Cook ground beef, pork, lamb and veal to 160 F.
- Cook poultry to 165 F, when the meat is no longer pink and the juices are clear-colored in appearance.
- Cook fish until it turns opaque and flakes when tested with a fork.
- Shrimp, crab, lobsters and scallops should turn opaque. The opening of oyster, clam and mussel shells may not be a good indicator of adequate cooking. Look for an opaque color instead.
- Use pasteurized milk rather than raw milk.

Fruits and Vegetables

In the past few years, several plant foods have attracted attention as the causes of some foodborne illness. Foodborne illness can occur from fruits and vegetables contaminated with pathogens. The microorganisms may come from the soil, fertilizer (especially manure) and other things in the environment that the food comes in contact with, or from food handlers.

As a consumer, you can do the following:

- Wash all fresh produce well before using it. Some may be scrubbed with a brush and rinsed with clean water. The use of a detergent is not recommended.
- Use clean equipment, utensils and surfaces to avoid cross-contamination.
- Cut away bruised or damaged areas of fruits or vegetables. These areas may allow an entry spot for microorganisms.
- Remove rinds and sometimes skins when the food is cut.
- Prepare the foods at serving time and keep them refrigerated. This will prevent microorganisms from multiplying rapidly.
- Use common sense and good sanitation practices and enjoy fresh fruits and vegetables.



Serving Tips

- ✔ **Do not use the same platters and utensils before and after cooking. Use a clean serving plate for grilled foods, too, not the one that held the raw meat, poultry or fish.**
- ✔ **Never leave perishable food out of the refrigerator more than two hours. This includes preparation and serving time.**
- ✔ **When temperatures reach 90 F or warmer, leave cooked food out for no longer than one hour before reheating, refrigerating or freezing.**
- ✔ **Pack lunches in insulated carriers with a cold pack. Caution children never to leave lunches in direct sun or on a warm radiator.**
- ✔ **Carry picnic food in a cooler with a cold pack. Carry the cooler in the car rather than the trunk.**
- ✔ **When possible, put the cooler in the shade. Keep the lid on as much as possible.**

SERVING

Don't Hold the Mayo

Mayonnaise is thought to be a common cause of foodborne disease, but a commercial mayonnaise actually is a preservative to some degree. This product is made with vinegar or lemon juice and salt.

The acid (vinegar or lemon juice) and salt slow bacterial growth. When low-acid ingredients such as ham, eggs or potatoes, are mixed with the mayonnaise, the acid level may be diluted enough to allow the growth of microorganisms.

The Temperature Makes the Difference

Virtually all microorganisms are capable of rapid multiplication at temperatures between 60 F and 125 F. Potentially hazardous foods should not remain in the 40 F to 140 F range for longer than two hours because some bacterial growth and survival occur at these outer limits. **This time-and-temperature principle is the most critical line of defense in keeping safe food safe.**

The only way to truly know a temperature is to use an accurate thermometer. As a guideline, 40 F is refrigerator temperature and will feel cold; 140 F is almost scalding; small bubbles will appear around the edges.

High temperatures (160 F to 212 F) reached in boiling, baking, frying and roasting kill most microorganisms that can cause foodborne illness. Refrigeration at 40 F or below inhibits the growth of most, but not all, of these microorganisms. Freezing at 0 F or below essentially stops bacterial growth but will not kill microorganisms that are already present.

Have a Cool Party

Setting foods out for parties and buffets presents some time/temperature concerns, but proper handling of the foods can give you a safe occasion.

The more a food is handled, the greater the chance for contamination to occur. During the preparation of a salad or appetizer, the ingredients may be cooked, peeled, chopped, marinated, shaped and mixed. Each step allows the opportunity for microorganisms to enter the food.

To start, make sure meat or poultry are cooked thoroughly. Chill ingredients before mixing. Have clean hands and utensils.

Store the prepared food in the refrigerator. Refrigeration slows bacterial growth.

