

Cover

This document provides some basic information regarding food safety, along with some more detailed advice on food preparation and food storage. This isn't an all-inclusive guide for everything you could possibly need to know to be safe in the kitchen (or grocery store). It provides some basic, helpful information on lowering exposure to some foodborne pathogens.

The **Document Tabs** organize the document by [Raw Produce](#) (vegetables, fruit, mushrooms, etc) [Animal Products](#) (meat, dairy and eggs) [Food Storage](#) and [Leftovers and Safety](#). There is some overlap between those categories, and you may see some of the same information or tips repeated throughout.

Image examples are included to provide clarification for things that may be confusing in text. Sources for claims are provided (whether PMID, direct link, or both) when appropriate. Archived links are included for .gov resources, in case the original page is taken down.

This document will be updated as often as possible so the information remains both reliable and relevant. **Last Updated:** February 2nd, 2026

Raw Produce

Produce

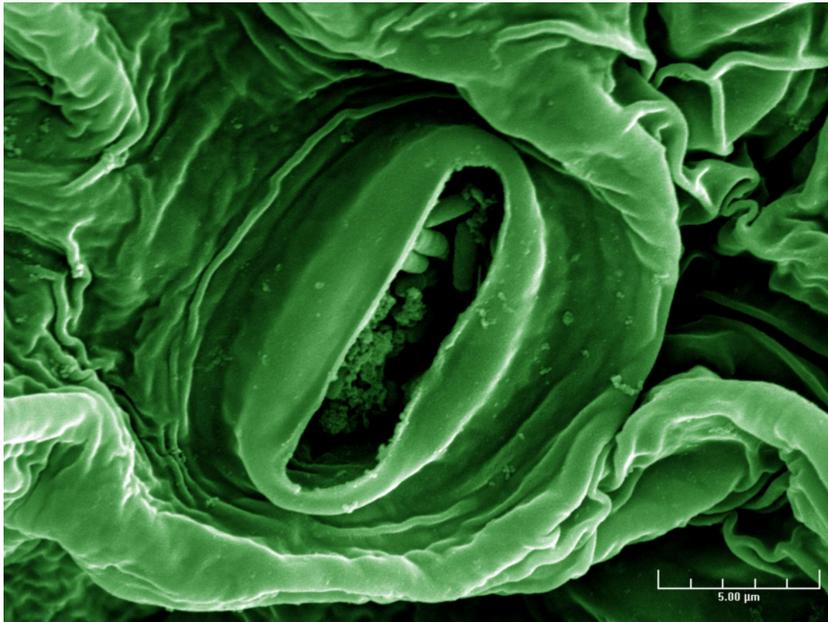
Currently, [most food poisoning in the United States is from raw produce, specifically leafy vegetables such as lettuce and spinach](#). This is primarily due to norovirus; a human pathogen that is spread to food due to handlers practicing improper hygiene.

However, raw produce is also contaminated by other means. Food can be contaminated with Salmonella, Listeria and E. coli bacteria from the soil, water run-off, cross-contamination with animal products, or equipment and machinery used in the production process (including human hands). Produce that has traveled farther has had more time for these organisms to grow, so **buying local lowers your risk for foodborne illness from raw fruit and vegetables**.

These foods are also usually eaten raw without being exposed to heat so they are more likely than cooked fruit and vegetables to spread foodborne disease. The easiest and simplest way to prevent illness from produce is by **not consuming it raw**.

This is why American cuisine from the 1800s-mid 1900s rarely included raw vegetables

Some vegetables or fruits pose a higher risk than others. This can be due to the physical structure of the plant, such as leafy vegetables or hard melons. The surface of the leaf is irregular, soft and porous, while the surface of a cantaloupe melon is hard but netted and rough. These traits of the plants allow for microscopic organisms to “hide” in these grooves and indents, even after the food is washed with running water.



Do you see the E. coli bacteria hiding in the stomata of this lettuce leaf?

Other produce may carry risk due to how the plant itself is grown.

Bean, alfalfa, other sprouts, and mushrooms are soft foods that are grown in warm, humid environments. This puts them at a higher risk for harboring bacteria like Salmonella, E. coli and Listeria. Because bacteria are both on the surface and internalized within the tissue of the plant, [washing them does not guarantee removal of all bacteria, even when a disinfectant is used.](#)

SPROUTS GROWN AT HOME STILL CARRY RISK FOR CONTAMINATION

HIGH RISK GREENS	LOW RISK SUBSTITUTES
Butter lettuce	Kale*
Romaine lettuce	Green & red cabbage*
Green leaf lettuce	Bok choy*
Spinach	Collard greens*

* These plants have leaves that are less porous, more tough so [they are less likely to harbor foodborne pathogens](#). Additionally, they are usually eaten cooked which lowers their risk for transmitting bacteria. Chopping kale, spinach and collard greens also releases lysate which has antimicrobial effects against some types of bacteria. See study above.

