

Background

The natural world - including humans, animals and plants - contains bacteria. Bacteria serve a critical role in ecology. Some bacteria - like those used to produce food products such as yogurt, cheese and fermented sausages - are considered "good bacteria." Other, much rarer bacteria, can be harmful to health. We call these bacteria "pathogens." Since bacteria are microscopic organisms, detection and measurement of the levels of certain bacteria in a sample is a sophisticated scientific process and care must be taken in interpreting testing results.

Reducing pathogens on meat and poultry is a top priority for the industry, but it is no simple task. A century ago, the major food safety challenge facing the meat industry was the threat of animal diseases, which could be diagnosed through physical examination. Eliminating pathogens that are invisible to the naked eye is far more complex.

Food safety experts, including the National Academy of Sciences and the National Advisory Committee on Microbiological Criteria for Foods, agree that reducing pathogens - especially on raw, unprocessed foods - requires a farm-to-table approach. When everyone in the production, processing, distribution and preparation chain understands their respective roles in ensuring safety, the safest possible meat and poultry supply is possible.

HACCP Approach

The cornerstone of the meat and poultry industry's food safety approach is a system called HACCP (Hazard Analysis and Critical Control Points.) HACCP for the food industry was developed by Pillsbury in the 1960s to make food safe for astronauts. The system has been adopted by many food processors over the past 20 years and is considered the "gold standard."

Using HACCP, meat and poultry companies carefully analyze processes for each product they make and identify critical control points or "CCPs" where potential hazards can be controlled. A critical control point might be proper cooling of meat to control bacterial growth, or thorough cooking of a ready-to-eat product like lunchmeats to kill bacteria. Once

these CCPs are identified, companies implement and monitor CCPs to control and document their process. This allows the greatest concentration of resources to be focused on the most risky parts of the food manufacturing process.

Microbiological testing may be used to verify that the HACCP system is working effectively. Scientific evidence proves that raw meat and poultry naturally may contain bacteria - even pathogenic bacteria, and HACCP plans reflect this fact. While a plant's goal is to reduce all bacteria, a well-designed HACCP plan acknowledges that this is not possible 100 percent of the time for raw meat and poultry. Therefore, pathogen testing of raw meat and poultry should not be a measure of plant's success or failure.

What does HACCP suggest about microbial testing of raw meat and poultry? Under HACCP programs, microbiological tests more commonly track amounts of generic bacteria - the harmless bacteria that naturally exist in measurable quantities on raw meat and poultry. The levels of generic bacteria on meat and poultry can be an indicator of how well a plant is succeeding in eliminating the much rarer and harder to find pathogenic strains.

For example, a company might routinely test its raw ground beef for total aerobic bacteria commonly called "total plate count," to make sure the quantity of microbes falls within the company's normal ranges, based on historical data from that facility. If the company averages 1,000 organisms per sample, but several samples in a row fall significantly outside the normal range, the plant would implement its action plan to identify potential causes for the increasing microbial counts. The increase does not necessarily mean that the product is unsafe, since cooking a raw product destroys bacteria, but it may indicate that perhaps something in the process had changed.

Testing for bacteria levels in a food product can be compared to polling. Much like voter polls leading up to an election are based on a small sample of the voting public, bacteria test results are merely an estimate of the amount of bacteria that may be present in the product that is represented by that sample. Just like with the voting polls, bacteria tests are subject to error based on many factors such as the size of the sample, how representative the sample is of the

total population, and most importantly, what specific bacteria are being detected. If the test is designed to detect a broad class of bacteria, the results are likely to yield larger numbers and will provide information that is more meaningful. On the other hand, if the test is designed to detect one specific strain of bacteria that rarely exists, the results are likely to yield inconclusive and less reliable results. Many of the test results from this type of testing will simply provide “zero” or “negative” data.

The Challenge of Testing

It is important to understand the limitations of microbiological testing of meat and poultry. For example, let's say a tablespoon sample is taken from a 100 pound container of ground beef and tested for a pathogenic bacteria. The test result may be negative for the pathogen, but that test result only applies to the tablespoon of ground beef. The pathogen may be in other places in the box, though the sample that was selected simply did not contain it.

Complicating the issue is the fact that the testing process destroys the sample. Therefore, to know with 100 percent certainty whether the container of ground beef contains a pathogen, the entire 100 pounds must be tested and thereby destroyed.

In fact, sampling probabilities indicate that in order to find *E. coli* O157:H7 in a “lot” of ground beef with a 99 percent confidence rate (when the incidence rate is 1 percent), 458 samples would need to be taken and tested. Each test would destroy the sample. For these reasons, AMSA says pathogen testing and “pass/fail” standards do little to enhance meat safety while driving up the cost of the product substantially.

Different Ecology

It is also important to understand that different types of bacteria come from different places. Some - like *E. coli* O157:H7 - come from the live animal and are introduced into a meat packing plant either on the hides of cattle or from the digestive tract of the animal, which can sometimes inadvertently contaminate carcasses during processing. Other bacteria, like *Listeria*, are environmental bacteria that are found in soil and water and have been shown to establish niches in floor drains, cracks and crevices in food processing facilities. *Listeria* like to live in cold, moist environments - like meat packing plants and even home refrigerators. Because each bacterium has

a unique origin and ecology, each requires a different strategy to prevent it from contaminating meat and poultry.

