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***Staphylococcus aureus* Food Poisoning**

Staphylococcus aureus food poisoning

Staphylococcus aureus is a common bacterium found in the nose and on the skin of about 25 percent Trusted Source of healthy people and animals. *S. aureus* is capable of making seven different toxins and is often the cause of food poisoning. It is most commonly transferred to food products like milk and cheese through contact with food workers that carry *S. aureus*.

S. aureus food poisoning (SFP) is usually not life-threatening. Most cases of SFP do not require treatment because the condition will pass on its own. Most people get over food poisoning in about two days.

Symptoms of Staphylococcus aureus food poisoning

SFP causes symptoms similar to a severe case of gastroenteritis, or inflammation of the digestive tract. Symptoms may appear rapidly, sometimes in as little as 30 minutes after you've eaten contaminated food. But it typically takes up to six hours for symptoms to develop.

Symptoms of SFP include:

- Diarrhea
- Vomiting
- Nausea
- Abdominal cramping

Illness is generally mild, and most people recover within one to three days.

Causes for Staphylococcus aureus food poisoning

SFP is caused by contaminated food products. *S. aureus* has a high salt tolerance, and can grow in ham and other meats, and in dairy products. The toxins that the bacteria produce are also heat resistant and cannot be destroyed through cooking. Once food has been contaminated, bacteria begin to multiply. Food products most commonly associated with SFP are milk and cheeses. And

the most common cause of contamination is through contact with food workers who carry the bacteria.

Foods that require a lot of handling and are stored at room temperature are often involved with SFP. These include:

- sandwiches
- puddings
- cold salads, such as tuna, chicken, macaroni, or ham salad
- sliced deli meats
- cream-filled pastries

- **Diagnosis of Staphylococcus aureus food poisoning**

- In most cases, SFP does not require medical attention. It often clears up with rest and fluids. But contact your doctor if your illness lasts longer than three days, or if you are unable to drink enough fluids to prevent dehydration.
- Doctor can diagnose SFP with a physical examination and a review of your symptoms. They may also ask questions about recent activities and things you have eaten. If symptoms are severe, your doctor may order blood tests or a stool culture.
- These tests can help determine if the *S. aureus* bacterium is present, and may also help your doctor rule out other potential causes
- **Treatment of Staphylococcus aureus poisoning**
- SFP generally lasts for a day or two. Medical intervention is often unnecessary as this illness generally disappears on its own.
- Treatment typically involves rest and increased fluid intake. But some people may need medical help. SFP may be dangerous in young children, babies, older adults, and people who have HIV.
- Because the most common complication of SFP is dehydration, treatment administering intravenous liquids may be required. In severe cases, you may be hospitalized for observation in order to prevent complications.

Outlook of Staphylococcus aureus food poisoning

- ❖ People who contract SFP, but are otherwise healthy, usually don't have lasting effects after the bacteria clear the body.

- ❖ However, children, older adults, and those with weakened immune systems may experience severe dehydration that requires treatment in a hospital. SFP can be fatal among these people. Prompt medical treatment increases their chances of making a full recovery.

Prevention of *Staphylococcus aureus* food poisoning

To prevent food poisoning and the spread of bacteria, take the following precautions:

- Avoid unpasteurized milk
- Wash hands and fingernails thoroughly before cooking, eating, or serving food
- Maintain clean and sanitary surfaces for food preparation
- Store hot foods at temperatures over 140°F (60°C) and cold foods under 40°F (4°C)
- Do not prepare food for others if you have wounds or sores on your hands or wrists

Food Poisoning: *Clostridium Perfringens*

***C. perfringens* food poisoning**

C. perfringens food poisoning is caused by infection with the *Clostridium perfringens* (*C. perfringens*) bacterium. *C. perfringens* is found frequently in the intestines of humans and many animals and is present in soil and areas contaminated by human or animal feces.

Causes of *C. perfringens* food poisoning

In most cases, *C. perfringens* food poisoning results when you eat improperly cooked and stored foods. Normally, bacteria are found on food after cooking, and these bacteria can multiply and cause *C. perfringens* food poisoning if the foods sit out and cool before refrigerating. Commonly infected foods include meats, meat products, and gravy.

Symptoms

Symptoms of *C. perfringens* food poisoning include intense abdominal cramps and watery diarrhea. Your symptoms usually appear 6 to 24 hours after eating foods containing large numbers of *C. perfringens*. The disease usually is over within 24 hours. Less severe symptoms may last for 1 or 2 weeks.

Diagnosis of *C. perfringens* food poisoning

Your doctor will do a medical history and physical exam and ask you questions about your symptoms, foods you have recently eaten, and your work and home environments. A stool culture and blood tests may be done to confirm the diagnosis.

Treatment

- *C. perfringens* food poisoning by managing any complications until it passes
- . Dehydration caused by diarrhea and vomiting is the most common complication. Do not use medicines, including antibiotics and other treatments, unless your doctor recommends them.
- To prevent dehydration, take frequent sips of a rehydration drink (such as Pedialyte). Try to drink a cup of water or rehydration drink for each large, loose stool you have.
- Use a sports drink, such as Gatorade. Soda and fruit juices have too much sugar and not enough of the important electrolytes that are lost during diarrhea, and they should not be used to rehydrate.
- Try to stay with a healthy diet as much as possible. Eating healthy foods will help you to get enough nutrition. Doctors believe that eating a healthy diet will also help you feel better faster. But try to avoid foods that are high in fat and sugar.
- Also avoid spicy foods, alcohol, and coffee for 2 days after all symptoms have disappeared.

Prevention of *C. perfringens* food poisoning

C. perfringens food poisoning is prevented by cooling and storing foods correctly (adapted from the U.S. Centers for Disease Control and Prevention).

