



Bacon and Food Safety

It's the "B" in a BLT sandwich, the star of breakfast buffets, the garnish on a spinach salad, and the "pork" in pork-and-beans. Bacon imparts a smoky flavor to innumerable dishes. This ancient, cured meat now appears in such modern forms as shelf-stable or refrigerated fully cooked strips, bacon made from turkey and/or beef, and meats certified as organic.

History of Bacon

Bacon has an ancient history. The domestication of "pigs" (immature hogs) for food dates back to about 7000 B.C. in the Middle East. Some historians say that bacon made from hogs was a favorite of the early Romans and Greeks. About 500 years ago, bacon or bacoun (a Middle English term) referred to all pork. The term derived from bako (French), *bakkon* (Germanic), and *backe* (Old Teutonic) that refer to the "back" of the hog.

European peasants in the 1500's couldn't afford to buy pork often. It was a sign of affluence if a man could "bring home the bacon." They would cut off some for guests and sit around "chewing the fat," now a colloquial term for "having a discussion." The term "bringing home the bacon" now means "earning a living" or "being successful."

Bacon is made in many countries of the world. In Germany, it is called speck; Netherlands, spek; France, lard or bacon; Italy, pancetta; and Spain, tocino or tocineta. It can be made from several different animal species including pork, turkey, and beef. Bacon can also be made from various parts of an animal; thus, its appearance can vary.

What is bacon?

The term "bacon" is used to describe the cured belly of a swine (hog) carcass. If meat from other portions of the carcass is used, the product name must identify the portions where the bacon comes from, e.g., "Pork Shoulder Bacon." Bacon is generally produced from young animals (6 to 7 months old) that weigh between 175 to 240 pounds.

Pork bacon without any other descriptors is raw (uncooked) and must be cooked before eating. Most bacon sold in the United States is "streaky" bacon, long narrow slices cut crosswise from the hog belly that contain veins of pink meat within white fat. Unless otherwise noted, the information in this publication refers to "streaky" bacon.

In addition to "streaky" bacon, other U.S. favorites are American-style Canadian bacon (round slices of pink meat from the loin), turkey bacon made from light and dark turkey meat, and beef bacon prepared from various beef cuts. See the "Glossary of Bacon Terms" (found at the end of this publication) for definitions.

How is bacon made?

Several steps are involved in producing sliced bacon. First each pork belly is skinned and any ragged edges trimmed. After curing with salt and nitrite, the pork bellies are heat processed. Mass-produced bacon is heat processed in large convection ovens. It is much faster to mass produce bacon using a convection oven (as little as 6 hours) than by traditional smoking (many days).

Bacon receives its smoke flavor from natural smoke obtained by smoldering wood chips or by spraying the bacon with a liquid smoke extract.

After heat processing and smoking, the bacon must be chilled to below 40 °F before it is sliced. The majority of bacon is sliced before packaging. Because of the added salt and nitrite, bacon is far less perishable than other raw meat products. Even so, the chilling is done quickly to prevent bacterial growth and promote its shelf-life.

According to FSIS regulations, the weight of cured pork bellies that are ready for slicing and labeling as “bacon” shall not exceed the weight of the fresh, uncured pork bellies.

What are the methods of curing bacon?

There are two primary methods of curing bacon: pumping and dry curing. Although less frequently used, FSIS still receives label applications for immersion-cured bacon.

“Pumped” bacon has curing ingredients that are injected directly into the meat to speed up the curing process and add bulk. This type of mass-produced bacon is held for curing for 6 to 24 hours before being heated. If not properly drained, pumped bacon can exude white liquid during frying.

“Dry-cured” bacon has a premeasured amount of cure mixture applied or rubbed onto the bacon belly surfaces, completely covering them. Additional cure may be rubbed in over a number of days, but the amount of added sodium nitrite cannot exceed 200 parts per million (ppm). After the curing phase, the bacon may be left to hang for up to 2 weeks in order for the moisture to be drawn out. Less time is needed if it is going to be smoked. Because of the lengthy processing time and labor required, dry-cured bacon is more expensive than the more mass-produced, pumped bacon.