Tests Commonly Performed

The meat and poultry industry is regulated by the U.S. Department of Agriculture (USDA). USDA requires several different tests, some of which are conducted by plants and some of which are collected by USDA inspectors and run in USDA laboratories.

Tests and testing programs that may be run in federally inspected meat and poultry plants can include:

- Baseline data collection,
- Generic *E. coli* for carcasses,
- *Salmonella* for carcasses and raw ground products,
- *E. coli* O157:H7 for ground beef,
- Generic *Listeria* in the environment of a ready-to-eat plant,
- *Listeria monocytogenes* for ready-to-eat meat and poultry products; and,
- Food safety assessments and in-depth verification testing by USDA regulatory personnel.

Baseline data collection

USDA's Food Safety and Inspection Service established a series of tests to acquire microbiological profiles of the meat and poultry for selected microorganisms, such as *E. coli* O157:H7 and *Salmonella*. These baseline studies are used to develop new prevention programs and develop new pathogen reduction performance standards for plants to meet. Over time, these profiles will help measure the effects of changes in slaughtering and processing on the levels of pathogens on raw products.

Generic *E. coli* testing

All federally inspected plants that slaughter livestock are required to test for generic *E. coli* to verify that their process control systems work as intended to prevent contamination. Test results that reveal marginal or unacceptable levels of *E. coli* that deviate from a plant's average *E. coli* counts can indicate the plant needs to review process controls and take corrective actions.

Salmonella Performance Standard for Raw Products

To verify that a plant's HACCP systems are effectively controlling contamination in raw products, the Pathogen Reduction/HACCP final rule instituted a *Salmonella* performance standard that plants must meet.

Products covered by the standard include carcasses of cattle, swine and broilers; and ground beef, ground chicken and ground turkey.

The pathogen reduction standard is based on the national prevalence of *Salmonella* in each of these products. Plants must conduct a series of tests for *Salmonella* (the numbers and intervals are different for each product). When a positive sample is found, plants must take corrective actions to prevent *Salmonella* contamination. Progress reports indicate that industry continues to reduce *Salmonella* prevalence on meat and poultry products.

E. coli O157:H7 in ground beef

USDA collects roughly 7,000 samples of ground beef and raw material used to make ground beef per year in plants, retail stores, import facilities, and tests these samples for the presence of *E. coli* O157:H7. When *E. coli* O157:H7 is found in raw ground beef, the product is deemed to be “adulterated” or unfit for consumption. If the pathogen is found on a whole muscle cut like a steak, USDA does not consider it adulterated. USDA treats these products differently because the inside of muscle meat is sterile, and external bacteria on cuts like steaks are destroyed when the steak is heated - even if eaten rare. The process of grinding or tenderizing beef, however, distributes bacteria through the meat, making it essential that ground or tenderized beef products be cooked thoroughly. Given these distinctions, USDA treats the presence of *E. coli* O157:H7 on ground or “non-intact” (e.g., tenderized) beef and whole muscle beef differently.

In addition to government tests, many companies conduct their own tests for *E. coli* O157:H7 voluntarily, sometimes in an effort to meet customer specifications which require such testing, or to verify CCPs.

FSIS also collects samples from cooked, ready-to-eat meat patties and dry fermented sausage in federally inspected plants. When *E. coli* O157:H7 is found on these products, they also are considered adulterated.

Listeria monocytogenes and *Salmonella* testing in ready-to-eat products

Ready-to-eat products are much as they sound: intended to be eaten right out of the package. For this reason, in the U.S., there is a “zero tolerance policy” in effect for pathogens on ready-to-eat meat and poultry products because they can pose a risk to certain populations, like the elderly, pregnant women and those who are immunocompromised.

USDA began testing these products for *Salmonella*

in 1983 and for *Listeria monocytogenes* in 1987. Since 2002, FSIS published numerous directives, which have increased the focus on *Listeria* control programs at establishments, including environmental sampling and testing programs.

Should a product test positive for either pathogen, FSIS will recommend an immediate product recall and conduct follow up testing at the plant. On the other hand, because fresh meats like raw ground beef are intended to be cooked, the presence of *Listeria monocytogenes* or *Salmonella* does not constitute a violation of federal rules since cooking destroys these pathogens.

In addition to USDA testing, many companies also voluntarily test their ready-to-eat meat and poultry products for the presence of pathogens.

The Seal of Inspection

The USDA seal of inspection is applied to all products that have been federally inspected. The seal contains an establishment number, which indicates where the product was produced. The seal represents the product’s compliance with one of the most comprehensive sets of regulations applied to any industry. Coupled with the industry’s commitment to producing the safest food possible, these government standards help ensure that U.S. meat and poultry products are among the safest in the world.



Helpful Links

American Meat Institute

<http://www.meatami.com>
<http://www.meatsafety.org>

American Meat Institute Foundation

<http://www.amif.org>

American Meat Science Association

<http://www.meatscience.org>

American Society for Microbiology

<http://www.asmusa.org>

Centers for Disease Control and Prevention

<http://www.cdc.gov>

Institute of Food Technologists

<http://www.ift.org>

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