**Foodborne Pathogens**

**Dr. Dana Pollard, Felton DeRouen II, and Keandrys Dalton**

**Agricultural Research and Extension Center**

**Southern University and A&M College**

**Telephone: (225) 771-2242**

**Email:** **dana\_pollard@suagcenter.com****;** **felton\_derouen@suagcenter.com****;** **keandrys\_dalton@suagcenter.com**

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**What are foodborne pathogens?**

Foodborne pathogens (i.e., viruses, bacteria, parasites) are biological hazards, and these hazards are the biggest threat to food safety. Of these pathogens, bacteria and viruses cause most foodborne illnesses. A foodborne illness occurs when there is an ingestion of food containing live bacteria, which establish themselves (and usually multiply) in the human intestinal tract, or when a toxigenic pathogen establishes itself in the food and releases a toxin that is consumed by the human host. These pathogens can be inherent in the product or introduced via mishandling (i.e., time/temperature abuse). To be considered a foodborne disease outbreak, two or more cases of similar illness must occur from the ingestion of a common food.

**Foodborne Bacteria**

***Listeria monocytogenes***

*Listeria monocytogenes* causes listeriosis (also known as Circling Disease or Silage Sickness), which is a zoonotic (transmitted between animal and man) disease that can affect **all** ruminants as well as other animal species and humans. This bacterium is seen in cooler climates and can be found in the soil, food sources, and even the feces of healthy animals. Sheep and goats can get infected with this bacterium from the environment, but listeriosis is most commonly observed in sheep and goats as a result of feeding moldy or spoiled hay or silage.

**Possible Locations of *Listeria monocytogenes*:**

* Manure.
* Rotting (decaying) woody debris.
* Silage not fermented (not acidified) properly, put up too dry or not compacted tight enough to protect it from the air.
* Round bales of hay that have started to rot.
* Feed bunks that are not cleaned regularly and in which some feces and wet feed leftover accumulate and ferment.
* Milk, urine, and drainage of the eyes and nose of infected animals.

**Symptoms:**

* Depression.
* Loss of appetite.
* Fever.
* Lack of coordination.
* Salivation.
* Facial paralysis.
* Circling.
* Most commonly causes encephalitis in sheep and goats but is also capable of causing a blood infection and abortion.

**Prevention:**

* Recently introduced animals should be considered suspect as carriers.
* Infected animals should be isolated from the rest of the herd or flock.
* Floors, pens, sheds, feed bunks, mineral feeders, etc. should be thoroughly cleaned and disinfected.
* If several animals are affected and silage or round bales of hay are being fed, their use should be discontinued until they can be ruled out as a source of contamination.

**Vibrio**

Vibriosis can be associated with illness with foodborne bacteria (*Vibrio*) or a chronic bacterial genital infection (*Campylobacter*) in cattle, sheep, and occasionally goats. *Campylobacter* sp. bacteria were formerly known as *Vibrio* species and have also been called ‘vibriosis.’

*Vibrio* bacteria cause foodborne illness through ingestion of raw or undercooked seafood. The CDC estimates that vibriosis causes 80,000 illnesses each year in the United States, with approximately 52,000 of those being foodborne illnesses. Others get infected by exposing a wound to seawater. Fish and other seafood can become contaminated with *Vibrio* species from a wide variety of aquatic and marine habitats. The most common species causing vibriosis in humans in the U.S. are *Vibrio parahaemolyticus*, *V. vulnificus*, and *V. alginolyticus.* Excluding *V. alginolyticus,* the other species along with *V. cholerae* are major public health concerns.

**Common Symptoms:**

* Watery diarrhea.
* Stomach cramping.
* Nausea.
* Vomiting.
* Fever.
* Chills.

**Treatment:**

* Antibiotics can shorten the length of disease and limit transmission.
* *V. cholerae* - Oral or IV rehydration salts solution; antibiotics: doxycycline, azithromycin, or ciprofloxacin.
* *V. parahaemolyticus* – antibiotics: doxycycline or quinolone.
* *V. vulnificus* – antibiotics: doxycycline and a third-generation cephalosporin.

***Escherichia coli***

*Escherichia coli* is a gram-negative, facultatively anaerobic, rod-shaped, coliform bacterium that is commonly found in the lower intestine of warm-blooded organisms. Animals like cows, goats, sheep, and deer can carry *E. coli*in their stomachs and shed the bacteria in their feces. The bacteria can live on their skin or fur and in the areas where they live or are housed. The **most common symptom** of *E. coli* infection in animals is diarrhea, but the bacteria often do not cause any signs of illness. Despite no signs of illness, these animals can still spread the bacteria. People can get *E. coli* when they touch an infected animal or a contaminated surface and then their mouths.