- **Shop safely.** Bag raw meat, poultry, and fish separately from other food items. Drive home immediately after finishing your shopping so that you can store all foods properly.
- **Prepare foods safely.** Wash your hands before and after handling food. Also wash them after using the bathroom or changing diapers. Wash fresh fruits and vegetables by rinsing them well with running water. If possible, use two cutting boards—one for fresh produce and the other for raw meat, poultry, and seafood. Otherwise, be sure to wash the cutting board with hot, soapy water between each use. You can also wash your knives and cutting boards in the dishwasher to disinfect them.
- **Store foods safely.** Cook, refrigerate, or freeze meat, poultry, eggs, fish, and ready-to-eat foods within 2 hours. Make sure your refrigerator is set at 40°F (4°C) or colder.
- **Cook foods safely.** Use a clean meat thermometer to determine whether foods are cooked to a safe temperature. Reheat leftovers to at least 165°F (74°C). Do not eat undercooked hamburger, and be aware of the risk of food poisoning from raw fish (including sushi), clams, and oysters.

- **Serve foods safely.** Keep cooked hot foods hot [140°F (60°C) or above] and cold foods cold [40°F (4°C) or below].
- **Follow labels on food packaging.** Food packaging labels provide information about when to use the food and how to store it. Reading food labels and following safety instructions will reduce your chances of becoming ill with food poisoning.
- When in doubt, throw it out. If you are not sure whether a food is safe, don't eat it. Reheating food that is contaminated will not make it safe. Don't taste suspicious food. It may smell and look fine but still may not be safe to eat.

It is important to pay particular attention to food preparation and storage during warm months when food is often served outside. Bacteria grow faster in warmer weather, so food can spoil more quickly and possibly cause illness. Do not leave food outdoors for more than 1 hour if the temperature is above 90°F (32°C), and never leave it outdoors for more than 2 hours.

Vibrio parahaemolyticus food borne illness

Introduction

- *Vibrio parahaemolyticus* is the most commonly isolated noncholera vibrio.
- Like *V. cholerae*, it is found in marine environments.
- *Vibrio parahaemolyticus* causes gastroenteritis as a result of consumption of raw or partially cooked food, particularly seafood.
- *V. parahaemolyticus* accounts for a large proportion of food-borne illness in Japan, where consumption of seafood is common. T
- The incubation period for *V. parahaemolyticus* ranges from 4 to 48 hours. Clinical illness tends to be mild, with gastroenteritis symptoms including nausea, vomiting, abdominal pain and diarrhea.
- The disease is usually self-limiting. Oral rehydration is typically adequate and tetracycline or ciprofloxacin can be administered in severe cases.

Characteristics

- Thriving in high salt concentrations, this bacteria lives in coastal waters and marine mud.
- *Vibrio parahaemolyticus* becomes particularly active in water temperatures of 15° C or higher. As such, seafood caught when water temperatures are warm (and large concentrations of *Vibrio parahaemolyticus* are breeding) can carry the bacteria.
- In turn, improper handling after capture, during distribution, or while cooking can result in *Vibrio parahaemolyticus* multiplying and causing food poisoning.

- Secondary contamination via cutting boards and cooking implements can also cause food poisoning with this bacteria.
- *Vibrio parahaemolyticus* is characterized by a multiplication rate that is much faster than other food poisoning-causing bacteria. However, this bacteria cannot multiply in fresh (tap) water.
- Food poisonings caused by *Vibrio parahaemolyticus* gradually increase from May to June and occur with particular frequency from July to September. In recent years, however, cases of *Vibrio parahaemolyticus*-induced food poisoning have occurred even in winter.

Causes of *Vibrio parahaemolyticus* infection

The most common example is seafood sashimi and sushi. Food poisoning cases also occur due to secondary contamination via cooking implements and hands after preparing raw seafood.

Symptoms of *Vibrio parahaemolyticus*

The incubation period lasts from 8 to 24 hours (2 to 3 hours in the shortest cases), after which the primary symptoms of infection are intense stomach pain and diarrhea. Some victims also experience fever, nausea, and vomiting.

Prevention of *Vibrio parahaemolyticus*

1. Thoroughly wash seafood in fresh (tap) water prior to cooking to rinse away bacteria.
2. Thoroughly wash and disinfect cooking implements used with seafood to prevent secondary contamination.
3. Do not cut vegetables or other foods on cutting boards just used to prepare seafood (use different cutting boards for different foods).
4. Take sufficient care when preparing and eating raw seafood during the summer and if at all possible store in a refrigerator below 4° C, even for brief intervals between preparation. (*Vibrio parahaemolyticus* cannot multiply under cool temperatures. Note that while cool temperatures prevent *Vibrio parahaemolyticus* from multiplying, freezing, at least for short periods of time, does not kill this bacteria.)
5. When thawing frozen seafood, use a dedicated thawing fridge or in your refrigerator.
6. When cooking, ensure that seafood is heated sufficiently so that heat penetrates to the center of food (60° C for 10 or more minutes).

Food poisoning by Vibrio

Introduction

Vibrio lives in brackish saltwater and causes gastrointestinal illness in humans. *Vibrio* naturally inhabits coastal waters in the United States and Canada and is present in higher concentrations during summer. When ingested, *Vibrio* causes watery diarrhea often with abdominal cramping, nausea, vomiting, fever and chills. Usually these symptoms occur within 24 hours of ingestion. Illness is usually self-limited and lasts 3 days. Severe disease is rare and occurs more commonly in persons with weakened immune systems.

Foods associated with Vibrio

Vibrio bacteria naturally live in coastal waters and can concentrate inside shellfish and other seafood that live in these waters.

- Oysters: Oysters feed by filtering water. As oysters feed, *Vibrio*, norovirus, and other germs can concentrate in them. When you eat raw or undercooked oysters, germs that may be in them can make you sick. [Get the facts about Vibrio and oysters >](#)
- Other shellfish: Oysters aren't the only shellfish that can carry *Vibrio* and other germs. *Vibrio* illnesses have also been linked to crawfish, crab meat, and other shellfish including clams, mussels, and scallops. Stay safe by following CDC's tips for cooking shellfish and [preventing wound infections](#).
- Fish: Although *Vibrio* infections from fish aren't as common as infections from shellfish, they do happen from time to time. Other harmful germs can be found in fish, too. To help prevent infection, cook fish to 145°F or until its flesh is opaque.

