Study the Virulence factors of some bacterial species isolated from domestic and imported meat

Amidah Ali Atiyah – University Samarra
Asmaa Easa Mahmood – University Samarra

Significant levels of bacterial toxins were are found in animal products that cause endotoxemia (bacterial toxins in the bloodstream) within hours of eating.

Bacteria endotoxins from animal products have been shown to survive high heat cooking for long periods, acid (like our stomachs), and digestive enzymes.

"Unfortunately, we found a number of problems, and it's hard to point a finger at just one sector of the industry," says the study's lead author Sarah Klein, a senior attorney in CSPI's food-safety program.

Klein and her colleagues looked at the number of outbreaks and illnesses caused by various cuts of meat and poultry and the pathogens that caused them, then ranked meats by risk factor based on the severity of illness that different bacteria in meat can cause; some are very common and can simply give you a queasy stomach, while others, though rare, send people to the hospital and can even prove fatal.

So how sick could you get? If you're eating chicken, very, and if you're eating steak, very much. Here's what else they found:

Chicken:

Americans eat more chicken than all types of beef combined, which may explain why more outbreaks linked to chicken were reported to the CDC than any other meat product they analyzed. Most illnesses were caused by Salmonella and campylobacter, two bugs that originate in slaughterhouses and feedlots. But the report also found high rates of chicken-related illnesses caused by Clostridium perfringens, bacteria that multiply on cooked foods that are left at room temperature for too long after cooking. The infections they cause are generally mild but can lead to a life-threatening form of intestinal damage. "That may suggest we have problem in the restaurant industry with the way food is held after cooking," Klein says, adding that common restaurant practices, such as setting out buffets or partially cooking meats before they're ready to be served, could be making you sick.

Chicken is usually bought raw and cooked in the home. However, many processed poultry products are also available from the chiller cabinets of shops. Raw chicken is sold either frozen or chilled. A wide variety of microbes can be present in both cooked and raw chicken.

Raw chicken

Raw chicken becomes contaminated with bacteria from the gut, skin and feet of the birds during slaughter and from the water and ice used in processing. Chilling the carcass immediately after slaughter reduces the number of microbes on most meats because it dries the surfaces. However this has less effect on chickens because their skin can stay moist. The raw chicken is stored at a low temperature which reduces the rate at which bacteria reproduce. Eventually cold-loving microbes such as Pseudomonas will cause spoilage, making the meat smelly and slimy. Other factors which affect the rate of spoilage are pH and the type of packaging.

Cooked chicken

In the home chicken should be cooked thoroughly, handled hygienically, wrapped to prevent contamination by microbes from the air or other foods, cooled quickly and stored at 0–5°C. Refrigeration

will slow the growth of microbes but it will eventually spoil. Cooked chicken should be eaten up quickly.

The microbiological content of cooked poultry products depends on the methods of processing, packaging and storage. Sometimes bacteria and spores in the centre of the product may survive cooking. The meat may become contaminated after cooking during handling, slicing and packaging. Cured products will tend to spoil in the same way as other cured meats such as ham. Non-cured products which have been packaged in the absence of oxygen may be spoiled by Enterobacteria which produce very strong and unpleasant odours in the packet. Packaged meats should be consumed before the use–by date on the label.

Can it be harmful?

Poultry is a common source of food-borne illness. Food poisoning bacteria such as Campylobacter jejuni, Salmonella, Clostridium perfringens and Staphylococcus aureus live in the gut and/or skin of the birds. They can get on to raw chicken during slaughter and processing. Outbreaks of food poisoning are often due to inadequate cooking or recontamination of the poultry after cooking. Raw poultry can also be a source of food poisoning bacteria for cross-contamination to other foods prepared in the same kitchen.

Ground beef:

"Ground beef, we know historically, has been a risky product," Klein says, simply because the act of grinding together meat from different animals introduces the possibility that bacteria from one animal can contaminate meat from dozens of others. Ground beef was the second most common source of meat-related illness outbreaks in the period studied, and 90% of those recalls were due to the presence of E. coli, Salmonella, or Listeria, all bacteria that originate in slaughterhouses and can lead to hospitalization, long-term health problems, or death.

Every time you eat a burger, you could be getting a side of bacteria with it. Most packages of ground beef in the grocery store contain at least one type of bacteria that could make you sick, according to a survey by Consumer Reports.

Researchers looked at 300 samples of ground beef from grocery stores in 26 cities across the United States. They included a range of leanness and cuts, from sirloin to chuck. About 40% of the packages bore labels stating they were "organic" or that the cows had been grass-fed or had not been given antibiotics.

The Consumer Reports team looked for five types of bacteria that have been found on beef, including E. coli O157, a strain that causes bloody diarrhea and abdominal pain and has been linked with the highest number of outbreaks of foodborne illnesses from beef.

What did they find?

Beef (other cuts). The CDC lumps any beef that doesn't fall into other categories (ground beef, steak, or roast beef products) into an "other" category that includes things like beef tacos and beef jerky. Most of the illnesses caused by "other" beef could be attributed to Clostridium perfringens, the bacteria that "luxuriates" as Klein puts it, on the surfaces of foods left out for too long after cooking.