HIGH RISK PRODUCE	NOTES
Bean & seed sprouts	Alfalfa, mung, soy, lentil, clover, broccoli, etc
Enoki mushrooms*	Safe to eat cooked
Wood ear mushrooms*	Safe to eat cooked

*These mushrooms specifically have been implicated in US outbreaks of foodborne disease. Other mushrooms may be at risk but have not been formally implicated. This is due to a number of reasons (such as reporting gaps) and does not mean that **only** these mushrooms are a risk for foodborne disease.

The safest way to eat these foods is to eat them cooked.

Canned bean sprouts are safe to eat, they are heated in the canning process.
Enoki mushrooms that have been boiled in a soup or fried in a stir-fry are safe to eat.
Alfalfa sprouts that have been put into a sandwich and then grilled or otherwise heated to 160-165* F are safe to eat.

Do not use them as a raw garnish.

This is not an exhaustive list of vegetables and other produce implicated in outbreaks of foodborne disease. If a food has not been listed here, this does not mean it does not pose a risk to you if eaten raw. Salmonella, Listeria, and E. coli have been identified as the cause of disease outbreaks from [cucumbers, melons, tomatoes, avocado, onion, etc.](#) (Table 2)

These pathogens can survive refrigeration. Colder temperatures do not kill them but only impede their growth. Some pathogens, like Listeria, are not impeded by cold temperatures at all and will continue to grow inside of a refrigerator. This is one of the reasons why melons have been implicated in Listeria outbreaks. They are often stored in the refrigerator for a prolonged amount of time, cut and then eaten later. This allows Listeria to grow inside of the cold refrigerator, be introduced to the fruit of the melon when cut, and has ample time to grow before infecting you later once the fruit is eaten.

Pre-cut Fruit and Vegetables

Pre-cut trays or bowls of fruit and vegetables pose a greater risk for foodborne illness than buying whole fruit/veg and preparing it yourself at home. This is because the food has been handled by more people, coming into contact with more surfaces, utensils and equipment. This increases the risk for cross-contamination.

Similarly, buying whole heads of greens and prepping them at home also reduces risk for foodborne illness from pre-bagged salad mixes.

Washing Produce

Produce that is labeled as “triple-washed and ready to eat” or “produce-washed and ready to eat” does not need to be washed again at home. Washing produce that has been labeled this way [is not necessary and can increase risk for cross-contamination and foodborne illness.](#)

Wait until you are ready to prepare and cook the food before washing it. Washing produce introduces bacteria and moisture to the food which can contribute to food spoilage and bacterial contamination, especially if foods are stored further before being consumed. [Produce should be stored unwashed and washed only before preparing and cooking.](#)

Before washing produce, examine the surface for mold and bruising or damage, especially at the root/stem scar or blossom tops. If the integrity of the skin/rind has been compromised this can allow bacteria and fungi to invade the pulp and grow inside. Remove the outer leaves if prepping a cabbage or other greens. Remove any bruised or damaged portions of the vegetable/fruit before washing.

Washing produce will not remove all pathogenic or spoilage-associated microbes. Washing will not render **recalled** produce safe to eat. Mold **cannot** be removed by washing.

The best way to wash produce is under cold, running water alongside mechanical scrubbing. Use clean hands and rub the fruit/veg briskly to remove dirt and microbes. You can also use a vegetable scrub brush on hard fruit/veg, but do not use it for any other purpose in your kitchen (*ie washing dishes or cups*). Soft fruit/veg like tomatoes or berries can be cleaned using a sink sprayer and a colander/strainer.

Do not use soap.

Do not use bleach.

Fruit and veg are porous, especially when exposed to water and friction. Using these chemicals can damage the food, and the food can absorb these chemicals changing taste or even making it unsafe to eat.

Do not use hot water. Thermal shock can change the texture of the food and help bacteria invade/be absorbed by the fruit/veg.

[Do not soak produce in water](#). This increases the risk of cross-contamination between pieces of fruit/veg.

Produce washes have **not** been shown to be more effective at removing bacteria from fresh produce than clean, running water and mechanical scrubbing. Their safety usually has not been reviewed either. These products are marketed to you out of interest of another person's profit margin.

