

FOOD INFECTIONS AND INTOXICATIONS

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Introduction

- Food infections and food intoxications are the two categories of food poisoning.
- Food poisoning refers to the harmful effects of consuming food contaminated by microorganisms (bacteria, viruses, moulds, fungus).
- **Food Infection:** When we consume contaminated food (i.e. microorganisms are already present in the food), the microorganisms enter the body, begins to grow and produces the disease. This is food infection.
- Common diseases infections cause as a result of eating contaminated food include dysentery, cholera, typhoid, infectious hepatitis (Viral infection).
- **Food intoxication:** consuming foods which contains toxic substances produced by the microorganism (in the food) leads to food intoxication.
- Intoxication produces symptoms shortly after the food is consumed because growth of the disease-causing microorganism is not required.
- Toxins produced in the food can be associated with microbial cells or can be released from the cells.
- Botulism (an illness) is one example of food intoxication.
- The toxin produced by *Clostridium botulinum* (a bacteria) in food, can cause death.
- Moulds, fungus also produce toxins in foods. Ergot fungus causes ergotism.

Food-Borne Infection: Salmonellosis

- **What is the causative organism?** *Salmonella typhimurium* and *Salmonella enteritidis*.
- **What is the source of infection?** Food gets infected through contaminated meat, milk and milk products, poultry, egg and egg products.
- Food also can get infected by rats and mice when the food gets contaminated by their urine and faeces.
- **How does the poisoning occur?** Contamination of food may occur at the source or by cross-contamination (due to excess of organisms from surroundings or their foods) during processing of food.
- It can also occur due to contamination by a carrier or faecal contamination by food handler.
- The Contaminant organisms on ingestion multiply in the intestine and give rise to sudden onset of diarrhoea or vomiting or both.
- **What are the signs and symptoms of salmonellosis?** The onset of the episode is usually sudden, accompanied by chills, fever, nausea, vomiting and a profuse watery diarrhoea lasting for 2 to 3 days.
- Death is reported to occur in about one per cent of cases.
- **What is the incubation period?** The incubation period varies from 12—24 hours.

Bacterial gastroenteritis

- *Campylobacter jejuni* is considered a leading cause of acute bacterial gastroenteritis in humans and can affect persons of all ages.
- This important pathogen is often transmitted by uncooked or poorly cooked poultry products.
- For example, transmission often occurs when kitchen utensils and containers are used for chicken preparation and then for salads.
- Contamination with as few as 10 viable *Campylobacter jejuni* cells can lead to the onset of diarrhea.
- *Campylobacter jejuni* also is transmitted by raw milk, and the organism has been found on various red meats.
- Thorough cooking of food prevents this disease transmission problem.

Listeriosis

- Listeriosis, caused by *Listeria monocytogenes* is of continuing interest, as shown by the outbreak that occurred in Southern California in 1985.
- This outbreak was caused by improper pasteurization of milk used in the commercial production of Mexican-style cheeses.
- At least 86 cases of infection occurred, including 58 cases involving mother-infant pairs.
- Fortyseven people died.
- The outbreak was traced to pinhole leaks in the heat exchangers of a pasteurizing unit.
- The leaks allowed incoming raw milk to contaminate the pasteurized milk before production of the cheese.
- *Listeria* is difficult to work with because an extended incubation of samples is required for growth and detection.

Escherichia coli O157:H7

- *E. coli* O157:H7 with its specific somatic (O) and flagellar (H) antigens first discovered in 1982 and now known around the world.
- The pathogen is spread by the fecal-oral route, and an infectious dose appears to be only 500 bacteria.
- **Found**
Intestinal tracts of some mammals, raw milk, unchlorinated water; one of several strains of *E. coli* that can cause human illness.
- **Transmission**
Contaminated water, raw milk, raw or rare ground beef, unpasteurized apple juice or cider, uncooked fruits and vegetables, person-to-person.
- **Symptoms**
Diarrhea or bloody diarrhea, abdominal cramps, nausea, and malaise; can begin two to five days after food is eaten, lasting about eight days.
- Some, especially the very young, have developed Hemolytic Uremic Syndrome (HUS) that causes acute kidney failure.
- A similar illness, thrombotic thrombocytopenic purpura (TTP), may occur in older adults.

Shigellosis

- *Shigella* sp.
- **Found**
Human intestinal tract; rarely found in other animals.
- **Transmission**
Person-to-person by fecal-oral route; fecal contamination of food and water.
- Most outbreaks result from food, especially salads, prepared and handled by workers using poor personal hygiene techniques.
- **Symptoms**
Disease referred to as "shigellosis" or bacillary dysentery.
- Diarrhea containing blood and mucus, fever, abdominal cramps, chills, and vomiting; 12 to 50 hours from ingestion of bacteria; can last a few days to two weeks.

