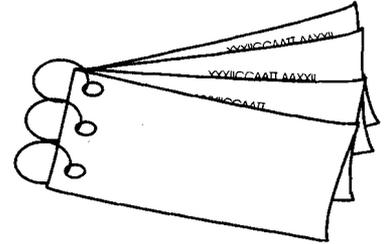


## UNIT 4 FOOD-BORNE INFECTIONS AND INTOXICATIONS

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- In developing countries food-borne diseases continue to be a serious health hazard and a major cause of morbidity and mortality. Most of the reported cases of food-borne disease are due to consumption of food contaminated with microorganisms.
- A bacterial food infection refers to food-borne illnesses caused by entry of bacteria into the body through ingestion of contaminated foods and the reaction of the body to their presence or to their metabolites.
- Bacterial food intoxication refers to food-borne illnesses caused by presence of a bacterial toxin formed in the food.
- Important bacterial agents implicated in food-borne intoxications are *Staphylococcus aureus* and *Clostridium botulinum*. *Salmonella* spp., *shigella* spp., *Campylobacter jejunae*, *Vibrio cholerae* and *Bacillus cereus* are bacteria implicated in food infections.

### 4.1 *Bacillus cereus*

*Bacillus cereus* is a facultatively aerobic, spore-forming bacterium whose cells are large rods. Infection with this microbe leads to gastroenteritis.

#### Symptoms

- Two types of illness caused by two distinct metabolites – diarrhoeal and vomiting types.
- Diarrhoeal type food poisoning is characterized by watery diarrhoea, abdominal cramps, pain occurring 6-15 hours after consumption of contaminated food. Nausea may accompany diarrhoea but vomiting rarely occurs. Symptoms persist for 24 hours in most instances.

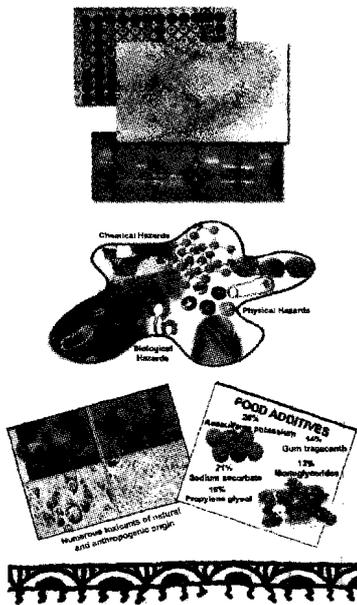
- Vomiting type of food poisoning characterized by nausea and vomiting within 0.5 to 6 hours after consumption of contaminated foods. Occasionally abdominal cramps and/ or diarrhoea may also occur. Duration of symptoms is generally less than 24 hours.

### Transmission

- A wide variety of foods including meats, milk, vegetables and fish are associated with diarrhoeal type food poisoning.
- The vomiting type outbreaks have generally been associated with rice products however, other starchy foods (such as potato, pasta) and cheese products have also been implicated.
- Food mixtures such as sauces, puddings, soups, casseroles, pastries and salads have frequently been incriminated in food poisoning outbreaks. The optimal temperature for growth of bacteria is 30° C (10-49° C). The pH range for growth is 4.9 to 9.3.

### Prevention of outbreaks

- Hot foods should be held at 65° C or above while foods to be stored should be chilled rapidly.
- Personal hygiene is of great importance in preventing spread of infection.
- Food should be processed and prepared in a sanitary manner.
- Leftovers should be heated to at least 71° C before consuming to destroy any microbes which have multiplied in the food on keeping.



## 4.2 Salmonella

- *Salmonella* is a rod-shaped bacterium causing salmonellosis. *S.typhi* and *S.paratyphi* produce typhoid and typhoid-like fever in humans. Other members of the *Salmonella* genus are responsible for the milder forms of the disease.
- *Salmonella* organisms enter into the wall of the small intestine and cause inflammation. There is evidence that an enterotoxin may be produced, perhaps within the cell.

### Symptoms

- Acute symptoms include nausea, vomiting, abdominal cramps, diarrhoea, fever and headache. These may last for 1 to 2 days or may be prolonged depending on fitness of the host, ingested dose of bacteria and strain characteristics.
- Onset time for symptoms is usually 6- 48 hours. *S. typhi* and the paratyphoid bacteria produce typhoid or typhoid-like fever in humans. Other forms of salmonellosis generally produce milder symptoms.

### Transmission

- It has widespread occurrence in animals especially poultry and swine.
- Environmental sources of the organisms include water, soil, insects, factory surfaces, kitchen surfaces, animal faeces, raw meats, raw poultry and raw sea-foods.

