1 HOUR SAN CE CBDM Approved

Cooking
A Crucial Step in Your HACCP Plan

by Melissa Vaccaro, MS, CHO

You have probably heard someone say, "That food is OK. Just cook it—that will kill any germs." That's generally true, but unfortunately some germs are a bit more tolerant and resilient than others. Why do we cook foods? Why do we have minimum temperatures for different kinds of foods?

Cooking is a great control method and is a critical control point in most HACCP Plans (Hazard Analysis Critical Control Points). That said, it can take a bit more control to keep some pathogens and toxins out of our food, especially sporeformers and toxin producers.

To be effective, the cook step must destroy pathogens. Several factors affect destruction of the organisms. First, the expected level of organisms in the raw product is important. Second, the initial temperature of the food will affect cooking. Third, the food's bulk (weight, thickness) will impact the time needed to reach the food's required final internal temperature. Finally, and very important, you need to know what the final internal temperature of the food should be in order to obtain a lethal kill step for the pathogens of concern. To kill all organisms, cooking must

bring *all* parts of the food to the final lethal kill temperature for the correct amount of time.

The biology of an organism will affect the required cooking temperature. This is determined by the organism's ability to survive at certain temperatures. Different pathogens can survive in different temperatures. That's why it's important to know the pathogen of concern in a particular food type. For example, *Salmonella* is a pathogen of concern in eggs. *E. coli* is a pathogen of concern in beef products. These are not the only pathogens that could be found on this type of food, but they have been identified scientifically as the most commonly found pathogens.

The growing stage of a particular species can also impact the lethality temperature. For instance, vegetative cells of bacteria are more sensitive to heat than the bacterial spore. The larva of a worm is less resistant to heat than the worm egg.

Heat will penetrate food differently; therefore the characteristics of the food itself could affect the lethality temperature. Fat in food will reduce the effective lethality of heat. If a product has high moisture content it will aid in thermal destruction of the pathogens.

In the FDA Food Code the stated temperature is the minimum that must be achieved and maintained in all parts of each piece of meat for at least the stated time. This is all done through science and experiments that assess the lethality of certain pathogens. You can find the time/temperature requirements in Part 3-4 of the FDA Model Food Code.

INTERNAL COOKING TEMPERATURE

Raw Animal Foods (2013 FDA Model Food Code)

145˚F for 15 seconds:

- Raw eggs cooked for immediate service
- Fish, except as listed next
- Meat, except as listed next
- Commercially raised game animals, rabbits

155˚F for 15 seconds:

- Raw eggs not for immediate service
- Injected meats
- Mechanically tenderized meats
- Comminuted meat, fish, or commercially raised game animals
- Ratites (ostrich, rhea, and emu)

165˚F for 15 seconds:

- Poultry
- Wild game animals
- Stuffed fish, meat, pork, pasta, ratites, and poultry
- Stuffing containing fish, meat, ratites, and poultry

Whole Meat Roasts: Refer to cooking charts in the Food Code, paragraph 3-401.11 (B)

Continued on page 12

Continued from page 11

Heating deviations, which most often involve slow cook time or an excessive hold time within the optimum temperature range for cell growth, can encourage the rapid growth of many pathogens. This growth sometimes can be so fast that even recooking may be ineffective in rendering the product safe. Also, certain toxigenic bacteria can release toxins into the product. Some of these toxins, such as those of *Bacillus cereus*, are heat stable and are not inactivated by normal recooking temperatures. Some bacteria produce heat resistant spores that can then germinate new cells after cooking.

It is absolutely true that heating will destroy vegetative cells of most foodborne pathogens, but for several pathogens it is not always the case.

What is a spore? A spore (or endospore) is a tough, nonreproductive and dormant structure that is produced by certain bacteria. It is not a spore like you would associate with plants. The endospore state allows the bacteria to remain dormant for long periods of time. The spore formation is usually triggered by harsh conditions that might allow it to survive to reproduce new vegetative cells at a later time, when conditions are better. Endospores are resistant to high temperatures, dehydration, UV radiation, freezing, and chemical disinfectants. Most bacteria cannot produce endospores, but some of these foodborne pathogen ones can. Spores are nature's brilliant way of keeping the species alive through rough times.

CLOSTRIDIUM PERFRINGENS

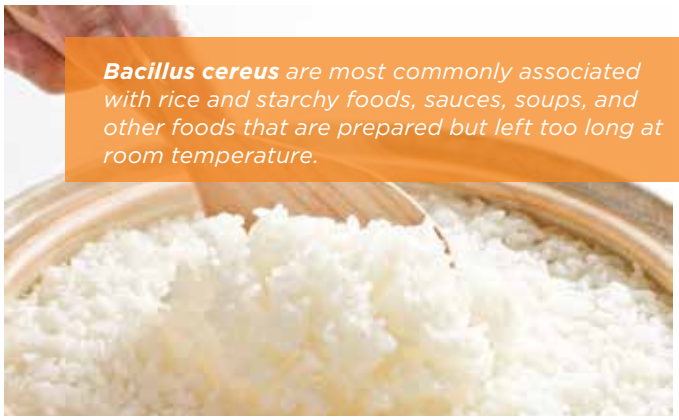
Associated most commonly with meat, poultry, gravy, dried or precooked foods, or other time/temperature abused foods is *Clostridium perfringens*. According to the CDC, this is one of the most common causes of foodborne illness in the United States. *C. perfringens* is widely found in the environment and frequently occurs in the intestines of humans, domestic animals, and feral animals. Spores persist in soil, sediments, and areas exposed to human or animal fecal pollution. If you get perfringens food poisoning, you will most likely experience intense abdominal cramps and watery diarrhea within about 8–16 hours after consuming contaminated food. These symptoms are typically self-eliminating and will last about 24 hours.