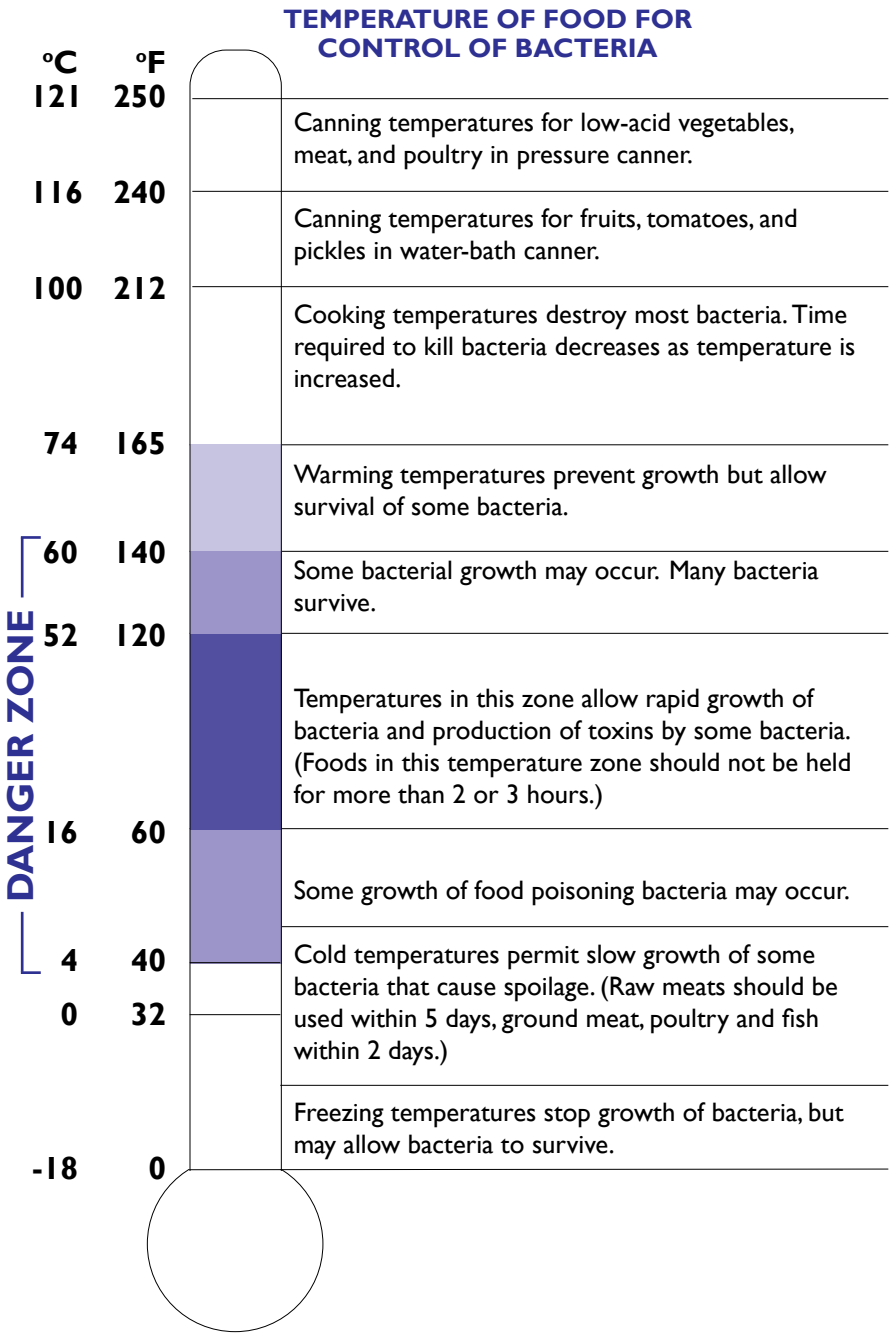
Set out small amounts for serving. To replenish, discard leftover foods from the previous serving and fill a clean bowl with cold food from the refrigerator.

Turn your table into a homemade salad bar. To keep perishable food safe, simply put food containers into larger bowls filled with ice. Make sure the ice surrounds the food so it will stay cold. Promptly refrigerate any leftover food.