.Vibrio infection

Most people become infected by eating raw or undercooked shellfish, particularly oysters. Less commonly, this organism can cause an infection in the skin when an open wound is exposed to warm seawater.

Diagnosis of ***Vibrio infection***

Vibrio organisms can be isolated from cultures of stool, wound, or blood. If there is clinical

suspicion for infection with this organism, the microbiology laboratory should be notified so that they will perform cultures using this medium. A physician should suspect *Vibrio* infection if a patient has watery diarrhea and has eaten raw or undercooked seafood, especially oysters.

Treatment of *Vibrio*

Treatment is not necessary in most cases of *Vibrio* infection. There is no evidence that antibiotic treatment decreases the severity or the length of the illness. Patients should drink plenty of liquids to replace fluids lost through diarrhea. In severe or prolonged illnesses, antibiotics such as tetracycline or ciprofloxacin can be used. The choice of antibiotics should be based on antimicrobial susceptibilities of the organism.

common is infection with *Vibrio*

An estimated 4500 cases of *Vibrio* infection occur each year in the United States. However, the number of cases reported to CDC is much lower because surveillance is complicated by underreporting. To improve our ability to monitor trends, infections caused by *V. parahaemolyticus* and other *Vibrio* species became nationally notifiable in 2007. State health departments report cases to CDC, and these reports are summarized annually.

Prevention of *Vibrio* infection

Most infections caused by *Vibrio* in the United States can be prevented by thoroughly cooking seafood, especially oysters. When an outbreak is traced to an oyster bed, health officials recommend closing the oyster bed until conditions are less favorable for *Vibrio*.

Timely, voluntary reporting of *Vibrio* infections to state health departments and to regional offices of the Food and Drug Administration (FDA) will help collaborative efforts to improve investigation of these infections. Regional FDA specialists with expert knowledge about shellfish assist state officials with tracebacks of shellfish. When notified rapidly about cases, officials can sample harvest waters to discover possible sources of infection and may close oyster beds. Ongoing research may help us to predict environmental or other factors that increase the chance that oysters carry *Vibrio*.

Prevention of poisoning by marine toxins

General guidelines for safe seafood consumption:

1. Although any person eating fish or shellfish containing toxin or disease-causing bacteria may become ill, persons with weakened immune systems or liver problems should not eat raw seafood because of their higher risk of *Vibrio* infection.
2. Keep seafood on ice or refrigerated at less than 38° Fahrenheit to prevent spoilage.

Specific advice for avoiding marine toxin poisoning:

1. Keep fresh tuna, mackerel, grouper, and mahi mahi refrigerated to prevent development of histamine. Don't believe that cooking spoiled or toxic seafood will keep you safe. These toxins are not destroyed by cooking.
2. Do not eat barracuda, especially, those from the Caribbean.
3. Check with local health officials before collecting shellfish, and look for Health Department advisories about algal blooms, dinoflagellate growth or "red tide" conditions that may be posted at fishing supply stores.
4. Do not eat finfish or shellfish sold as bait. Bait products do not need to meet the same food safety regulations as seafood for human consumption.

Marine

toxins

Marine toxins are naturally occurring chemicals that can contaminate certain seafood. The seafood contaminated with these chemicals frequently looks, smells, and tastes normal. When humans eat such seafood, disease can result.

The most common diseases caused by marine toxins in United States in order of incidence are scombrototoxic fish poisoning, ciguatera poisoning, paralytic shellfish poisoning, neurotoxic shellfish poisoning and amnesic shellfish poisoning.

Campylobacter Infection

Introduction

- Campylobacter (camp-UH-low-back-ter) is a genus of bacteria that is among the most common causes of bacterial infections in humans worldwide. The name means "curved rod," deriving from the Greek campylos (curved) and baktron (rod).
- It has been noted that there "is wide diversity in the genus. The species are metabolically and genetically different to the extent that one can question whether one genus is adequate to house all of the species.
- Of its many species, *Campylobacter jejuni* (juh-JUNE-eye) is considered one of the most important from both a microbiological and public health perspective.

When people worry about eating undercooked chicken, they usually focus on getting sick from salmonella bacteria. But another common type of bacteria called campylobacter can also make you ill if you eat poultry that isn't fully cooked.

- Like a salmonella infection, campylobacteriosis can cause diarrhea and sometimes other serious complications.

- Infants and children have a greater chance than adults for campylobacter infection, but it can strike anyone at any age. Males are also more likely than females to become infected. It's more common in summer than winter.
- About 1.3 million people are infected in the United States every year, and that doesn't include the many people who never report their symptoms or become officially diagnosed.

Causes

- Campylobacter bacteria can get into your system if you eat undercooked poultry or you eat food that has touched raw or undercooked poultry.
- The bacteria usually live in the digestive systems of animals, including poultry and cattle. Unpasteurized milk can also have campylobacter bacteria.
- Campylobacteriosis usually develops in isolated cases. Sometimes, though, there can be an outbreak when several people have the same infection. In developing countries, the bacteria can be found in water and sewage systems.

Symptom

The infection usually lasts about a week. If you've been infected, symptoms start within a couple of days of consuming the bacteria.

The most common symptom is diarrhea. The stool may have blood in it. You may also be sick to your stomach and vomit.

Other signs of infection include:

- Belly cramps
- Bloating
- Fever

Some people never get any symptoms. When you have a weakened immune system, the bacteria can cause a very serious infection of your bloodstream.

Treatment

- If you have a weakened immune system, see your doctor soon after diarrhea and other symptoms appear. Your immune system can be weakened by an infection, such as HIV, or by medications to treat cancer, for example.
- If you're generally in good health and you get a bout of diarrhea, you may wait a couple of days. Treat it as you would any illness that causes diarrhoea.
- If you feel very sick, which can happen in serious cases, then see your doctor sooner. Some of the symptoms to watch for include:
 - Diarrhea for more than 2 days
 - Signs of dehydration (dark pee, dry mouth and skin, dizziness)

- Severe pain in your gut or rectum
- Fever of 102 F or more

Tests and Diagnosis

- Diarrhea and vomiting are common campylobacteriosis symptoms, but they can also be symptoms of many other illnesses. This is true for bloody stools, too.
- To make an official diagnosis, your doctor may ask for a stool sample, which will be sent to a lab.
- Someone at your doctor's office will give you a special container in which to collect the sample. It can take several days to get the results.
- In rare cases, a doctor may order a blood test, but these results take even longer -- up to 2 weeks.