- Faeces of infected animals and humans are known to contaminate water and foodstuffs.
- Raw meats, poultry, eggs, milk and milk products, fish, shrimp are foods often implicated.
- *S. enteritidis* can be present inside the egg in the yolk. This may be because of deposition of the organism in yolk by an infected hen prior to cell deposition.
- All age groups are susceptible but symptoms are most severe in the elderly, infants and the malnourished. AIDS patients suffer salmonellosis frequently. The carrier state lasts a few days to a few weeks.

#### **Prevention of Outbreaks**

- Avoidance of contamination of food with bacteria from sources such as diseased human beings, animals and carriers and ingredients carrying the organisms e.g. contaminated eggs are important measures.
- Cooking or pasteurization of food or food ingredients can destroy the organism.
- Growth of the organisms can be prevented in foods by adequately refrigerating. Of course care and cleanliness in food handling and preparation are important.

### **4.3 *Shigella***

- *Shigella* are non-spore forming rod shaped bacteria causing shigellosis (bacillary dysentery).
- *Shigella* primarily causes disease in humans.

#### **Symptoms**

- Symptoms include abdominal pain, cramps, diarrhoea, fever, vomiting, blood, pus or mucous in stools.
- Onset time is 12 to 50 hours.
- Disease is caused when *Shigella* organisms attach to, and penetrate, epithelial cells of the intestine. After invasion, they multiply intracellularly and the spread results in tissue destruction. Infections are associated with ulceration, rectal bleeding, drastic dehydration which can result in death.
- Some strains produce enterotoxin.
- Infants, the elderly and infirm are susceptible to the severest symptoms of the disease but all humans are susceptible to some degree.
- Shigellosis is a very common ailment suffered by individuals with Acquired Immune Deficiency Syndrome (AIDS).

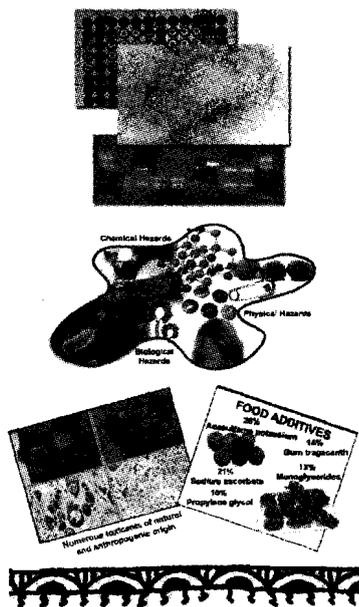
#### **Transmission**

- *Shigella* species are highly infectious agents transmitted by the faecal-oral route.
- The organism is frequently found in water polluted with human faeces.

- Salads, raw vegetables, milk, dairy products and poultry are foods generally implicated.
- Unsanitary handling of foods by food handlers is also a common cause of contamination.

### Prevention of Outbreaks

- Protection of water sources from contamination and boiling of drinking water are two important measures to prevent outbreaks.
- Clean water should be used for washing and cooking.
- Food handlers should follow strict hygienic practices to avoid contaminating water and foodstuffs.
- Heating foods to appropriate temperatures destroys the microbes.
- Foods should be refrigerated immediately if they are not being consumed.



## 4.4 *Vibrio cholerae*

*Vibrio cholerae* is the bacterium causing cholera. It is a facultatively anaerobic rod shaped bacterium. Severe epidemics are now uncommon.

### Symptoms

- Asiatic cholera symptoms may vary from a mild, watery diarrhoea with characteristic rice water stools.
- Onset is generally sudden, incubation periods range from 6 hours to 5 days.
- Abdominal cramps, nausea, vomiting, dehydration shock may occur. Severe fluid and electrolyte loss can result in death.
- Production of cholera toxin by the bacteria attached to the wall of the small intestine causes the watery diarrhoea associated with the illness.
- The illness is generally self limiting. Preventing dehydration prevents all complications. Antibiotics can shorten the course of the disease.

### Transmission

- Transmission occurs through water and food supplies contaminated with faeces of patients/ persons recovering from the illness.
- Individuals with damaged or underdeveloped immunity, reduced gastric acidity or malnutrition may suffer more severe forms of the illness.

### Prevention of Outbreaks

- Maintaining adequate levels of hygiene and sanitation prevents spread of infection.
- Washing hands thoroughly after each visit to the toilet and not letting patients or carriers handle food goes a long way in checking spread of disease.
- Chlorinating water, boiling water before use and using clean water for washing raw vegetables and fruits are important safety measures to take especially in summer months and during monsoons.

## 4.5 *Campylobacter jejuni*

- This bacterium is now recognized as an important enteric pathogen causing Campylobacteriosis or Campylobacter enteritis.
- *Campylobacter jejuni* is a slender, curved, rod-shaped bacterium which is microaerophilic or in other words requiring reduced levels of oxygen (3 to 5%).