If an additional step would bring peace of mind, [the USDA recommends](#) using a 1:2 ratio of vinegar:water (½ cup vinegar per 1 cup water) to briefly soak produce, followed by a rinse + scrub with cold, running water. (*Page 2, paragraph 1*)

There is [some evidence](#) that sodium bicarbonate (baking soda) is an effective way to remove **some** pesticide residues from some fruit. This involves soaking in a 1% solution for 15 minutes. Consider the risk of bacterial cross-contamination before choosing to do this.

Avoiding cross-contamination.

When preparing raw produce, prevent bacterial contamination by:

- Cleaning and sanitizing food prep surfaces (counters, sink, and faucet).
- Wash your hands before and after handling produce.
- Use clean knives and cutting boards that are **only** used for produce. Do not use the same cutting board for lettuce as you do for meat as you do for cheese and bread.
- **Do not** soak produce in water or use the same bowl/sink of water to clean multiple pieces of fruit/veg.

Remember: the easiest and safest way to prevent food poisoning from produce is by eating these foods **cooked**. Canned foods are considered cooked as they have been subjected to heat and pressure in the canning process. Frozen fruits and vegetables are not considered cooked unless otherwise indicated on the package. Freezer temperatures do not kill pathogens, they simply prevent their growth.



Keep foods separate, wash both surfaces and hands before and after switching tasks in the kitchen. This is the simplest way to prevent cross-contamination.

Mold

Fungi are literally everywhere so it is common for them to contaminate fresh produce. Some fruits and veg can safely be trimmed of mold and prepared or eaten, **not all**.

Remember that the mold you see is only a small fraction of the fungal organism, like the tip of an iceberg poking out of water.

[It is safe to remove mold from hard, dense foods like carrots, cabbage and peppers.](#) Cut 1-2 inches from the colony. Be sure not to contaminate your knife with the mold, this will allow it to spread to other parts of the food when cut.

For soft fruit and vegetables such as cucumbers, berries and oranges, **discard the food**. There is no way to know how far the fungi has grown into the food. There is no way for you to determine if it has produced dangerous levels of mycotoxins. These can make you sick when ingested, and can even lead to cancer.

If the food has several, large colonies of mold or the growth is not isolated to one portion of the food, **discard the food**.



The tomatoes on the left are unsafe to eat.

Not only is this food soft (allowing the fungus to grow farther into the fruit) it is surrounded by other moldy fruits. You can't guarantee the safety of these foods by removing the mold.

The squash on the right is safe to eat.

This food is hard and dense, so fungi can't grow very far. These colonies of mold are small and are isolated to one portion of the food. You can safely remove the mold (1-2 inches from the colony) **be sure to verify the interior of the food is not discolored or otherwise showing signs of contamination.**

Mold vs Oxidation

Normal, harmless changes to produce can sometimes resemble mold or spoilage. Both oxidation and bruising may change the color or consistency of raw fruits and vegetables without compromising the safety of the food, even though they *may* resemble mold.



These photos both show cauliflower with oxidized florets. The dark, almost black, specks may resemble mold, but this is a harmless change caused by exposure to oxygen. Note how the purple cauliflower oxidizes in the same manner. This cauliflower is **safe** to eat.



[Compendium of Brassica Diseases, 2007](#)

These photos both show cauliflower that has molded. The image on the left shows a large colony of black mold while the image on the right shows mildew that has spread through the stalks.

Note how the dark specks in the left image are raised above the surface of the cauliflower (*while oxidation is level with the surface of the plant tissue*) and the mold almost appears soft or “fluffy” with white mycelium branching away from the florets.



This is a tell-tale sign that we are looking at mold growth as opposed to mere oxidation.

Another way to determine if we are looking at mold vs. oxidation is noting the consistency and texture of the produce. Mold spoilage often causes plant tissue to become slimy or moist alongside the change in color and will typically give off a noticeable odor.



The image on the left shows a molded carrot. Take note of the dramatic color change, the compromised integrity (*change in texture*) of the tissue and the slimy, moist appearance surrounding the contaminated area. This carrot is **not safe** to eat. Compare to the image on the right of several carrots with oxidized browning. These carrots have a slight color change where they have browned but the surrounding tissue is typical. The texture of the tissue is normal, with no soft, mushy or slimy appearance. Finally, the browned spots are not raised above the vegetable. These carrots are **safe** to eat.



These images also show oxidation in green, leafy vegetables. They are typical in color, texture and the browning is not accompanied by moisture or “fluffy” mycelium. Both are examples of produce that is **safe** to eat.