Clostridium perfringens *are most commonly associated with meat, poultry, gravy, dried or precooked foods.*

Cooking (heat) kills *C. perfringens* vegetative cells, but the toxin producing spores may survive and can produce a toxin that will cause gastrointestinal illness.

BACILLUS CEREUS

The food sources for *Bacillus cereus* tend to be rice and starchy foods, sauces, soups, and other items that are prepared but left too long at room temperature. *Bacillus* is widely distributed in the environment; in many types of soil and in sediment, dust and plants.



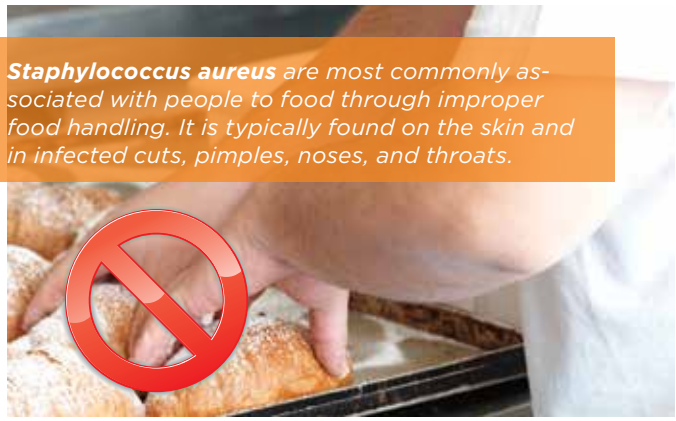
Bacillus cereus *are most commonly associated with rice and starchy foods, sauces, soups, and other foods that are prepared but left too long at room temperature.*

Bacillus is a sporeforming, enterotoxin producer. These toxins can create two types of illnesses: one type causing diarrhea/abdominal cramps (diarrheal syndrome) and the other causing nausea and vomiting (emetic syndrome). If you get *Bacillus*, you will most likely start showing symptoms anywhere from 30 minutes (emetic type) to 15 hours (diarrheal type) after consumption of contaminated food. But rest assured you should only be sick for 24-48 hours.

Cooking (heat) kills *Bacillus* vegetative cells that cause food poisoning, but not the spores that can grow into new cells. If cooked food is temperature or time abused, these endospores will produce new vegetative cells. These

bacterial cells can produce toxins that will cause gastrointestinal illness.

STAPHYLOCOCCUS AUREUS



Staphylococcus aureus *are most commonly associated with people to food through improper food handling. It is typically found on the skin and in infected cuts, pimples, noses, and throats.*

Often associated with people to food through improper food handling, *Staphylococcus aureus* is often found on the skin, and in infected cuts, pimples, noses, and throats. The bacteria will multiply rapidly at room temperature to produce toxins (exotoxin) that cause illness. *Staphylococcus* toxins are resistant to heat and cannot be destroyed by cooking. There is no spore formation with *Staphylococcus aureus*. The bacteria itself produces the toxins.

Mostly associated with foods that will have significant hand contact, you may find Staph bacteria in pastries, sandwiches, salads, and sliced meats. Once contaminated food is eaten, symptoms of *Staphylococcus aureus* such as severe nausea, abdominal cramps, vomiting, and diarrhea can occur within 30 minutes and up to six hours after ingestion. It may take two or three days to recover from this illness.

All three of these illnesses are referred to as *foodborne illness intoxications*. The illness is caused by ingesting toxins made by the bacteria or spores. Spores and toxins are very heat tolerant. Hopefully, you are noticing that heat alone will not control these organisms from potentially making us sick. You must incorporate control measures to assure these types of pathogens are also controlled. Along with proper cooking, you must have other control measures such as:

Sources:

- www.cfsan.fda.gov
- www.cdc.gov
- Food and Drug Administration. Bad Bug Book, Foodborne Pathogenic Microorganisms and Natural Toxins. Second Edition. 2012
- 2013 FDA Model Food Code, www.fda.gov/food

1. Good hygienic practices and hand hygiene
2. Good health and wound care practices
3. No bare hand contact on ready-to-eat foods
4. Proper and quick cooling practices
5. Proper hot and cold holding practices
6. Reduced time in the danger zone (41˚F - 135˚F)
7. No cross contamination, especially after cooking

It's not so important that foodhandlers know exactly what bacteria produce spores or toxins, but they must understand that some do and that heat (cooking) is not the sole answer to keeping food safe. They should understand that the control measures listed above, and others not listed here, must be established and used. These measures—in addition to proper cooking temperature—will give you the edge on foodborne illness control.

The next time you hear someone say, "Just cook it to death, it will be fine," you can now reply, "Well, that might not be exactly true."

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