“Immersion-cured” bacon is placed in a brine solution containing salt, nitrite, and flavoring material or in a container with salt, nitrite, and flavoring material for 2 to 3 days. Sugar, honey, or maple syrup may be added to the brine. The meat must then be left to hang until it is cured.

Can bacon be home cured?

Yes, you can make bacon at home. For instructions, contact your local Extension Office or visit:

<http://muextension.missouri.edu/explore/agguides/ansci/g02528.htm>

How is cooked bacon made shelf-stable?

To make bacon safe to store at room temperature (shelf stable), it is pre-cooked in the plant to have a water activity at or below 0.85 to control *Staphylococcus aureus*. The cooked yield is 40% of the raw weight.

Is bacon “red” meat?

“Bacon” can only be made from pork bellies, which are red meat by definition. Pork is classified as “livestock,” and all livestock are considered “red meat.” Bacon can also be made from other species of livestock (e.g., beef) and poultry (e.g., turkey). These types of bacon products require a descriptive name such as, “Beef Bacon-Cured and Smoked Beef Plate” and “Turkey Bacon-Cured Turkey Thigh Meat.”

Is “salt pork” the same as bacon?

Salt pork is not bacon. Although it is salted, it is much fattier, and, unlike bacon, it is not smoked. It is generally cut from the hog’s belly or side. Because salt pork is so salty, cooks often blanch or soak it to extract some of the salt before using.

Does bacon contain additives?

Yes. Bacon is made with salt as a curing agent, and nitrite (but not nitrate) is the other most frequently used additive. Bacon may also contain other additives such as sugars, maple sugar, wood smoke, flavorings, and spices. Pumped bacon (see above) must also contain either ascorbate or sodium erythorbate (isoascorbate), which greatly reduces the formation of nitrosamines by accelerating the reaction of nitrite with the meat.

At certain levels, salt prevents the growth of some types of bacteria that spoil meat. Salt prevents bacterial growth either by directly inhibiting it or by its drying effect. Most bacteria require substantial amounts of moisture to live and grow.

Sodium nitrite produces the pink color (nitrosohemoglobin) in cured bacon. Nitrite also greatly delays the development of the *Clostridium botulinum* toxin (botulism); develops a cured-meat flavor; retards the development of rancidity, off-odors, and off-flavors during storage; and inhibits the development of a warmed-over flavor.

Sugar is added to reduce the harshness of salt. Spices and other flavorings are often added to achieve a characteristic "brand" flavor. Most, but not all, cured meat products are smoked after the curing process to impart a smoked meat flavor.

What are nitrosamines and what cooking methods minimize their formation?

Under certain conditions not yet fully understood, the products from the natural breakdown of proteins known as "amines" can combine with nitrites to form compounds known as "nitrosamines." There are many different types of nitrosamines, most of which are known carcinogens in test animals.

Not all cured meat products contain nitrosamines; however, when present, they usually are in very minute amounts. Many variables influence nitrosamine levels: amount of nitrite added during processing, concentrations of amines in meat, type and amounts of other ingredients used in processing, actual processing conditions, length of storage, storage temperatures, method of cooking, and degree of doneness.

Researchers at the USDA's Agricultural Research Service (ARS) found that the addition of vitamin C (also known as ascorbate) and vitamin E (also known as tocopherol) reduced the levels of nitrosamines in fried bacon and in nitrite-cured products. The findings led to changes in Federal regulations and industry processing to minimize consumer exposure to nitrosamines. USDA now requires adding 550 ppm (parts per million) of either sodium ascorbate or sodium erythorbate to pumped bacon. This addition greatly reduces the amount of free nitrite and, thus, minimizes the formation of nitrosamines. This regulation is found in 9 Code of Federal Regulations (CFR) 424.22 (b)(1).

A bacon cooking study, "Effect of Frying and Other Cooking Conditions on Nitrosopyrrolidine Formation in Bacon" (Journal of Science, Vol. 39, pages 314-316), showed no evidence of nitrosamines in bacon fried at 210 °F for 10 minutes (raw), 210 °F for 15 minutes (medium well), 275 °F for 10 minutes (very light), or 275 °F for 30 minutes (medium well). But when bacon was fried at 350 °F for 6 minutes (medium well), 400 °F for 4 minutes (medium well), or 400 °F for 10 minutes (burned), some nitrosamines were found. Thus, well-done or burned bacon is potentially more hazardous than less well-done bacon. Also, bacon cooked by a microwave has less nitrosamine than fried bacon.