Animal Products

Animal Products

Animal products pose a significant risk for the spread of foodborne illness.

[Most foodborne pathogens are zoonotic in origin](#). This means that they come from animals.

If possible, consider lowering your consumption of animal products. Even if this means merely eating *less* meat or dairy than you do now. While thoroughly cooking animal products does lower your risk for some foodborne diseases (*Listeria* and *Salmonella*), some of these diseases occur through the production of toxins (*E. coli* and *S. aureus* infections). These toxins are often heat stable. This means cooking contaminated foods won't render them safe to eat.

Safe storage and safe preparation is an easy and simple way to prevent foodborne illness from animal products.



Meat & Fish

Raw meats or fish that have already been prepped and trimmed at a butcher counter, grocery store, etc do not need to be washed (*rinsed under running water*) at home. Washing raw meat in this way does not lower your risk for foodborne illness. It increases it.

The more you handle raw meat, the greater risk for cross-contamination.

Water splashing over raw meat spreads bacteria into the air, onto surfaces [3+ feet away](#), onto you, your clothes, etc where they can easily be spread to other foods or people in your home. These bacteria can be contained in microscopic droplets of water that we cannot see or feel, and can travel through our kitchen aided by ambient air, foot traffic and exhaust fans above ranges or cooktops. We cannot see bacteria by looking at a surface or the air around our sink, so we cannot know if we have contaminated our kitchen with *Salmonella* or *E. coli* from washing raw chicken or beef.

The observational study linked above did not find that **any** amount of cleaning after washing raw meat was sufficient in removing all pathogens and cross-contamination. Consider this before washing raw meat in your home. Consider all of the surfaces that are within 3 feet of your sink and whether or not you would be able to clean them (including the air).

Assessing Safety & Quality

Some assume they should wash raw meat because of “blood” or “slime.” Blood is not present in properly prepared raw meat. The red liquid is merely myoglobin (a protein in muscle) dissolved in water absorbed by the meat. The protein layer that covers whole cuts of raw meat can feel slippery or like “slime.” Both are normal but can be removed by patting the meat dry with a paper towel.

Patting raw meat with a paper towel can also be used to assess safety. This protein layer should be clear, thin and have no color. Thick and/or green, yellow or brown in color means the meat is not safe to eat.

The color of meat can also be used to assess safety. Color of meat can vary depending on the animal’s diet, how it was frozen and thawed, room lighting, and even exposure to oxygen.

Sometimes, beef is red on the outside and dark purple on the interior, or brown on the outside and bright red on the interior. This is oxidation (color change from exposure to oxygen) and is not a sign of spoilage, nor does it mean the meat isn’t safe to eat.



Both of these images show oxidized beef that is **safe** to eat.

Beef can be red, brown or even purple but should never be yellow, green or gray. These colors should always be considered a sign of spoilage or contamination.

Chicken can also vary in color. While it is typically light pink and off-white, chicken meat can also be light purple or even red if bone marrow has seeped into the meat while cooking.



Both of these pictures show chicken that is **safe** to eat.

Chicken should never be green, yellow or gray. These colors should always be considered a sign of spoilage or contamination.



This picture shows chicken that is **not safe** to eat. The bottom of the breast is no longer light-pink and there are clear signs of contamination where meat has turned green.

You cannot use the color or consistency of **any** meat (including the juice!) to determine if it has been fully-cooked and is safe to eat. Fully-cooked chicken can be pink in the middle, undercooked beef can have juice that runs clear.

 U.S. DEPARTMENT OF AGRICULTURE

Is it done yet? You can't tell just by looking!

Use a food thermometer to check for the safe minimum internal temperature.

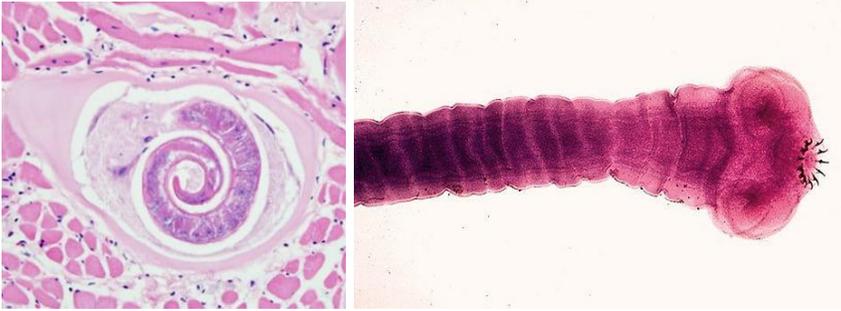
Fish	Red Meat	Ground Meat	Egg Dishes	Poultry
				