Treatment

- ✓ Most people get over the infection without medicine or special treatments. You should drink lots of fluids while you have diarrhea.
- ✓ Unless your doctor tells you otherwise, don't take anything to prevent vomiting and diarrhea. That's your body's way of getting rid of the infection.
- ✓ If your immune system is weak, your doctor might prescribe medicine to fight the infection.
- ✓ Doctors will often first try levofloxacin (Levaquin). If you can't take it for some other reasons, they may prescribe one of these common antibiotics that are used to treat several types of infections:

Possible Complications

- ✚ Usually, the infection clears up within 2 to 10 days. If left untreated, campylobacteriosis may lead to serious consequences for a very small number of people.
- ✚ Some problems can happen early on. One example is a gallbladder infection (cholecystitis).
- ✚ There can also be complications from the later stages of the infection, too, though serious long-term problems are unusual.
- ✚ The infection is associated with arthritis in rare cases. It may also lead to Guillain-Barre syndrome. It's a disorder in which your immune system attacks nerves in your body. You can be partially paralyzed and be in the hospital for weeks.

Prevention

- The most effective way to avoid campylobacteriosis is to cook poultry to at least 165 F. The meat should be white, not pink. You should never eat chicken that looks undercooked.
- Heating foods and pasteurizing dairy products are the only ways of knocking out the bacteria in foods that have been contaminated.

Here are some other tips:

- Wash your hands before cooking and after touching raw poultry or meat.

- Keep uncooked meat and poultry away from other foods, such as vegetables, by using separate cutting boards, utensils, and cooking surfaces.
- Wash your hands after touching a pet or pet feces.
- Make sure your child or anyone with diarrhea washes his or her hands well.

***E.coli* food poisoning**

Introduction

Escherichia coli (*E. coli*) are bacteria that live in human and animal intestines. Shiga toxin-producing strains of *E. coli*, or STECs, are responsible for most food-related *E. coli* infections. *E. coli* O157:H7 and other STECs like *E. coli* O145 and *E. coli* O121:H19 produce a toxin called Shiga toxin, which causes illness in humans. *E. coli* bacteria do not make animals such as livestock and deer, which harbor the bacteria in their intestines, ill. t.

Sources of *E. coli*

E. coli O157:H7 is most commonly found in cows, although chickens, deer, sheep, and pigs have also been known to carry it. Meat becomes contaminated during slaughter, when infected animal intestines or feces come in contact with the carcass. Ground or mechanically tenderized meats are considered riskier than intact cuts of meat because *E. coli* bacteria, can be mixed throughout the meat in the grinding process or during tenderization.

Other foods that sometimes become contaminated with *E. coli* bacteria include unpasteurized milk and cheese, unpasteurized juices, alfalfa and radish sprouts, lettuce, spinach, and water. However, any food is at risk of becoming contaminated with *E. coli* through cross-contamination. One can also get *E. coli* bacteria from contact with feces of infected animals or people.

The breakdown of sources of *E. coli* bacteria from 1998-2007 was as follows:

- Food: 69%
- Water: 18%
- Animals or their environment: 8%
- Person-to-person: 6%

Symptoms of *E. coli*

E. coli symptoms change as the infection progresses. Symptoms usually begin two to five days after infection. The initial symptoms include the sudden onset of cramps and abdominal pain, followed by diarrhea within 24 hours. Diarrhea will become increasingly watery, and then noticeably bloody. People with *E. coli* infection also often feel nauseated and experience headaches. Less common symptoms include fever and chills.

HUS: A Rare but Serious Complication

Hemolytic Uremic Syndrome, or HUS, follows around 10 percent of *E. coli* O157:H7 infections. HUS occurs when Shiga toxins get into the bloodstream and cause the part of the kidney that filters toxins out of the blood to break down, causing kidney injury and sometimes kidney failure. Some HUS patients also suffer damage to the pancreas and central nervous system impairment.

Diagnosis of *E. coli*

Shiga toxin-producing *E. coli* infection can be diagnosed in a doctor's office or hospital by laboratory analysis of a stool sample.

Bacteria isolated from patients' stool samples can be compared through laboratory analysis, helping to match strains of *E. coli* to the food or other source it came from, a process called "fingerprinting."

Treatment for *E. coli* Infection

Illness from *E. coli* usually goes away within a week and does not cause any long-term problems. One should make sure to remain hydrated and get proper nutrition while sick.

Antibiotics are not used as *E. coli* treatment, as they do not improve the illness, and some studies show that they can increase the risk of HUS.

HUS is treated by hospitalization. Since there is no way to directly cure HUS, treatment includes care to alleviate symptoms.

Preventing Infection from *E. coli* Bacteria

Any food that you eat has the potential to be contaminated with *E. coli* bacteria. This is why it is important to take precautions in preparing food and before eating at restaurants. We should also be aware that *E. coli* bacteria can survive for several weeks on surfaces, so keeping countertops clean is important. Other simple steps you can take to reduce your risk of *E. coli* infection include:

- Wash hands thoroughly before and after eating and after going to the bathroom
- Sanitize all fruits and vegetables before eating by skinning them if possible and washing them before eating
- Check with your local department of health to find out which restaurants in your area have had recent problems with sanitation
- Avoid allowing raw meats to come into contact with other foods while cooking
- Do not allow children to share bath water with anyone who has diarrhea or symptoms of stomach flu
- Wash hands thoroughly after any contact with farm animals
- Wear disposable gloves when changing diapers of children with diarrhea
- Make sure ground meat (such as hamburger patties) reaches an internal temperature of at least 160°F
- Avoid drinking any non-chlorinated water



Salmonella food infection

Introduction

Salmonella is the second most common intestinal infection in the United States. More than 7,000 cases of *Salmonella* were confirmed in 2009; however the majority of cases go unreported. The Centers for Disease Control and Prevention estimates that over 1 million people in the U.S. contract *Salmonella* each year, and that an average of 20,000 hospitalizations and almost 400 deaths occur from *Salmonella* poisoning, according to a 2011 report.