Keep Hot Food Hot

Some home-style food warmers, such as chafing dishes, vary in their ability to keep food warm throughout. When using these warmers, don't keep food out for more than two hours. Uneven warming may lead to temperature pockets in the danger zone where bacteria multiply quickly.

Manage hot foods the same as cold. That is, start with small servings. Replenish with fresh containers of hot food. Do not add more hot food to food that has been standing out.



- ✔ **Keep cold party food on ice or serve it throughout the gathering on platters from the refrigerator.**
- ✔ **Divide hot party food into smaller serving platters. Keep platters refrigerated until you reach the time to warm them for serving.**

Leftovers Tips

- ✔ **Use small containers for quick cooling.**
- ✔ **Divide large amounts of leftovers into small, shallow containers for quick cooling in the refrigerator.**
- ✔ **Cool air must circulate in the refrigerator to keep food safe. Do not pack the refrigerator or stack the shallow containers.**
- ✔ **With poultry or other stuffed meats, remove stuffing and refrigerate it in separate containers.**
- ✔ **Avoid tasting old leftovers to determine safety.**
- ✔ **Discard outdated, unsafe or possibly unsafe leftovers in a garbage disposal or tightly wrapped packages that cannot be consumed by people or animals.**
- ✔ **To reheat, bring sauces, soups and gravy to a boil. Heat other leftovers thoroughly to 165 F.**
- ✔ **Do not mix leftovers with fresh food portions.**

LEFTOVERS

Cool It Right

Improper cooling is one of the most common mistakes made in all foodborne illness outbreaks. The two predominate practices are leaving cooked foods at room temperature too long and refrigerating foods in large, deep containers.

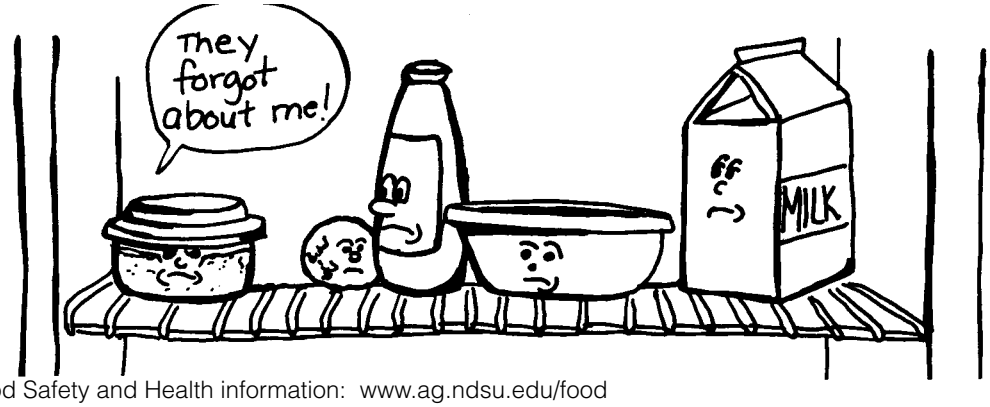
The No. 1 rule is that **POTENTIALLY HAZARDOUS FOODS SHOULD NOT BE LEFT AT ROOM TEMPERATURE FOR LONGER THAN TWO HOURS.** This includes the preparation and serving time. Think about the holiday dinner when the family sits and visits at the table following an enjoyable meal. Calculate the total time the turkey, for example, sits out. Remember to add on the time when you set it out again later in the day for sandwiches and for people to help themselves at their leisure. These conditions have the potential for causing foodborne illness. Get in the habit of refrigerating the necessary foods before the visit so the event can have a happy ending.

Turkey and dressing should be separated and refrigerated in separate containers. Cover tightly for storage.

Keep several things regarding safe refrigeration in mind. Overpacked refrigerators do not cool foods well. Refrigerators need air circulation, and this is impeded when foods are pressed together and stacked on top of each other. Refrigerators need to be clean. Clean and organize the refrigerator before an event when you will need extra space. Some foods may be placed directly in the freezer for later use when space is limited.

Serious errors can occur when cooling large amounts of food. For example, a large bowl or kettle of potato salad or chili cools very slowly. Adequate cooling of food does not occur automatically when a hot item is taken from the stove, table or preparation area and placed in the refrigerator. However, it can be accomplished by following some guidelines.