	Beef, Pork, Veal & Lamb (Steaks, Roasts & Chops)	Beef, Pork, Veal & Lamb (Ground)		Turkey, Chicken & Duck (Whole, Pieces & Ground)
145°F	145°F <small>(with a 3-minute rest time)</small>	160°F	160°F	165°F

Have more questions? Visit our website at www.FSIS.USDA.gov
or contact the USDA Meat and Poultry Hotline at **1-888-MPHotline (1-888-674-6854)** or MPHotline@usda.gov

The only way to make sure raw meat is safe to eat is by cooking it to a proper internal temperature.

For a more detailed temperature chart: [click here](#) (or alternatively, [here](#))

Food safety regulations are engineered to reduce the presence of pathogens in food **when properly enforced**. Thoroughly cooking your food to a safe internal temperature, as verified by a food thermometer, is an underrated measure to lower disease risk in the face of regulatory rollbacks.



Trichinella spiralis (left) and *Taenia solium* (right) are two parasites spread through the consumption of undercooked pork. Incidence in the US has been low in recent decades thanks to food safety bodies of authority and oversight.

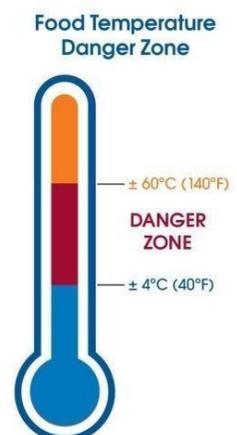
Defrosting & Thawing

Safely thawing meat	
Refrigerator	Below RTE foods to minimize cross-contamination from water/juice
Cold water	Immersed, change water every 30 minutes
Microwave	Cook immediately

Do not defrost or thaw meat by leaving it on the counter or in the sink.

Raw meat that has stayed cold (*in the refrigerator*) can be safely refrozen. Meat that has been thawed in the microwave cannot and should be immediately cooked. Completely thaw frozen meats **before using a slow cooker**, but they can safely be cooked from frozen in an oven, on the stove or grill.

This is because of “the danger zone” or the zone between 40°F and 140°F. When bacteria are in this temperature zone, they can grow rapidly and this can lead to disease. Keeping raw meat out of the danger zone, even while thawing, is an important step for



preventing foodborne disease.

Vacuum-sealed proteins should be thawed after breaking the vacuum to prevent botulism.

The risk for botulinum toxin exposure is highest with regard to fish, but is present for many different proteins when they are vacuum-packed. The spores of this bacteria are ubiquitous and when allowed to come to favorable temperature in an anaerobic environment, can allow for toxin formation. Breaking the vacuum allows ambient air to come into contact with the meat, removing the ability for *C. botulinum* to produce the botulinum toxin.

Relevant case literature:

[PMID: 33518376](#)

[PMID: 35900283](#)

[PMID: 16966764](#)

How do I know if something is vacuum-packed or not?

Vacuum-sealed or vacuum-packed means the air has been manually removed from the packaging, creating an anaerobic environment. Only the meat on the **bottom left** of this image is vacuum-packed.

TYPES OF GROUND BEEF PACKAGING

Southern Living



Traditional



Modified Atmosphere
& Controlled Atmosphere



Vacuum-Sealed



Chub

[Image credit: Southern Living](#)

Dairy

Dairy products from animals pose a risk for the transmission of zoonotic disease, such as bacterial, fungal or even parasitic infections. To lower your risk for contracting these infections, only eat pasteurized dairy products or consider replacing them with plant-based alternatives.

The vast majority of milk, butter, cheese and yogurt sold in grocery stores is pasteurized. If it is not pasteurized, it must be clearly labeled as unpasteurized or “raw.” Your store’s deli section may also carry raw cheeses.

Aged cheeses made with raw milk can carry a lower risk for bacterial disease. It is a common myth that there is no risk for disease if the cheese is hard and aged. However, this is not true. **Raw aged cheeses can still [get you sick.](#)**

“Pasteurization” for dairy products typically refers to milk being heated to a minimum of 161°F for at least 15 seconds or 145°F for 30 minutes and packaged in clean & sanitized conditions. Pasteurization does not render milk sterile, but lowers bacteria sufficient to lower risk for disease transmission.