Characteristics of Salmonella

Salmonella infection usually occurs when a person eats food contaminated with the feces of animals or humans carrying the bacteria. *Salmonella* outbreaks are commonly associated with eggs, meat and poultry, but these bacteria can also contaminate other foods such as fruits and vegetables. Foods that are most likely to contain *Salmonella* include raw or undercooked eggs, raw milk, contaminated water, and raw or undercooked meats.

Salmonella is generally divided into two categories. Non-typhoidal *Salmonella* is the most common form, and is carried by both humans and animals. Most serotypes of *Salmonella*, such as *Salmonella* Javiana and *Salmonella* Enteritidis cause non-typhoidal *Salmonella*. Typhoidal *Salmonella*, which causes typhoid fever, is rare, and is caused by *Salmonella* Typhi, which is carried only by humans.

Foods associated

Salmonella **infection from a variety of foods.** *Salmonella* can be found in many foods including beef, chicken, eggs, fruits, pork, sprouts, vegetables, and even processed foods, such as nut butters, frozen pot pies, chicken nuggets, and stuffed chicken entrees.

Symptoms of Salmonella Infection

Symptoms of *Salmonella* infection, or Salmonellosis, range widely, and are sometimes absent altogether. The most common symptoms include diarrhea, abdominal cramps, and fever.

Typical Symptoms of *Salmonella* infection: Appear 6 to 72 hours after eating contaminated food and last for 3 to 7 days without treatment.

- Diarrhea

- Abdominal Cramps
- Fever of 100 F to 102 F

Additional symptoms:

- Bloody diarrhea
- Vomiting
- Headache
- Body Aches

Typhoid Fever Symptoms: Symptoms of typhoid fever appear between 8 and 14 days after eating contaminated food and last anywhere from 3 to 60 days. They include a fever of 104 F, weakness, lethargy, abdominal pain, coughing, nosebleeds, delirium, and enlarged organs. Typhoid fever is a serious illness that can result in death.

Complications of Salmonella

Complications of *Salmonella* poisoning are more likely to occur among young children and people age 65 or older.

Possible complications include:

- ✓ **Reactive Arthritis:** Reactive arthritis is thought to occur in 2 to 15 percent of *Salmonella* patients. Symptoms include inflammation of the joints, eyes, or reproductive or urinary organs. On average, symptoms appear 18 days after infection.
- ✓ **Focal Infection:** A focal infection occurs when *Salmonella* bacteria takes root in body tissue and causes illnesses such as arthritis or endocarditis. It is caused by typhoidal *Salmonella* only

Salmonella Treatment

- ❖ *Salmonella* infections generally last 3 to 7 days, and often do not require treatment. People with severe dehydration may need rehydration through an IV.
- ❖ Antibiotics are recommended for those at risk of invasive disease, including infants under three months old. Typhoid fever is treated with a 14-day course of antibiotics.
- ❖ Unfortunately, treatment of *Salmonella* has become more difficult as it has become more resistant to antibiotics. Finding the right antibiotic for a case of *Salmonella* is crucial to treating this bacterial infection.

Prevention of Salmonella Infection

These safety measures can help prevent *Salmonella* poisoning:

- Wash your hands before preparing food and after handling raw meats
- Cook meat and eggs thoroughly until they reach an internal temperature of 160 F (71 C)
- Do not eat foods containing raw eggs or milk, such as undercooked French toast
- Avoid cooking raw meat in the microwave, as it may not reach a high enough internal temperature to kill *Salmonella* bacteria and may be unevenly cooked

- Avoid bringing uncooked meat into contact with food that will not be cooked (i.e. salad)
- Wash hands with soap after handling reptiles or animal feces
- Always wash your hands after going to the bathroom

Advice for Restaurants and Retailers

In the event that retailers and/or other food service operators are found to have handled recalled or other potentially contaminated food in their facilities, they should:

- **Contact their local health department** and communicate to their customers regarding possible exposure to *Salmonella*.
- **Wash** the inside walls and shelves of the refrigerator, cutting boards and countertops, and utensils that may have contacted contaminated foods; then **sanitize** them with a solution of one tablespoon of chlorine bleach to one gallon of hot water; **dry** with a clean cloth or paper towel that has not been previously used.
- **Wash and sanitize display cases** and surfaces used to potentially store, serve, or prepare potentially contaminated foods.
- **Wash hands with warm water and soap** following the cleaning and sanitation process.
- **Conduct regular frequent cleaning and sanitizing** of cutting boards and utensils used in processing to help minimize the likelihood of cross-contamination.

Hepatitis-Food borne illness

Introduction

- Hepatitis A is a highly contagious liver infection caused by the hepatitis A virus. The virus is one of several types of hepatitis viruses that cause inflammation and affect your liver's ability to function.
- Hepatitis A from contaminated food or water or from close contact with a person or object that's infected. Mild cases of hepatitis A don't require treatment. Most people who are infected recover completely with no permanent liver damage.
- Practicing good hygiene, including washing hands frequently, is one of the best ways to protect against hepatitis A. Vaccines are available for people most at risk.

Symptoms

Hepatitis A signs and symptoms typically don't appear until you've had the virus for a few weeks. But not everyone with hepatitis A develops them. If you do, hepatitis signs and symptoms can include:

- Fatigue
- Sudden nausea and vomiting
- Abdominal pain or discomfort, especially on the upper right side beneath your lower ribs (by your liver)
- Clay-colored bowel movements
- Loss of appetite
- Low-grade fever
- Dark urine
- Joint pain
- Yellowing of the skin and the whites of your eyes (jaundice)
- Intense itching

These symptoms may be relatively mild and go away in a few weeks. Sometimes, however, hepatitis A infection results in a severe illness that lasts several months

Treatment

Getting a hepatitis A vaccine or an injection of immunoglobulin (an antibody) within two weeks of exposure to hepatitis A may protect you from infection. Ask your doctor or your local health department about receiving the hepatitis A vaccine if:

- You've traveled out of the country recently, particularly to Mexico or South or Central America, or to areas with poor sanitation
- A restaurant where you recently ate reports a hepatitis A outbreak
- Someone close to you, such as a roommate or caregiver, is diagnosed with hepatitis A
- You recently had sexual contact with someone who has hepatitis A

Causes

Hepatitis A is caused by a virus that infects liver cells and causes inflammation. The inflammation can affect how your liver works and cause other signs and symptoms of hepatitis A. The virus most commonly spreads when you eat or drink something contaminated with fecal matter, even just tiny amounts. It does not spread through sneezing or coughing.