How much nitrite can be used in curing bacon?

The USDA is responsible for monitoring the proper use of nitrite by meat processors. While sodium nitrite cannot exceed 200 ppm going into dry-cured bacon, sodium nitrite cannot exceed 120 ppm for both pumped and immersion-cured bacon.

Can bacon be made without the use of nitrite?

Bacon can be manufactured without the use of nitrite, but must be labeled "Uncured Bacon, No Nitrates or Nitrites added" and bear the statement "Not Preserved, Keep Refrigerated Below 40 °F At All Times" -- unless the final product has been dried according to USDA regulations, or if the product contains an amount of salt sufficient to achieve an internal brine concentration of 10% or more, the label does not have to carry the handle statement of "Not Preserved, Keep Refrigerated below ___ etc. Recent research studies have shown for products labeled as uncured, certain ingredients added during

formulation can naturally produce small amounts of nitrates in bacon and, therefore, have to be labeled with the explanatory statement “no nitrates or nitrites added except for those naturally occurring in ingredients such as celery juice powder, parsley, cherry powder, beet powder, spinach, sea salt etc.”

Is bacon inspected and graded?

All bacon found in retail stores is either USDA inspected for wholesomeness or inspected by State systems that have standards equal to the Federal government. Each animal, from which the bacon is made, is inspected for signs of disease. The “Inspected and Passed by USDA” seal ensures the bacon is wholesome.

Bacon is not graded.

Can hormones and antibiotics be used in pork from which bacon is made?

No hormones are used in the raising of hogs. Hormones are not permitted in pork by Federal regulations; therefore, bacon cannot have added hormones.

Antibiotics may be given to prevent or treat disease in hogs. A “withdrawal” period is required from the time antibiotics are administered until it is legal to slaughter the animal. This is so residues can exit the animal’s system and won’t be in the meat.

FSIS randomly samples pork at slaughter and tests for residues. Data from this monitoring program have shown a very low percentage of residue violations.

What foodborne organisms are associated with pork?

Pork, like other raw animal muscle foods, frequently contains bacterial pathogens. Some other foodborne pathogenic microorganisms that can be found in pork, as well as other meats and poultry, are *Salmonella*, *Staphylococcus aureus*, *Toxoplasmosis gondii*, *Campylobacter*, *Yersinia enterocolitica*, and *Listeria monocytogenes*. They all can be destroyed by cooking.

Humans may contract trichinosis (caused by the parasite, *Trichinella spiralis*) by eating undercooked pork. Much progress has been made in reducing trichinosis in grain-fed hogs, and cases in humans have greatly declined since 1950.

Can the term “natural” be used on bacon?

Yes, bacon can be labeled as “natural” if the bacon is “uncured.” This means the bacon does not contain nitrites or nitrates as direct additive curing agents. Therefore, the bacon would meet the definition for “natural” (minimally processed, no artificial ingredients) and can be labeled as “Natural* Uncured Bacon (No Nitrates or Nitrites Added, Not Preserved, Keep Below 40 °F At All Times), *Minimally Processed, No Artificial Ingredients.”

Can the term “organic” be used on bacon?

Yes, if the bacon is made from certified organic meat or poultry, the bacon can be labeled “organic.”

Is a nutrition facts panel required on bacon?

Generally, a nutrition facts panel is required on both cooked and raw bacon products.

Is a safe handling label required on bacon?

Yes, FSIS requires safe handling instructions on packages of bacon and all other raw or partially cooked meat and poultry products as part of a comprehensive effort to protect consumers from foodborne illness.

Can turkey bacon contain pork?

Yes, it is possible for turkey bacon to contain pork, but it must be included on the label (either in the name or in the ingredients statement). All ingredients used in the manufacture of a meat product must be listed in the ingredient statement on the package.