“Ultra-high-temp-pasteurized” means that the milk has been heated to a minimum of 280°F for a minimum of 2 seconds. UHT pasteurization dramatically lowers the risk for disease transmission due to near-sterile conditions being achieved. The process for production and packaging is why these products can be stored at room temperature before opening.



The milk on the left is ultra-pasteurized, rendering it shelf stable until the package is opened. The milk on the right is pasteurized, rendering it cleaner than unpasteurized milk but not sterile so it must be stored with refrigeration.

Milk that is ultra-high-temp-pasteurized, or “UHT-pasteurized,” is safe on the shelf (unopened) for upward of 6 months and does not contain microbes associated with spoilage or foodborne disease.

For a comprehensive review of the different types of pasteurization used for dairy products and their considerations: [click here](#)

Amendment: February 7th, 2025

This document previously stated that pasteurized milk does not contain infectious virions of the H5N1 virus. I have removed this statement due to this [peer-reviewed paper published in Virology](#) that demonstrates how the uncleaved hemagglutinin protein on influenza A virions may increase thermal resistance to pasteurization.

This is not evidence that H5N1 is spreading through pasteurized milk **or** that pasteurized milk is responsible for current cases and spread of the H5N1 virus. However, it is something to be aware of as the outbreak progresses and we learn more about the spread of HPAI. If such evidence arises in the future, I will be sure to include it here.

Eggs

The primary pathogen of concern in eggs is the bacteria Salmonella. You cannot tell if an egg is contaminated with Salmonella by looking at it. Clean eggs with undamaged or uncracked shells can harbor the bacteria. This is because Salmonella can infect the inside of the egg from the time it is formed inside of the hen. The safest way to protect yourself is by fully cooking all eggs. For dishes that require raw eggs, use pasteurized eggs or pasteurized egg products.

H5N1, or Avian Flu, is also a pathogen of concern with regard to bird eggs. Cooking eggs to temperature will deactivate H5N1 virus if present and render the eggs safe to eat. To protect yourself and your family or pets from H5N1, cook all eggs to a safe temperature.

Do not eat raw, unpasteurized eggs.

Do not feed raw eggs to pets.

When purchasing eggs at the store, physically examine them for cracks. Cracked shells can introduce Salmonella and other bacteria on the shell to the yolk and this can cause disease. If you drop or otherwise damage an egg, **do not** store it for later use. Cook it immediately or throw it away.

Do not wash store-bought eggs.

Eggshells are porous, they have small holes all over that we cannot see. Washing them at home allows bacteria to cross the shell using these pores and contaminate the yolk inside, making you sick later. Store-bought eggs have been cleaned using special, approved cleansers at specific temperatures to prevent this from happening.

Eggs with blood spots are **safe** to eat.

Eggs with reddish yolks are **safe** to eat.

Eggs with cloudy albumen (*the white of the egg*) are safe to eat.

Eggs with pink albumen are **not safe** to eat.

Uncooked* eggs with green yolks or albumen are **not safe** to eat, even after cooking.

overcooking, such as hard-boiled eggs, can cause the yolk to have a green tinge. These are safe to eat, the issue is if you see a green color **before cooking.*



The image on the left shows a raw egg that is unsafe to eat. The albumen, or white, of the egg is fluorescent green. This is a sign of bacterial contamination with *Pseudomonas*. The image on the right shows a cooked egg that is safe to eat. The yolk has merely taken on a slightly green tinge from overcooking.

Float tests are not a reliable way to determine if an egg is safe.

Float tests qualitatively measure the size of the air pocket within the egg. This air pocket can change size without spoilage or bacterial contamination. An egg can float and be safe to eat. An egg can sink and be unsafe to eat.

Fresh eggs, such as from a farm or a backyard coop, do not need to be refrigerated but they will last longer if they are. This is because, unless washed, their bloom (cuticle) is intact. This preserves the interior of the egg without refrigeration.

Commercially processed eggs need to be refrigerated. Their bloom has been removed through washing for decontamination.

Raw eggs appropriately refrigerated will keep for about 3-6 weeks.
Raw eggs can be frozen for 12 months or longer.

Do not freeze eggs in their shells.

Eggs freeze best when beaten or “scrambled” together.

(This is necessary because whites freeze well, yolks do not)

Do not “water-glass” eggs or store them in pickling lime.

This is an older method of preserving eggs from before the advent of microbiology and our modern understanding of Salmonella and botulism. **This is not safe.**

The high, or basic/alkaline, pH of pickling lime allows for the survival of *C. botulinum*. This is the bacteria that causes botulism. The lime solutions used for water-glassing often contain the spores of *C. botulinum* within them.