### Symptoms

- *Campylobacter jejuni* infection causes watery or sticky diarrhoea which can contain blood and white blood cells.
- Other symptoms often present are fever, abdominal pain, nausea, headache and muscle pain.
- Onset ranges from 2-5 days after ingestion of contaminated food or water.
- Illness generally lasts 7-10 days but relapses are not uncommon (about 25% of cases). Most infections are self-limiting but antibiotic treatment reduces the length of time that infected individuals shed bacteria in their faeces.
- Children under 5 years and young adults are more frequently afflicted.

### Transmission

- Transmission occurs mainly by ingestion of food or water contaminated with faecal matter from infected animals.
- *C.jejuni* frequently contaminates raw chicken. Raw milk is also a source.

### Prevention of Outbreaks

- *C.jejuni* is a relatively fragile organism sensitive to environmental stress. Hence exposure to 21% oxygen, drying, heating, disinfectants, acidic conditions can easily destroy it.
- Properly cooking chicken, pasteurizing milk and chlorinating drinking water generally kills the bacteria.

## 4.6 *Clostridium botulinum*

- *Clostridium botulinum* is an anaerobic, spore-forming, rod-shaped bacterium causing botulism.
- Botulism is a severe type of food poisoning caused by ingestion of foods containing the potent neurotoxin formed during growth of the organism. If not properly and immediately treated, it can result in death.

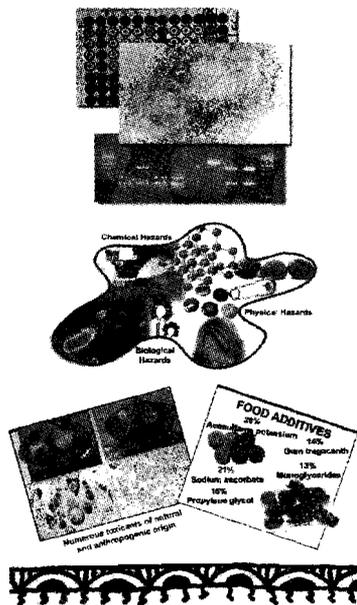
### Symptoms

- Early signs of intoxication consist of marked lassitude, weakness and vertigo usually followed by double vision and progressive difficulty in speaking and swallowing. Difficulty in breathing, weakness of other muscles, abdominal distention and constipation may also be common symptoms.

- Botulinum toxin causes paralysis by blocking motor nerves. The paralysis progresses symmetrically downward starting with eyes and face to throat, chest, extremities ultimately resulting in respiratory failure and death.
- Affected people are treated by administering antitoxin. They might also require mechanical breathing assistance.

### Transmission

- Outbreaks are commonly associated with inadequately processed, home-canned foods though occasionally commercially produced foods have been involved.
- Sausages, meat products, canned vegetables and seafood products have been the most frequent vehicles for transmission. Types of foods involved vary according to food preservation and eating habits in different regions.
- Almost any type of food that is not very acidic (pH above 4.6) can support growth and toxin production. If the food is not subsequently heated before consumption, it can result in botulism.



### Prevention of Outbreaks

- The toxin is heat-labile and can be destroyed if heated at 80°C for 10 minutes or longer.
- Good sanitation should be maintained throughout production and handling.
- Puffed or swollen cans should be rejected as they are indicative of bacterial spoilage which has resulted in gas production.
- Raw or pre-cooked foods that have been frozen, thawed and held at room temperatures should be avoided.

## 4.7 *Staphylococcus aureus*

- *Staphylococcus aureus* is a spherical bacterium appearing in pairs, short chains or grape-like bunches.
- Some strains produce an enterotoxin causing inflammation of the lining of the intestinal tract. The toxin is highly heat-stable.

### Symptoms

- Onset is rapid depending on individual susceptibility to toxin, amount of contaminated food eaten, amount of toxin in food, general health of the person.
- Most common symptoms are nausea, vomiting, retching, abdominal cramping and prostration.
- In more severe cases, headache, muscle cramping and transient changes in blood pressure and pulse rate may occur.
- Recovery generally takes two to three days or longer depending on severity of the case.

## Transmission

- Humans and animals are the primary reservoirs. Staphylococci are present in the nasal passages and throats and on the hair and skin of 50% or more of healthy individuals.
- Incidence is even higher for those who associate with or who come in contact with sick individuals.

## Prevention of Outbreaks

- Hygiene and sanitation should be maintained.
- Ingredients like milk, cream should be pasteurized and food handlers should not be carriers.
- Growth of bacteria can also be prevented by adequate refrigeration or by making pH of foods slightly acidic.

### Key Terms

**Debilitated:** Weakened

**Food handlers:** People involved in food preparation or service

**Lassitude:** Weariness

**Metabolites:** Substances formed during metabolism

**Morbidity:** Sickness

**Mortality:** Death

**Prostration :** Lying down

**Retching:** Involuntary motion of vomiting but without effect

**Vertigo:** Dizziness



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