- For a cold food, such as potato salad, have all ingredients chilled before mixing.
- Cut large pieces of meat into smaller pieces.
- Place foods in shallow containers, not more than 2 inches deep for chili or thick foods and 3 inches deep for soup or liquid foods.
- Do not cover foods during the initial cooling because they stay hot longer when the steam and heat are not allowed to escape.
- Do not stack containers for cooling for the same reason as above.
- Check the refrigerator temperature to be sure it is at or below 40 F.
- Set the refrigerator temperature at 32 F and freezer temperature below 0 F if you have plans to add large quantities of foods.



Cool it Properly

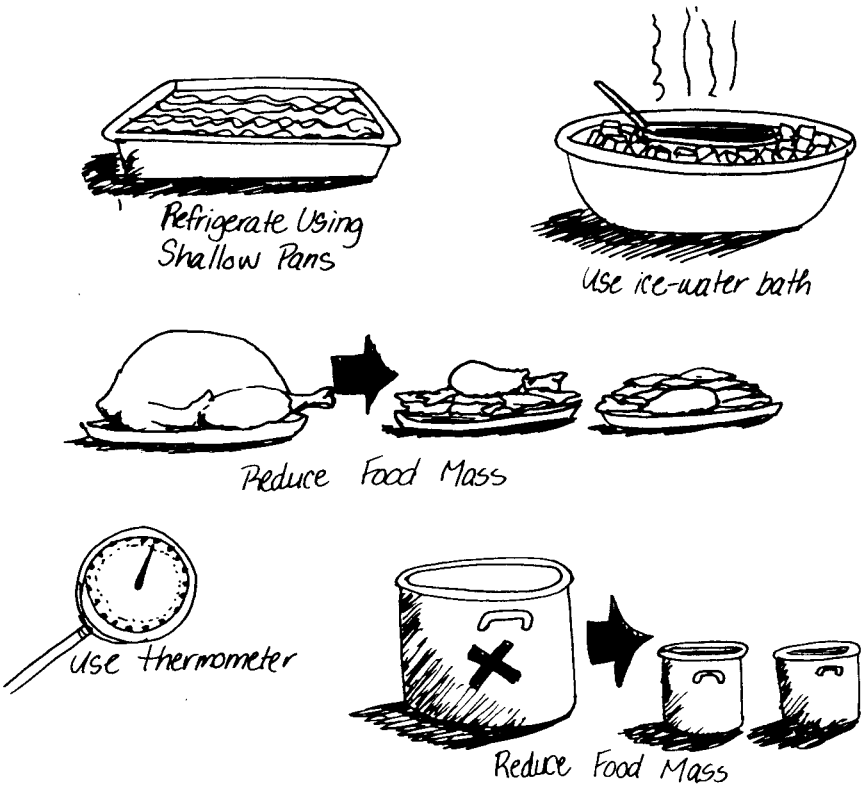
Adding too much hot food to a refrigerator can raise the temperature and hinder cooling. This can be avoided by cooling large amounts of food in an ice-water bath before refrigerating it.

Let's look at an example to see what happens and what needs to be done to keep food safe. You have been asked to make 12 gallons of stew for a service club money maker. Twelve gallons of stew will weigh about 93 pounds.

You borrow a large pot (16 inches in diameter) from the community center. The stew will be about 13 inches deep in this pot. If, after cooking, this pot of stew were placed in a 40 F refrigerator, it would take well in excess of 36 hours to cool the center portion below 50 F. This would give plenty of time for growth of microorganisms, which could result in a sick community following the fundraiser.

An alternative is to divide the stew into two 6-gallon pots and put them both in an ice-water bath to chill (see illustration) before refrigerating. The stew must be stirred frequently for uniform cooling. Cover as soon as possible. By using the ice bath and frequently stirring, the temperature can be brought down from 140 F to around 75 F in one hour.

Now place the stew in shallow containers and refrigerate. Continue to stir frequently until the product reaches 40 F.