Eggs, including farm fresh eggs, can be contaminated with Salmonella on the inside of the egg without showing any external signs of spoilage or contamination. This is because Salmonella bacteria can contaminate the inside of the egg from the time it was formed inside of the hen. Water-glassing does not remove Salmonella from the egg.

[Small, backyard flocks are also more likely to harbor Salmonella than commercially sustained flocks of chickens.](#)

Freezing eggs is the safest way to store them long-term and **does not come with the added risk of lime poisoning, Salmonella or botulism.**

Deli Products

Similar to pre-cut fruit and veg trays, pre-sliced deli meats and cheeses pose a greater risk of bacterial disease than whole cuts you slice yourself at home. This is because they have come into contact with more hands, more equipment which increases the risk of cross-contamination.

This is why Listeria outbreaks are more common in pre-cut, deli meat and cheese than whole meats or cheese blocks.

Food Storage

Food Storage

Just as cleanliness is important for preventing cross-contamination when cooking, proper food storage is crucial for preventing contamination before food is ever prepared.

There are a number of safe, evidence-backed ways to store food in your home while preventing contamination and subsequent foodborne illness. One of the safest methods is proper canning.

This document will not be covering home canning for efficiency sake.

[Here](#) is an archived copy of the USDA Complete Guide to Home Canning. It has everything you need to know to safely can your own food.

When eating home-canned goods (or any other canned goods you may be concerned or suspicious of) boil the food. Boiling for a sufficient length of time [will render the botulinum toxin inactive](#).

For altitudes below 1000 feet, boil foods for at least 10 minutes.

Add 1 minute of boiling time for each additional 1000 feet of elevation.

Do not store herb, garlic-infused oils at room temperature.

Do not store herb, garlic-infused oils for longer than 4-5 days in the refrigerator.

The oil produces an anaerobic environment. *C. botulinum* spores are ubiquitous in and on plants. The anaerobic environment allows for toxin production in these infused oils.

Do not feed honey or **any processed foods containing honey** to infants under a year old. This includes graham crackers, honey-sweetened cereals or oatmeals.

This is a risk for infant botulism.

Cooking and processing does not destroy *C. botulinum* spores. Infant botulism is caused when these spores are introduced to the infant's gastrointestinal tract. Adults are protected by our strong stomach acid and well-established microbiome aided by our immune system.

Infants do not have these, putting them at risk for paralysis or death.

Potatoes baked in aluminum foil should have the foil loosened/be unwrapped before storage. A small vacuum is formed between the foil and potato and this can foster *C. botulinum* growth and toxin production.

Relevant literature

[PMID: 9652437](#)

[PMID: 30856729](#)

[Baked Potatoes and Botulism](#)

Do not “rebel can.”

Ignoring food safety for the sake of rebellion is silly. This is not revolutionary. Nobody is liberated by succumbing to preventable, foodborne diseases like botulism.

Do not “dry can.”

This **does not** refer to putting dry grains, beans or pasta into jars or other containers. “Dry canning” refers to a specific, antiquated canning practice of using the dry heat of an oven to form a small vacuum in canned goods.



The image on the **left** depicts dry canning. **This is not safe.**
The image on the **right** depicts storing dry foods in jars. **This is safe.**



You can also use a vacuum-sealer machine to increase the shelf-life of dry goods like pasta or oats.

Vacuum-sealing is safe when used to preserve dry, uncooked foods that are safe to store at room-temperature.

Vacuum-sealing is **not safe** for storing cooked foods like soups, vegetable or fruit puree at room temperature. Vacuum-sealing is not an alternative to canning. The only safe way to store these foods at room temperature is with true canning.

A popular food storage “hack” is to store fresh vegetables or fruit immersed in jars of water in your refrigerator. **This is not safe.**

While the water can keep the tissue of the plants hydrated and crisp, this poses a risk for bacterial contamination. The moisture of the water allows bacteria on the skin and in the water to permeate the pulp of the fruit/veg and grow to sufficient numbers to cause disease.

Do not store fresh fruit or vegetables immersed in water.

Storing fruit or vegetables in dry, airtight jars is a **safe** way to keep them fresh longer by conserving humidity to keep them crisp. You can even couple this with a vacuum-sealer.



The image on the **left** depicts **unsafe** food storage (immersed in water). The image on the **right** depicts **safe** food storage (dry and airtight jars).

Frozen Food

If you are concerned about long-term storage of food, consider freezing instead of refrigeration or canning. Frozen foods will remain safe to eat **indefinitely**, provided they stay adequately frozen and are safely stored and prepared beforehand. Remember that freezing does not kill bacteria, but it prevents their growth and toxin production.