Are “bacon bits” made from pork?

“Bacon bits” are made from 100% real bacon. These products are inspected by USDA. The label and ingredient statement on the jars and resealable pouches will display the product information. For comparison, 1 tablespoon of real bacon bits is equivalent to 1 1/2 strips of bacon.

Imitation products are made from a soy-based product that have a bacon texture and flavor, but are kosher and vegetarian. Soy-based products are inspected by FDA. Companies should not be using the term “bacon” on products not made from pork bellies.

Dating of Bacon

Product dating (i.e., applying “sell-by” or “use-by” dates) is not required by Federal regulations. However, many stores and processors may voluntarily choose to date packages of bacon. Use or freeze products with a “sell-by” date within 7 days of purchase. If the manufacturer has determined a “use-by” date, observe it. It’s always best to buy a product before its date expires. It’s not important if a date expires after freezing bacon because all foods stay safe while frozen.

What should you look for when buying bacon?

When buying bacon, look for slices with long veins of lean pink meat and a relatively small amount of fat. If the package bears an expiration date, purchase the package before the date expires.

Should bacon be rinsed before cooking?

Washing raw bacon before cooking it is not recommended. Any bacteria that might be present on the surface would be destroyed by cooking.

How to Handle Bacon Safely

RAW BACON

- Select the bacon just before checking out at the supermarket register.
- Take the bacon home immediately and refrigerate it at 40 °F or below.
- Use within 7 days or freeze (0 °F).

COOKED BACON PRODUCTS

- Read the product label for handling instructions.
- For refrigerated, cooked bacon, select it just before checking out at the supermarket register.
- Take the bacon home immediately and refrigerate it at 40 °F or below.
- For shelf-stable, cooked bacon, store the product at 85 °F or below. Refrigerate after opening.
- Observe the manufacturer’s recommended “use-by” date.

How to Thaw Bacon Safely

There are three safe ways to thaw bacon: in the refrigerator, in cold water, and in the microwave. Never defrost bacon on the kitchen counter or at room temperature.

In the Refrigerator: It’s best to plan ahead for slow, safe thawing in the refrigerator. After defrosting bacon by this method, it will be safe in the refrigerator for 7 days before cooking. If you decide not to use the bacon during this time, you can safely refreeze it without cooking it first.

In Cold Water: This method is faster than refrigerator thawing. The food must be in a leak-proof package or plastic bag. If the bag leaks, bacteria from the air or surrounding environment could be introduced into the food. Also, the bacon may absorb water, resulting in a watery product. Submerge the bag in cold tap water, changing the water every 30 minutes so it continues to thaw. A one-pound package of bacon may thaw in an hour or less. If thawed completely, the food must be cooked immediately.

In the Microwave: When thawing bacon in the microwave, plan to cook it immediately after thawing because some areas of the food may become warm and begin to cook during microwaving. Holding partially cooked food is not recommended because any bacteria present will not be destroyed.

Foods defrosted in the microwave or by the cold water method should be cooked before refreezing because they may have been held at temperatures above 40 °F, where bacteria can multiply.

It is safe to cook bacon from the frozen state.

To what temperature should bacon be cooked?

It's very difficult to determine the temperature of a thin piece of meat such as bacon, but if cooked crisp, it should have reached a safe temperature. Cooked, cured meat such as bacon can remain pink due to its curing agents, even when the meat has reached a safe temperature.

Partial Cooking

Never brown or partially cook raw bacon and then refrigerate to finish cooking later. This is because any bacteria present will not be destroyed. Cook bacon completely before removing it from the heat source.

Safe Cooking

The three main ways to cook bacon are in a skillet or pan on the stove, in a conventional oven, or in the microwave. The length of time to cook bacon depends upon the type and thickness of the bacon, the heat used, and the desired crispness.

How can precooked bacon be reheated?

While it is safe to eat precooked bacon from the package, you may desire to reheat it. To reheat, follow the package directions or place the strips on a microwave-safe plate or a paper towel and microwave for about 10 seconds per strip.