**Effects of *Escherichia coli***

Although most *E. coli* are harmless bacteria and part of the normal intestinal flora, **serotypes** such as ***E. coli* O157:H7** can cause intestinal disease (food poisoning) in humans, resulting in bloody diarrhea, kidney failure, and death. People can become infected by ingestion following contact with the feces of infected animals (and humans) in contaminated food and water.

**Prevention:**

* Thoroughly wash hands with soap and water after handling animals and anything where they dwell or roam.
* No eating, drinking, or preparing food around animals.
* Clean the areas where animals have been.
* If an owner notices that their animal has diarrhea or is otherwise concerned that it might be carrying pathogenic *E. coli*, they should seek advice and/or treatment from a veterinarian.

***Clostridium perfringens***

*Clostridium perfringens* is a widespread pathogenic bacterium with close to one million illnesses in the U.S. every year. The bacteria live naturally in the environment and can be found in raw meat and poultry and in the intestines of animals and people. These bacteria produce **spores** (protective coverings), which enable the bacteria to survive. Under certain conditions, such as when food is left at room temperature or in the “danger zone” between 40°F and 140°F, the bacteria grow and multiply rapidly. After someone ingests the bacterium, it can produce a **toxin** (poison) that causes symptoms.

**Symptoms:**

Most people with *C. perfringens* experience stomach cramps and diarrhea 6 to 24 hours after contaminated food is eaten. The illness has a quick onset and lasts for less than 24 hours. Dehydration can result from diarrhea.

**Treatment:**

* Fluids and rest are used in treatment.
* Antibiotics are not necessary.

**Prevention:**

Infection cannot be passed from one person to another. To prevent infection:

* Cook food to a safe temperature.
* Refrigerate leftovers promptly at 40°F or colder.
* Reheat leftovers thoroughly to a minimum of 165°F.

***Salmonella***

*Salmonella* is a leading cause of bacterial foodborne illnesses in the U.S. According to the CDC, nearly 1.35 million infections, 26,500 hospitalizations, and 420 deaths in the U.S. every year can be attributed to *Salmonella*, and food serves as the origin of these illnesses. Albeit several food items being sources of *Salmonella*, meat products, poultry, and eggs have been linked to the most foodborne illness outbreaks.

The two major *Salmonella* species are *Salmonella enterica* and *Salmonella bongori*. *Salmonella enterica* is the type species and is further divided into six subspecies that consist of over 2,600 serovars, and these serovars can be divided into two main groups—**typhoidal and nontyphoidal**. **Nontyphoidal** serovars are **zoonotic** and can be transmitted via direct contact with infected animals or their environment and directly between humans

Nontyphoidal serovars cause gastroenteritis, bacteremia, and subsequent focal infection. **Typhoidal** serovars live in **humans** and can cause foodborne infection, typhoid fever, and paratyphoid fever. Typhoid fever is caused by *Salmonella* bypassing host defenses, invading the bloodstream (the typhoidal form), spreading to various organs (liver, spleen, and kidneys), and forming secondary foci (the septic form).

**Symptoms:**

They appear around 6 hours to 6 days after infection and can last 4 to 7 days. Some symptoms are:

* Diarrhea.
* Fever.
* Stomach cramps.

**Treatment:**

* Most healthy people recover without specific treatment and do not utilize antibiotics.
* Current recommendations are that antibiotics be reserved to treat people with severe diseases or who are at risk for invasive diseases.
* Some illnesses may require hospitalization.
* Replace fluid loss.

**Prevention:**

* Proper handwashing.
* Clean all food preparation areas.
* Avoid unpasteurized foods.
* Cook and store your food at the appropriate temperatures.
* Handle animals with care.
* Use caution when swimming.

***Campylobacter***

*Campylobacter* is one of the most common causes of food poisoning in the United States. Most cases occur as isolated events, not as part of recognized outbreaks.

**Sources:**

* Raw and uncooked poultry.
* Unpasteurized milk.
* Contaminated water.

**Symptoms:**

* Diarrhea (may be bloody).
* Cramps.
* Fever.
* Vomiting.

**What do I do?**

Drink plenty of fluids and get rest. If you cannot drink enough fluids to prevent dehydration or if your symptoms become worse, call your doctor. In more serve cases certain antibiotics can be used and can shorten the duration of symptoms.