Steak. Here's a dirty little secret about your steak dinner: Heavy use of antibiotics and other methods used on America's feedlots produce tougher meat, says Klein. So slaughterhouses have increasingly turned to a practice called "mechanical tenderization," a process that uses needles or blades to pierce the exterior of a piece of meat to tenderize it. However, in doing so, she says, those needles or blades drive any bacteria that may be living on the exterior of a piece of meat further into the flesh. So when that filet or T-bone reaches the restaurant and you order it medium-rare, the bacteria on the outside will be killed when the steak is seared, but anything living on the inside will continue to thrive. More than half of the 82 outbreaks linked to steak during the study period could be linked to E. coli, a bacterium that's commonly found on the exterior of whole cuts of meat.

Turkey:

Turkey was the source of the largest food recall in US history, which occurred in 2011 when one person died and more than 100 were hospitalized after eating ground turkey products contaminated with an antibiotic-resistant strain of Salmonella. In total 36 million pounds of ground turkey were recalled, so it may come as no surprise that CSPI labeled it a "High Risk" meat. But it's not just Salmonella, nor just ground forms of turkey that are making people sick, the report found. The most common illness associated with turkey is caused by Clostridium perfringens, and the greatest numbers of turkey-related illnesses occur in November and December—prime turkey-cooking holidays.

the most common microorganisms contributing to foodborne illnesses associated with turkey are Campylobacter jejuni, Clostridium perfringens, Escherichia coli O157:H7(E. coli), Listeria monocytogenes, Salmonella, Shigella and Staphyloccocus aureus.

Campylobacter jejuni has only recently been associated with human illness and is frequently mistaken for a stomach virus infection. It is a slow-growing bacteria found in the gastrointestinal tract of animals. It causes illness two to five days after eating the contaminated food

Clostridium perfringens can grow without oxygen and can create spores that are resistant to cooking temperatures. These bacteria grow in meat or poultry that has been held for a long time before cooking or in precooked meat that is eaten cold or improperly reheated. Institutional feeding (such as school cafeterias, hospitals, nursing homes, prisons, etc.) where large quantities of food are prepared several hours before serving is the most common circumstance in which Clostridium perfringens occurs. The young and elderly are the most frequent victims. Factors involved in the curing process help make cured meats an unlikely vehicle for this microorganism. To prevent this organism from growing, cook turkey immediately after thawing or chill cooked turkey rapidly, cover and refrigerate promptly.

Escherichia coli O157:H7 (E. coli) is found in the intestinal tract of warm-blooded animals. Usually associated with ground beef, the organism can be found in ground turkey. E. coli 0157:H7 is sensitive to heat and can be destroyed by thorough cooking. Cook all ground poultry thoroughly. Because ground poultry can turn brown before disease-causing bacteria are killed, use a digital instant-read food thermometer to ensure thorough cooking. Ground poultry should be cooked until a thermometer inserted into several parts of the patty, including the thickest part, reads 165Ã‚ÂºF.

Listeria monocytogenes is found in water, soil and sewage. Many healthy humans are carriers as are healthy wild and domestic animals. The disease that results is called listeriosis, which is often manifested in a mononucleosis-like infection or meningitis. Because of the seriousness of these symptoms and other long-term effects of the disease, there is significant concern in the scientific community about Listeria monocytogenes.

In general, Listeria monocytogenes poses little or no threat for healthy children and adults. However, pregnant women, newborns, individuals with compromised immune systems and the elderly are more susceptible to listeriosis, the disease caused by Listeria monocytogenes. It is particularly important that foodservice employees follow proper food handling and food safety techniques for all foods, especially those serving the population with a greater potential risk to become contaminated with Listeria monocytogenes.

Salmonella bacteria are widespread in nature and live and grow in the intestinal tracts of humans and animals. Fully cooked foods, including poultry, do not normally contain Salmonella. The disease caused by salmonella (salmonellosis) may occur if foods contaminated by the bacteria are not properly cooked or are mishandled after cooking. Salmonella are found in both cooked and uncooked foods, especially protein foods such as meat, milk, poultry and eggs.

higella causes a bacterial dysentery called shigellosis. Foods implicated in outbreaks include salads

(e.g., potato, tuna, poultry) and other types of cut, diced or chopped and mixed foods. The bacteria are spread by food handlers, who may be symptomless carriers or may be recovering from the disease. Food is contaminated by hand manipulation or mixing and by subsequently cooking the product incompletely or holding the food at temperatures that allow the organisms to grow.

Staphyloccocus aureus can grow in a variety of foods and can produce a heat-resistant toxin or poison that can cause illness. Because the toxin is difficult to destroy, you must prevent it from forming. You can do this by keeping foods out of the "danger" temperature zone (i.e., 40º to 140ºF) and by minimizing food contamination. Handling by foodservice personnel is a major issue related to staph.

References:

1.What's bugging your burger -Carina Storrs

2.Microbes and food : society for general microbiology

3.The Complete Idiot's Guide to Understanding Cloning:

4.Regina Bailey

5. The capacity of foodstuffs to induce innate immune activation of human monocytes in vitro is dependent on food content of stimulants of Toll-like receptors 2 and 4. Br J Nutr. 2011 Jan; 105(1):15-23.