Here are some of the specific ways the hepatitis A virus can spread:

- Eating food handled by someone with the virus who doesn't thoroughly wash his or her hands after using the toilet
- Drinking contaminated water
- Eating raw shellfish from water polluted with sewage
- Being in close contact with a person who's infected — even if that person has no signs or symptoms
- Having sex with someone who has the virus

Risk factors

Travel or work in areas of the world where hepatitis A is common

- Attend child care or work in a child care center
- Live with another person who has hepatitis A
- Are a man who has sexual contact with other men
- Have any type of sexual contact with someone who has hepatitis A
- Are HIV positive
- Are experiencing homelessness
- Have a clotting-factor disorder, such as hemophilia
- Use any type of illegal drugs (not just those that are injected)

Complications

Unlike other types of viral hepatitis, hepatitis A does not cause long-term liver damage, and it doesn't become chronic.

In rare cases, hepatitis A can cause a sudden loss of liver function, especially in older adults or people with chronic liver diseases. Acute liver failure requires a stay in the hospital for monitoring and treatment. Some people with acute liver failure may need a liver transplant.

Prevention

The hepatitis A vaccine can prevent infection with the virus. The vaccine is typically given in two shots. The first one is followed by a booster shot six months later.

The Centers for Disease Control and Prevention recommends a hepatitis A vaccine for the following people:

- All children at age 1, or older children who didn't receive the childhood vaccine
- Anyone age 1 year or older who is experiencing homelessness
- Infants ages 6 to 11 months traveling internationally
- Family and caregivers of adoptees from countries where hepatitis A is common
- People in direct contact with others who have hepatitis A
- Laboratory workers who may come in contact with hepatitis A
- Men who have sex with men
- People who work or travel in parts of the world where hepatitis A is common
- People who use any type of illicit drugs, not just injected ones
- People with clotting-factor disorders
- People with chronic liver disease, including hepatitis B or hepatitis C
- Anyone wishing to obtain protection (immunity)

Steps to prevent infection:

- Peel and wash all fresh fruits and vegetables yourself.
- Don't eat raw or undercooked meat and fish.
- Drink bottled water and use it when brushing your teeth.
- Avoid all beverages of unknown purity, with or without ice.
- If bottled water isn't available, boil tap water before drinking it.
- Practice good hygiene. Thoroughly wash your hands often, especially after using the toilet or changing a diaper and before preparing food or eating.

Foodborne Disease-Amoebiasis

Introduction

- Amebiasis is a parasitic infection of the intestines caused by the protozoan *Entamoeba histolytica*, or *E. histolytica*. The symptoms of amoebiasis include loose stool, abdominal cramping, and stomach pain. However, most people with amoebiasis won't experience significant symptoms.
- Amoebiasis is common in tropical countries with underdeveloped sanitation. It's most common in the Indian subcontinent, parts of Central and South America, and parts of Africa. It's relatively rare in the United States.

People with the greatest risk for amoebiasis include:

- people who have traveled to tropical locations where there's poor sanitation
- immigrants from tropical countries with poor sanitary conditions
- people who live in institutions with poor sanitary conditions, such as prisons
- men who have sex with other men
- people with compromised immune systems and other health conditions

Causes of amoebiasis

Amoebiasis occurs when the parasites or their eggs (cysts) are taken in by mouth. People with amoebiasis have *Entamoeba histolytica* parasites in their faeces (poo). The infection can spread when infected people do not dispose of their faeces in a sanitary manner or do not wash their hands properly after going to the toilet.

Contaminated hands can then spread the parasites to food that may be eaten by other people and surfaces that may be touched by other people. Hands can also become contaminated when changing the nappies of an infected infant.

Amoebiasis can also be spread by:

- drinking contaminated water
- eating contaminated raw vegetables and fruit
- unprotected oral-anal sexual contact.

Some people carry the parasite or cysts in their faeces without having symptoms, but they can still pass the disease on to other people.

Symptoms of amebiasis

- When symptoms occur, they tend to appear 1 to 4 weeks after ingestion of the cysts. According to the Centers for Disease Control and Prevention Trusted Source (CDC), only about 10 to 20 percent of people who have amebiasis become ill from it.
- Symptoms at this stage tend to be mild and include loose stools and stomach cramping.
- Once the trophozoites have breached the intestinal walls, they can enter the bloodstream and travel to various internal organs.
- They can end up in your liver, heart, lungs, brain, or other organs. If trophozoites invade an internal organ, they can potentially cause:
 - abscesses
 - infections
 - severe illness
 - death
- If the parasite invades the lining of your intestine, it can cause amebic dysentery.
- Amebic dysentery is a more dangerous form of amebiasis with frequent watery and bloody stools and severe stomach cramping.
- The liver is a frequent destination for the parasite. Symptoms of amebic liver disease include fever and tenderness in the upper-right part of your abdomen.

Diagnosis of amebiasis

A doctor may suspect amebiasis after asking about your recent health and travel history. Your doctor may test you for the presence of *E. histolytica*. You may have to give stool samples for several days to screen for the presence of cysts. Your doctor may order lab tests to check liver function to help determine if the amoeba has damaged your liver.

- When the parasites spread outside the intestine, they may no longer show up in stool. So your doctor may order an ultrasound or CT scan to check for lesions on your liver.
- If lesions appear, your doctor may need to perform a needle aspiration to see if the liver has any abscesses. An abscess in the liver is a serious consequence of amebiasis
- Finally, a colonoscopy may be necessary to check for the presence of the parasite in your large intestine (colon).