**Prevention:**

Simple food handling practices can help prevent *Campylobacter* infections:

* Cook all poultry products thoroughly. Make sure that the meat is cooked throughout (no longer pink), and all juices run clear. All poultry should be cooked to reach a minimum internal temperature of 165 °F.
* Wash hands with soap before preparing and after handling raw food of animal origin.
* Prevent cross-contamination in the kitchen by using separate cutting boards for food of animal origin.

***Clostridium botulinum***

Foodborne botulism is caused by eating food that contains the botulinum toxin produced by the bacterium, *Clostridium botulinum*. Foodborne botulism can be fatal and is a public health emergency.

**Sources:**

* Improperly canned foods (especially home-canned vegetables).
* Fermented fish.
* Baked potatoes in aluminum foil.

**Symptoms**:

* Vomiting.
* Diarrhea.
* Blurred vision; double vision.
* Difficulty in swallowing.
* Slurred speech.
* Muscle weakness.

**What do I do?** Botulism is a medical emergency. If you have symptoms of botulism, contact your doctor immediately. Physicians may try to remove contaminated food in the gut by inducing vomiting or by using enemas.

**Prevention:** Simple food handling practices can help prevent *Clostridium Botulinum* infections:

* Foodborne botulism most often comes from home-canned foods with a low acid content, such as asparagus, green beans, beets, and corn.
* The botulinum toxin is destroyed by high temperature (persons who eat home-canned foods should consider boiling the food for 10 minutes before eating it to ensure safety).
* Proper handling of food items (e.g., canned cheese sauce, chili peppers, tomatoes, and carrot juice) during manufacture, at retail, or by consumers can help prevent botulism.
* Honey can contain the bacteria that causes infant botulism, so children less than 12 months old should not be fed honey.

***Staphylococcus aureus (Staph)***

*Staphylococcus aureus* (Staph) is a type of germ that about 30% of people carry in their noses and skin. It usually does not cause illness, but if Staph is transmitted to food, it can replicate and produce toxins.

**Sources:**

* Commonly found in the environment (soil, water, and air).
* Nose.
* Skin.

**Symptoms**:

* Vomiting.
* Nausea.
* Stomach cramps.
* Diarrhea

**What do I do?** Contact your healthcare provider if you suspect Staph food poisoning and are displaying severe symptoms.

**Prevention:** Simple food handling practices can help prevent *Staphylococcus aureus* infections:

* Measuring with a food thermometer, cook foods to their safe minimum internal temperature.
* Keep cold foods cold (40°F or colder) and hot foods hot (140°F or hotter).
* Save cooked food in wide, shallow containers and refrigerate within 2 hours (or 1 hour if it is hotter than 90° F outside).
* Thoroughly wash hands (for 20 seconds) with warm water and soap before, during, and after preparing food, and before consuming food and drinks.
* Do not prepare food if you are experiencing diarrhea or vomiting.
* If you have infections or wounds on your hands or wrists, wear gloves for food preparation.

**Foodborne virus**

**Norovirus**

Norovirus is the most common cause of gastroenteritis in people in the U.S. Gastroenteritis is inflammation of the lining of the intestines and stomach, causing an acute case of vomiting, cramping, and diarrhea. Norovirus illness is usually short in healthy people; young children, the elderly, and people with other medical illnesses are more prone to developing an infection that is more severe or longer in duration. Norovirus infections are highly contagious. Because of increased person-to-person contact, more outbreaks are associated with healthcare facilities and other institutional settings (e.g., daycare centers, schools, etc.).

The feces and vomit of infected people are where noroviruses can be detected. Infection can occur by:

* Direct contact with an infected person.
* Consuming food or drinks contaminated with norovirus.
* Touching your mouth or other food items after encountering surfaces or objects contaminated with norovirus.

 **Symptoms:**

The most common symptoms of norovirus are:

* Diarrhea.
* Vomiting.
* Nausea.
* Stomach pain.

Other symptoms may include:

* Fever.
* Headache.
* Body aches.

 **Treatment:**

Like all viral infections, antibiotics are not effective against the norovirus, and there is no specific treatment for norovirus illness.

* Have fluids and rehydration solutions to prevent dehydration for fluid loss with vomiting and diarrhea.
* Sometimes drugs, especially with diarrhea.

 **Prevention:**

## Practice proper hand hygiene.

## Prepare and handle food safely.

* Do not care for others or prepare food when ill.
* Clean and disinfect surfaces.
* Thoroughly wash laundry.

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**For more information contact:**

Dr. Renita W. Marshall, DVM, MS

**Telephone**: (225) 771-0252

**Email**: renita\_marshall@suagcenter.com

or Dr. Dana Pollard, PhD, MS

**Telephone**: (225) 771-3505

**Email**: dana\_pollard@suagcenter.com

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