HOME STORAGE OF BACON PRODUCTS

These short, but safe, time limits compiled from a variety of sources will help keep refrigerated bacon from spoiling or becoming dangerous to eat. Because freezing keeps food safe indefinitely, recommended storage times are for quality only.

PRODUCT	PANTRY	REFRIGERATOR 40 °F or below	FREEZER 0 °F or below
Salt pork	Not applicable (N/A)	1 month	4 to 6 months
Bacon	N/A	7 days	4 months
Beef bacon	N/A	7 days	4 months
Canadian bacon, sliced	N/A	3 to 4 days	4 to 8 weeks
Poultry bacon	N/A	7 days	4 months
Pancetta	N/A	7 days	4 months
Dry-cured sliced bacon	10 days without refrigeration	4 weeks in the refrigerator	3 months
Dry-cured slab bacon	3 weeks without refrigeration	4 to 6 weeks in the refrigerator	3 months
Bacon cured without nitrites	N/A	3 weeks in the refrigerator	6 months
Leftover cooked bacon, cooked by consumer	N/A	4 to 5 days	1 month
Baby food with fresh bacon	Observe "use-by" date.	2 to 3 days after opening (leftovers not heated)	1 month
Cooked bacon, purchased shelf stable	Unopened in the pantry (stored below 85 °F) until the "use-by" date on the package.	After opening, refrigerate and use within 5 to 14 days. See product package for specific recommendations.	3 months
Cooked bacon, purchased refrigerated	Observe manufacturer's "use-by" date.	Observe manufacturer's "use-by" date.	3 months for best quality
Canned bacon in pantry	2 to 5 years in pantry	3 to 4 days after opening	2 to 3 months after opening
Bacon bits, made with real bacon	Unopened in pantry, good until "sell-by" date	After opening, refrigerate up to 6 weeks.	1 to 2 months
Imitation bits (made with soy)	4 months in pantry	Refer to jar for refrigerator storage.	Not necessary for safety

GLOSSARY OF BACON TERMS

BABY FOOD WITH FRESH BACON: Bacon without nitrites must be shown in the ingredients statement as bacon (water, salt, sugar, etc., without nitrates or nitrites). Nitrites and nitrates are not acceptable in baby and toddler foods. (Nitrate is prohibited in all bacon.)

BACK BACON (United Kingdom): Most bacon consumed in the U.K. is back bacon (also called short back bacon). The cut comes from the loin in the middle of the back of the animal. It is a lean, meaty cut of bacon, with relatively less fat compared to other cuts.

BACK RASHERS (Irish): Pork bacon made from the meat on the back of the pig. This type of bacon is part of a traditional Irish breakfast.

BACON: The cured belly of a swine (hog) carcass. If meat from other portions of the carcass is used, the product name must be qualified to identify the portions, e.g., "Pork Shoulder Bacon."

BACON AND PORK SAUSAGE: Product is formulated with a high percentage of bacon (usually bacon ends and pieces) with at least 20% pork.

BACON ARKANSAS and **ARKANSAS STYLE BACON:** Product which is identified as "Arkansas Bacon" or "Arkansas Style Bacon" is produced from the pork shoulder blade Boston roast. The pork shoulder blade Boston roast includes the porcine muscle, fat, and bone; cut interior of the second or third thoracic vertebra; posterior of the atlas joint (first cervical vertebra); and dorsal of the center of the humerus bone.

For "Arkansas Bacon," the neck bones and rib bones are removed by cutting close to the underside of those bones. The blade bone (scapula) and the dorsal fat covering, including the skin (clear plate), are removed, leaving no more than one-quarter inch of fat covering the roast. The meat is then dry cured with salt, sugar, nitrites, and spices, and smoked with natural smoke.

The meat may not be injected or soaked in curing brine, nor may any artificial or liquid smoke be applied to the meat. Product that is prepared outside the state of Arkansas, but in the manner prescribed, may be identified as "Arkansas Style Bacon." The true product name must be shown as "Boneless Cured Pork Shoulder Butt."

BACON (CANNED - PASTEURIZED): A shelf-stable item, which must have at least 7% brine concentration.