Treatments for amebiasis

- ✓ Treatment for uncomplicated cases of amebiasis generally consists of a 10-day course of metronidazole (Flagyl) that you take as a capsule.
- ✓ Your doctor may also prescribe medication to control nausea if you need it.
- ✓ If the parasite is present in your intestinal tissues, the treatment must address not only the organism but also any damage to your infected organs. S
- ✓ Surgery may be necessary if the colon or peritoneal tissues have perforations.

Prevention of amoebiasis

To help prevent the spread of amoebiasis around the home:

- Wash hands thoroughly with soap and hot running water for at least 15 seconds after using the toilet or changing a nappy.
- Clean bathrooms and toilets often. Pay particular attention to toilet seats and taps.
- Avoid sharing towels or face washers.

When preparing food, food handlers are advised to make sure that:

- hands are thoroughly washed with soap and hot running water before touching food. Use paper towel or an air dryer to dry hands
- raw vegetables are thoroughly washed and cooked
- the internal temperature of reheated food reaches at least 75 °C
- microwaves are used according to the manufacturer's instructions.

When travelling and visiting developing countries:

- Avoid eating uncooked foods, particularly vegetables and fruit which cannot be peeled before eating.
- Drink only packaged drinks, boiled water or chlorinated and filtered water.
- Avoid drinks containing ice.
- Remember, 'cook it, peel it or leave it'.

Control measures

Currently, no vaccine is available to immunize the susceptible population. Therefore, the control of disease depends on certain measures, such as protection of food and water from faecal contamination, proper cleaning of fruits and vegetables before consumption, sanitary disposal of human stools, provision of potable water to the community, prohibition on the use of night soil as manure in vegetable field, periodic examination of food handlers, treatment of asymptomatic carriers, thorough washing of hands with soap and water after toilet and before eating of food, and health education of public about the source of infection, importance of personal hygiene, and risks involved in eating of unclean raw fruits, uncooked vegetables, and drinking of unwholesome

Algal toxins

Introduction

Algal toxins are toxic substances released by some types of algae when they are present in large quantities (blooms) and decay or degrade. High nutrient levels and warm temperatures often result in favorable conditions for algae blooms to form. These blooms can be identified as floating mats of decaying, bad-smelling and gelatinous scum. One type of algae, cyanobacteria (also referred to as blue-green algae), naturally occurs in all freshwater ecosystems. When algae blooms form and cyanobacteria degrade, many release algal toxins that can be harmful to aquatic and human life.

Algal toxins

Algal toxins are organic molecules produced by a variety of algal species from fresh, brackish and marine waters

. Many bloom forming species of algae are capable of producing biologically active secondary metabolites which are highly toxic to human health and other animals

. Cyanobacteria can produce different type of Cyanotoxins which belongs to four major classes namely Neurotoxins, Hepatotoxins, Cytotoxins, Dermatotoxins and Lipo polysaccharides.

Toxins produced by Blue Green Algae

- Of the more than 50 genera of blue green algae at least 8 have exhibited toxic characteristics of these include *Anabaena sp.*, *Aphanizomenon sp.*, *Coelosphaerium sp.*, *Gleotrichia sp.*, *Lyngbea sp.*, *Nodularia sp.*, and *Nostoc sp.*

- Cyanobacteria produce variety of toxins called cyanotoxins.
- Cyanotoxins are diverse group of natural toxins. In spite of their aquatic origin most of the Cyanobacteria that have been identified, so far appear to be more hazardous to humans and other aquatic animals

Neurotoxins

- ❖ Neurotoxins are produced by different genera of Cyanobacteria including *Anabaena* sp, *Aphanizomenon* sp, *Microcystis* sp, *Planktothrix* sp, *Raphidopsis* sp, *Cylindrospermium* sp, *Phormidium* sp, and *Oscillatoria* sp.
- ❖ Neurotoxins of *Oscillatoria* sp. and *Anabaena* sp. have been responsible for animal poisoning
- ❖ Neurotoxins usually cause acute effects in vertebrates including rapid paralysis of the peripheral skeletal and respiratory muscles.
- ❖ Neurotoxins affect the nervous system of the animals. Anatoxin-A inhibits transmission at the neuromuscular junction by molecular mimicry of the neurotransmitter, Acetylcholine

Hepatotoxins

- ❖ The cyclic penta peptide Nodularin is most commonly produced from the filamentous, planktonic, Cyanobacterium, *Nodularia spumigena*.
- ❖ . Nodularin is a potent hepatotoxin for humans and other animal. It induces liver hemorrhage in mice, when it injected in artificial way.
- ❖ The toxic effects of nodularin are primarily associated with the hepatic cells due to active transport of the toxin to liver via the bile acid, multi specific organic anion transporters
The consumption of *N.spumigena* may cause massive liver hemorrhage in animal.

Saxitoxins

- ❖ Saxitoxins are heterocyclic guanidine neurotoxins act like carbamate pesticides produced by different fresh water algae like *Anabaena circinalis*, *Aphanizomenon*., *Aphanizomenon gracile*., *Lyngbea wolleri* are responsible for shell fish poisoning
- ❖ . Blooms of these toxic species have led to mass kills of fish, native mammals and live stock as well as the contamination of fresh water resources.

- ❖ Paralytic shell fish poisoning symptoms generally onset within 30 min of ingestion and invariably begin with a tingling or burning of lips, tongue and throat increase to total numbness of face
- ❖ The saxitoxin causes several health problems in humans include perspiration, vomiting, diarrhea.
- ❖ In case of acute poisoning numbness may be spread to neck and extremities and progress to muscular weakness, loss of motor coordination, and finally leads to paralysis

Lipopolysaccharides (LPS)

- ❖ Lipopolysaccharides are known as irritant toxins and are generally found in the outer membrane of the cell wall of Gram-negative bacteria, including Cyanobacteria,
- ❖ It is generally the fatty acid component of the LPS molecule that elicits an irritant allergic response in humans and mammals. Cyanobacterial LPS are considerably less potent than LPS from pathogenic Gram-negative bacteria such as *Salmonella*.
- ❖ LPS is a potent activator of macrophages and can result in the production of cytokines and growth factors.