Reheating

Be sure the food you're reheating has been handled and stored properly. Heating may not destroy all the microorganisms in food that was left at room temperature or stored too long. Heat may not destroy toxins produced by some types of bacteria. **If you are in doubt about the safety of the food, throw it out.**

When reheating soup, liquids and foods in sauces or gravy, always stir before as well as during and after microwaving. Stir these foods when reheating on a conventional range as well.

Allow microwave reheated foods to stand a couple of minutes before eating them.

Reheated foods should reach 165 F to ensure that microorganisms are destroyed. Food should steam throughout, not just around the edges. It is nearly a simmering temperature. When microwave cooking, the center bottom of the plate or utensil containing the food should be very hot to the touch.

Thorough reheating to an internal temperature of 165 F or above will kill microorganisms that may have grown during storage. However, foods that have been stored improperly or otherwise mishandled cannot be made safe by reheating.

Foodborne Illness Strikes—Now What?

When foodborne illness strikes, see a doctor or get to a hospital if the symptoms are severe or if the victim is young, elderly or suffers from a chronic illness. Do not destroy suspect foods, but make certain they will not be eaten by someone else. Suspect foods may be tested to identify the cause of a foodborne illness.

If you suspect botulism, get medical help immediately! Botulinum toxin attacks the nervous system, causing double vision, trouble swallowing and difficult breathing.

Generally, diarrhea, nausea, vomiting and abdominal cramps characterize foodborne illness, but symptoms vary from microbe to microbe and with the amount of contaminants actually eaten. Symptoms usually appear in six to 48 hours, but they can show up much sooner, sometimes even within half an hour. For mild cases of food poisoning, maintain liquid intake to replace fluids lost through vomiting and diarrhea.

GLOSSARY

Amino acids: The substances that make up (the building blocks) of proteins.

Bacteria: This is the scientific term for a large group of microorganisms, only some of which produce disease. Many others are active in processes beneficial or not harmful to human, animal and plant life.

Carrier: An individual who harbors an infectious agent in his or her body and can transmit it to others but exhibits no symptoms of disease.

Clean: Free of visible soil but not necessarily free of disease-causing microorganisms.

Contamination: The unintended presence of harmful substances or microorganisms, especially in food.

Cross-contamination: The transfer of harmful microorganisms from one food to another by means of a nonfood surface such as utensils, equipment or human hands.

Danger zone: The temperature range between 40 and 140 F (4.4 and 60 C) within which most microorganisms experience their best growth and reproduction.

Disinfectant: An agent that kills the growing forms but not necessarily the spores of microorganisms; especially for use on inanimate surfaces.

Foodborne disease: An illness that implicates foods as its source. This includes foods that support the growth of microorganisms, as well as those that merely serve as carriers for a microbial agent.

Foodborne illness: Disease or injury occurring as a result of consumption of contaminated food.

Food poisoning: Intoxication or infection caused by consumption of contaminated food.

Germ: Microorganisms, particularly pathogens.

Hazard: To run the risk of; to expose oneself to.

Microorganisms: Forms of life that can be seen only with the aid of a microscope, including bacteria, viruses, yeasts, algae and single-celled animals.

Modified Atmosphere Package (MAP): An atmosphere in which most of the oxygen has been replaced with carbon dioxide and nitrogen.

Mold: A fungus that causes mold growth.

Pathogen: Any disease-producing agent, usually a living microorganism.

Pathogenic: Capable of producing disease.

Perishable: Food subject to quick decay or spoilage unless it is kept under proper conditions.

Sanitary: Free of disease-causing microorganisms and other harmful substances.

Shelf life: Length of time a product can be stored and still retain quality and remain safe.

Spore: An inactive, resistant, resting or reproductive body that can produce a new vegetative individual in a favorable environment.

Sterile: Free from all living organisms, especially microorganisms.

Toxic: Poisonous.

Toxin: A poison; specifically, a poison produced by a living microorganism.

Vacuum packaging: The removal of oxygen from inside a package.

Virus: Any of a large group of infectious agents lacking independent metabolism and requiring a living host to reproduce, consisting of DNA or RNA in a protein shell.

Yeast: Any of various fungi capable of fermenting carbohydrate.

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