***Vibrio parahaemolyticus* and other marine *Vibrio* spp.**

- **Found**

Both pathogenic and non-pathogenic forms of the organism can be isolated from marine and estuarine environments and from fish and shellfish dwelling in these environments.

- **Transmission**

Infections with this organism have been associated with the consumption of raw, improperly cooked, or cooked, recontaminated fish and shellfish.

- **Symptoms**

Diarrhea, abdominal cramps, nausea, vomiting, headache, fever, and chills may be associated with infections caused by this organism.

Hepatitis A virus

- **Found**
Hepatitis A is widely distributed throughout the world, occurring in both epidemic and sporadic cases.
- Hepatitis A is primarily transmitted person to person by the fecal-oral route, but common source transmission does occur.
- **Transmission**
Hepatitis A virus is excreted in feces of infected people and can produce clinical disease when a susceptible individual consumes contaminated water or foods.
- Cold cuts and sandwiches, fruits, fruit juices, milk and milk products, vegetables, salads, shellfish, and iced drinks all can be considered vehicles for the transmission of Hepatitis A.
- **Symptoms**
Hepatitis A is usually a mild illness characterized by sudden onset of fever, malaise, nausea, anorexia, and abdominal discomfort, followed by several days of jaundice.

Foodborne Intoxications: Staphylococcal food poisoning

- Most *Staphylococcus aureus* strains cause a staphylococcal enteritis related to the synthesis of extracellular toxins.
- These are heat-resistant proteins, and heating will not usually render the food safe.
- The effects of the toxins are quickly felt, with disease symptoms occurring within 2 to 6 hours.
- The main reservoir of *S. aureus* is the human nasal cavity.
- Frequently *S. aureus* is transmitted to a person's hands and then is introduced into food during preparation.
- Growth and enterotoxin production usually occur when contaminated foods are held at room temperature for several hours.

Bacillus Cereus

- *Bacillus cereus* also is of concern in starchy foods.
- It can cause two distinct types of illnesses depending on the type of toxin produced: an emetic illness characterized by nausea and vomiting with an incubation time of 1 to 6 hours, and a diarrheal type, with an incubation of 4 to 16 hours.
- The emetic type is often associated with boiled or fried rice, while the diarrheal type is associated with a wider range of foods.

Clostridium perfringens

- They are common inhabitants of soil, water, food, spices, and the intestinal tract.
- Upon ingestion the cells sporulate in the intestine.
- The enterotoxin is a spore specific protein and is produced during the sporulation process.
- Enterotoxin can be detected in the feces of affected individuals.
- *Clostridium perfringens* food poisoning is common and occurs after meat products are heated, which results in O₂ depletion.
- If the foods are cooled slowly, growth of the microorganism can occur. At 45°C, enterotoxin can be detected 3 hours after growth is initiated.
- Onset of the symptoms—watery diarrhea, nausea, and abdominal cramps—usually occurs in about 8 to 16 hours.

Botulism

- Botulism is a very serious form of food poisoning but fortunately its occurrence is rare.
- If it occurs, it can kill upto the extent of two thirds of its victims.
- The organism responsible is *Clostridium botulinum* and it is the toxin liberated by the organism that causes the food poisoning.
- The organism that causes poisoning is widely distributed in soil and dust.
- Toxin produced *by Clostridiurn botulinum* is the toxic agent.
- Toxins are produced in improperly processed foods and unrefrigerated foods of low acidity.
- It is also observed to be present in the intestinal tracts of domestic animals. The organism enters the food as spores.
- The foods that are commonly affected by botulism poisoning are home preserved foods (pickles, vegetables), home made cheese etc.
- Incubation period for botulism is reported to be from 12 to 36 hours.

...Botulism

- **How does the poisoning occur?** Once spores of the organisms enter the food, under favorable anaerobic conditions they grow and liberate the toxin.
- The toxin thus liberated acts on the nervous system.
- The effects of the toxin on the gastrointestinal system are minimal.
- **What is the mode of transmission?** Consumption of contaminated food usually consisting of inadequately processed canned items used as it is, without adequate cooking, is responsible for the transmission of the disease.
- Incidence of botulism as a result of contamination from the infected wounds also is known.
- **What are the signs and symptoms?**
- The prominent symptoms in botulism include: difficulty in swallowing, blurring of vision, double vision, closing of the eyelids, painful joints, weakness of the muscles and sometimes even the paralysis of both hands and legs.
- Subject is conscious and usually there is no fever.
- The condition is usually fatal and death results in 4 to 8 days due to failure of functioning of respiration or heart or both.