CLEMSON
E X T E N S I O N

HOME & GARDEN INFORMATION CENTER

HGIC 3502

1-888-656-9988
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Effects of Temperature on Food

BACKGROUND

"Last night I left cooked roast beef on the counter to cool before refrigerating but fell asleep and discovered it this morning. I immediately put it in the refrigerator. Since the meat is cooked, shouldn't it be safe to eat?"

The U.S. Department of Agriculture's Meat and Poultry Hotline receives similar calls every day from consumers who have questions about how to keep their food safe. The answer to this caller's question is that the roast beef should be thrown out. Why? Because leaving food out too long at room temperature can cause bacteria — such as *Staphylococcus aureus, Salmonella enteriditis, Escherichia coli* O157: H7, and *Campylobacter* — to grow to dangerous levels that can cause illness.

Bacteria exist everywhere in nature. They are in the soil, air, water and the foods we eat. When the bacteria have nutrients (food), moisture, time and favorable temperatures, they grow rapidly increasing in numbers to the point where some can cause illness. Therefore, understanding the important role temperature plays in keeping food safe is critical. If we know the temperature at which food has been handled, we can then answer the question, "Is it safe?"

THE DANGER ZONE (40 to 140 °F)

Bacteria grow most rapidly in the range of temperatures between 40 and 140 °F, doubling in number in as little as 20 minutes. This range of temperatures is often called the "Danger Zone." That's why the Meat and Poultry Hotline advises consumers to never leave food out of refrigeration over two hours. If the temperature is above 90°F, food should not be left out more than one hour.

COOKING

Raw meat and poultry should always be cooked to a safe internal temperature. Temperatures (160 ° to 212 °F) reached in baking, roasting, frying and boiling will destroy bacteria that can cause food-borne illness.

When roasting meat and poultry, use an oven temperature no lower than 325 °F. Cook ground meats (beef, veal, lamb and pork) to an internal temperature of 160 °F and ground poultry to 165°F. Steaks and roasts cooked to an internal temperature of 145 °F are medium rare, 160 °F are medium and 170 °F are well done.

For doneness, poultry breast meat should be cooked to an internal temperature of 170°F; 180°F for other parts and whole birds. Use a meat thermometer to assure that meat and poultry have reached a safe internal temperature.

If raw meat and poultry have been handled safely, using the above preparation recommendations will make them safe to eat. If raw meats have been mishandled (left in the Danger Zone too long), bacteria may grow and produce toxins, which can cause foodborne illness. Cooking does not destroy toxins that are heat-resistant. Therefore, even though cooked, meat and poultry mishandled in the raw state may not be safe to eat even after proper preparation.

STORING LEFTOVERS

One of the most common causes of foodborne illness is improper cooling of cooked foods. Bacteria are everywhere, even after food is cooked to a safe internal temperature, and they can be reintroduced to the food and then reproduce. For this reason leftovers must be put in shallow

containers for quick cooling, and refrigerated immediately or within two hours of preparation.

REHEATING
Foods should be reheated thoroughly to an internal temperature of 165°F or until hot and steaming. In the microwave oven, cover food and rotate so it heats evenly. Follow manufacturer's instructions for stand time for more thorough heating. In the absence of manufacturer's instructions, at least a two-minute stand time should be allowed.

COLD STORAGE TEMPERATURES
Properly handled food stored in a freezer at 0°F will always be safe. Freezing keeps food safe by slowing the movement of molecules, causing bacteria to enter a dormant stage. Once thawed, these bacteria can again become active and multiply to levels that may lead to foodborne illness. Because bacteria on these foods will grow at about the same rate as they would on fresh food, thawed foods should be handled as any other perishable food.

A temperature of 34 to 40 °F should be maintained in the refrigerator. In contrast to freezer storage, perishable foods will gradually spoil in the refrigerator. Spoilage bacteria will make themselves known in a variety of ways. The food may develop an uncharacteristic odor, color and/or become sticky or slimy. Molds may also grow and become visible. Bacteria capable of causing foodborne illness either don't grow or grow very slowly at refrigerator temperatures. A refrigerator/ freezer thermometer should always be used to verify that the temperature of the unit is correct.

Safe food-handling practices are a good defense against foodborne illness. Because we know how different temperatures affect the growth of bacteria in our food, we can protect ourselves and our families from foodborne illnesses by proper handling and cooking, and by storing foods at safe temperatures.

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