Cylindrospermopsin

- ❖ Cylindrospermopsin produces symptoms of hepatoenteritis. It also affects domestic animals.
- ❖ It also interferes with systems of Liver, Nerves, Thymus and Heart and is considered a potential carcinogen.
- ❖ Cylindrospermopsin is produced by eight fresh water Cyanobacterial members including *Cylindrospermopsis raciborskii*, *Aphanizomenon ovalisporum*, *Aphanizomenon flos-aquae*, *Anabaena bergii*, *Anabaena lapponica*, *Lyngbya wollei*, *Raphidiopsis carvata*, *Umezakia natans*.

Anatoxins

- ❖ . Anatoxin-a is one of the neurotoxic alkaloids that have been produced from cyanobacteria including *Anabaena*, *Planktothrix*, (*Oscillatoria*), *Aphanizomenon*, *Cylindrospermum*, *Microcystis spp.*
- ❖ Anatoxin-a (s) produced by *A.flos-aquae*, and induced salivation in mice by which it can be differentiated from other cyanobacterial neurotoxins. It acts as an irreversible anti cholinesterase inhibitor

*****.

Mycotoxin

Introduction

- Mycotoxins are secondary toxic metabolites with a wide variety of chemical structures synthesized by fungi (mold)].
- Mycotoxins are thought to be a kind of “chemical defense system” to protect mold from insects, microorganisms, nematodes, grazing animals, and humans
- . Molds reproduce by means of spores, and their small molecular weight spores are easily disseminated to environment by wind.
- They cannot be affected by the adverse environmental conditions and can be present in the latent state for long periods. Moreover, when the environmental conditions are appropriate, spores return to vegetative form and can form into new mold colonies.
- Agricultural products can be contaminated with mold in pre-harvest via insect and bird damage and harsh weather condition damage such as hail damage.
- In addition, selected harvesting method is one of the most important reasons in contamination of the mold to the products. Improper storage, transport, and marketing can also cause the mold growth and synthesis of mycotoxins .

Mycotoxin can occur in food and agricultural products via many contamination pathways, at any stage of production, processing, transport, and storage .

Factors

Factors that affect mold growth and mycotoxin production are temperature, relative humidity, fungicides and/or fertilizers, interaction between the colonizing toxigenic fungal species, type of substrate and nutritional factors, geographical location, genetic requirements, and insect infestation

Characteristics

- ❖ Approximately 400 fungal secondary metabolites are known to be toxic, and one quarter of agricultural products have been reported to be contaminated with mycotoxins in the world .
- ❖ While a type of mold may form more than one mycotoxin, a mycotoxin can be synthesized by many molds.

- ❖ The most common types of mold which are known to produce mycotoxins are *Aspergillus*, *Penicillium*, *Fusarium*, and *Alternaria* .
- ❖ According to the result of many studies in poultry and mammals, mycotoxins can be carcinogenic, mutagenic, teratogenic, hepatotoxic, nephrotoxic, immunosuppressive, and embryotoxic . The phenomenon of toxicity is called **mycotoxicosis** occurring after consumption of mycotoxin-contaminated product by human and animal.
- ❖ Especially cereals, grains, nuts, oilseeds, fruits, dried fruits, vegetables, cocoa and coffee beans, wine, beer, herbs, and spices are major mycotoxin vectors since they are used by a large mass of people and animals.
- ❖ Mycotoxins cause different degrees of toxicity according to exposure time, mycotoxin amount, physiological state, and sensitivity of the organism in humans and animals.

Table-Types of algal toxin&its toxic effects

Aflatoxin (AFL), ochratoxin A (OTA), patulin (PAT), fumonisin (FUM), trichothecenes (TCT), and zearalenone (ZEA) mycotoxin health effects [20].

Mycotoxins	Genus/species	Major food	Toxic effects and diseases
Aflatoxin	<i>Aspergillus flavus</i> <i>A. parasiticus</i> <i>A. nomius</i> <i>Penicillium</i>	Cereals, feeds, oilseeds and pulp, coconut	Carcinogenic, hepatotoxicity, teratogenicity, decreasing immune systems, affecting the structure of DNA, hepatitis, bleeding, kidney lesions
Fumonisin	<i>Fusarium verticillioides</i> <i>F. culmorum</i>	Cereals, corn	Encephalomalacia, pulmonary edema, carcinogenic, neurotoxicity, liver damage, heart failure, esophageal cancer in humans
Ochratoxin OTA	<i>Aspergillus</i> <i>Penicillium</i> <i>A. ochraceus</i> <i>P. nordicum</i> <i>P. verrucosum</i>	Cereals, herbs, oil seeds, figs, beef jerky, fruits, and wine	Kidney and liver damage, loss of appetite, nausea, vomiting, suppression of immune system, carcinogenic
Patulin	<i>Aspergillus terreus</i> <i>A. clavatus</i> <i>Penicillium</i> <i>Penicillium carneum</i>	Silage, wheat, feeds, apples, grapes, peaches, pears, apricots, olives, cereals	Neural syndromes, brain hemorrhage, skin lesions, skin cancer, lung, mutagenicity, antibacterial effect

Mycotoxins	Genus/species	Major food	Toxic effects and diseases
	<i>P. clavigerum</i> <i>P. griseofulvum</i>		
Trichothecenes (T2, DON, DAS, HT2)	<i>Fusarium</i> <i>Cephalosporium</i> <i>Trichoderma</i> <i>Fusarium oxysporum</i>	Cereals, feeds, silage, legumes, fruits, and vegetables	Immune suppression, cytotoxic, skin necrosis, hemorrhage, anemia, granulocytopenia, oral epithelial lesions, GIS lesions, hematopoietic, alimentary toxic aleukia (ATA), hypotension, coagulopathy
Zearalenone	<i>Fusarium</i> <i>F. graminearum</i> <i>F. culmorum</i>	Cereals, corn, silage, timothy grass, fodder	Carcinogenic, hormonal imbalance, estrogenic effect, reproductive problems, teratogenic