Almost any food can be frozen!

As discussed in **Animal Products**, eggs can be frozen outside of their shells but not in-shell. Canned goods cannot be frozen **directly**, but can be frozen **after** being removed from the can. Some foods will change in consistency, texture or other physical quality. This is not a safety issue but it may be unappetizing.

Safety of Dented or Damaged Canned Goods

It is a **myth** that a can with any dents or external damage is unsafe to eat. It is true that **some** dents can make canned food unsafe to eat. The key is knowing what to look for.

There are a few things you must consider when deciding if you will eat food from a dented/damaged can.

Size: How deep is the dent?

Location: Where is the dent located on the can? Is it on a seam?

Amount: How many dents are there? If there are multiple, do they meet?

Shape: Does the dent have sharp edges or points?

Dents shouldn't be deep enough that you can set your finger into them. The deeper a dent, the more likely that it has compromised the seal of the can, allowing air and bacteria to contaminate the food.



The can on the **left** has a large, deep dent. This dent is large and deep enough that you could set your finger into the dent. It also has sharp points and edges. **This can is unsafe to eat from.**

The can on the **right** has multiple small, shallow dents. These dents are not big enough for you to lay your finger into. They do not have sharp points or edges. **This can is safe to eat from.**



The can on the left is safe to eat from. There is one dent that is large but it is shallow. The dent does not affect the seams of the can. There are no sharp edges or points.

The can on the right is not safe to eat from. There are multiple dents that are small but they meet, forming multiple sharp edges and points. You can also see that these dents affect the seam of the can.

Cans that appear crumpled or whose sides are “buckling” are not safe to eat from. There is a risk that these dents have compromised the seal of the can, allowing air and bacteria to enter. Even holes that we cannot see with the naked eye can be big enough to allow these things to contaminate the food inside.



This image shows cans that are crumpled or have “buckled” sides, leaving the food stored inside **unsafe** to eat.

If you drop a can and dent it to the point it wouldn't be considered safe by these images, **do not store it**. You can throw the can away, or you can immediately remove the food from the can and store it safely (or immediately cook it instead.) This is a safe way to prevent foodborne illness from a potentially unsafe can while also avoiding food waste.

Do not eat food from bloated, swollen, or bulging cans.
Do not eat food from cans that are leaking, hissing, rusted or corroded.

Leftovers and Safety

Safely Storing Leftovers

As explained in **Food Storage**, foods stored under freezing temperatures will stay safe indefinitely. There may be a change in texture or quality, but this does not affect safety.

Leftovers can be safely stored under refrigeration for a few days - a week, depending on the food. It can be hard or overwhelming to remember all of the rules for different foods. Instead, a safe general rule of thumb is to store refrigerated leftovers for no more than 4 days. If you suspect you will need to store it longer, consider freezing instead.

Easy Steps to Ensure Safe Leftovers:

- **Keep food out of the danger zone.**

Don't leave food out at room temperature, (or removed from a heating element or ice) more than 2 hours if you are planning on storing it for later. If you are at an outdoor event such as a picnic or barbecue in the summer, that rule changes to 1 hour.

- **Cool food quickly.**

Keep food out of the danger zone by cooling it down as quickly as possible.

[Hot leftovers can go directly into the refrigerator](#), provided they are divided into small portions/containers. A large pot of soup should be separated and cooled before storing. A large piece of protein such as a hot roast or a turkey should be cut and separated before storing.

If you are nervous or concerned with putting warm leftovers into the fridge, use ice or cold water baths to chill the food before storing.

- **Do not store food that has been stored unsafely.**

Food that has been unsafely stored, such as at room temperature for several hours or left in the hot sun at a picnic, is not safe to eat. Heating this food, even to boiling temperatures, will not render it safe to eat after unsafe storage.

While some foods can be made safe with boiling (such as canned goods) the pathogens of concern for foods stored at room temperature (such as *S. aureus* or *B. cereus*) produce toxins that are not destroyed by the heat of cooking. These toxins can cause devastating organ or tissue damage, even at [subclinical doses](#). There is even evidence that food poisoning from *B. cereus* toxins can [increase the risk of diabetes](#). No food is worth potentially sacrificing your current or long-term health over.

- **Thaw frozen leftovers safely.**

As discussed in **Animal Products**, safely thaw all frozen leftovers. **Do not** thaw at room temperature without cold water. Thawed leftovers can be safely refrozen if they have reached an internal temperature of 165° F