BACON (COOKED): Not to yield more than 40% bacon — 60% shrink required. BHA and BHT may be used as antioxidants in precooked bacon at level of 0.01% individually or 0.02% collectively, based on fat content. TBHQ (tertiary butylhydroquinone) can be used in products as an antioxidant (reduces the damage from oxygen) in combination with the preservatives BHT (butylated hydroxytoluene) and BHA (butylated hydroxyanisole), but it can not be used alone except in cooked bacon.

BACON-LIKE PRODUCTS: Bacon-like products, including poultry bacon, labeled with "bacon" in the name must follow the same requirements as those applied to pork bacon. These requirements include, but are limited to, limits on restricted ingredients and the requirement that the bacon must return to "green weight" (see below).

BACON PRODUCTS: The bacon products intended for further cooking before consumption, i.e., slab bacon for deli slicing, can be labeled "certified," "roasted," or "partially cooked" provided the product is cooked to 148 °F and the labeling clearly indicates the product is intended to be further cooked before consumption.

BEEF BACON: Beef bacon is a cured and smoked beef product sliced to resemble regular bacon. It is prepared from various beef cuts and offered with a variety of coined names, including "Breakfast Beef," "Beef Bacon," etc. A common or usual name is required, e.g., "Cured and Smoked Beef Plate," and should be shown contiguous to the coined name.

CANADIAN BACON: In the United States, "Canadian" bacon is plain lean "back bacon" (see above) made from the loin, and it is trichina treated. It is simply called "back bacon" in Canada, where "Canadian bacon" is traditionally unsmoked back bacon that has been sweet pickle cured and coated in yellow cornmeal. This variation is also known as peameal bacon because, in times past, a mixture of ground yellow peas was used for coating to improve curing and shelf-life.

Bacon and Food Safety

CERTIFIED: If pork is treated to eliminate *Trichinella spiralis*, and the processing company demonstrates that viable trichinae have been destroyed or rendered ineffective in causing infection, the resulting pork can be labeled as "certified pork."

DIXIE BACON or **DIXIE SQUARE:** Bacon made from cured and smoked cheeks of pork. The true product name, e.g., "Pork Jowl Dixie Bacon, Cured and Smoked" shall appear on the label.

FINISHED WEIGHT: The final weight of cured pork bellies after processing. The weight of cured pork bellies ready for slicing and labeling as "Bacon" shall not exceed the weight of the fresh, uncured pork bellies (green weight).

GREEN WEIGHT: The weight of fresh pork bellies, normally skinned and trimmed, prior to pumping with curing solution.

ORGANIC BACON: Bacon can be certified organic if made from organically raised meat or poultry.

PANCETTA (pan-CHET-uh): Italian streaky bacon, smoked or green (unsmoked), with a strong flavor. It is usually cured in salt and spices and then air-dried. The name is a diminutive of *pancia*, meaning "belly."

POULTRY BACON: Poultry bacon products are acceptable and may be designated as (Kind) Bacon. However, a true descriptive name must appear contiguous to (Kind) Bacon without intervening type or design, in letters at least one-half the size of the letters used in the (Kind) Bacon, and in the same style and color and on the same background. An example of an acceptable designation is "Turkey Bacon - Cured Turkey Breast Meat - Chopped and Formed." The descriptive name can serve alone as the product name. Poultry bacon is cooked.

STREAKY BACON: The name for North American bacon in the United Kingdom and Ireland. It comes from the belly of a pig and is very fatty with long veins of fat running parallel to the rind. It is also called "streaky rashers."

TURKEY BACON: (see "POULTRY BACON")

Food Safety Questions?

Call the USDA Meat & Poultry Hotline

If you have a question about meat, poultry, or egg products, call the USDA Meat and Poultry Hotline toll free at

1-888-MPHotline
(1-888-674-6854)

The hotline is open year-round



Monday through Friday from 10 a.m. to 4 p.m. ET (English or Spanish). Recorded food safety messages are available 24 hours a day.

Check out the FSIS Web site at

www.fsis.usda.gov

Send E-mail questions to **MPHotline.fsis@usda.gov**.

Ask Karen!

FSIS' automated response system can provide food safety information 24/7 and a live chat during Hotline hours.



AskKaren.gov

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