

FOOD PATHOGENS AND FOOD BORN DISEASES

A food borne disease or infection is any gastrointestinal illness resulted due to ingestion of contaminated food altered by a pathogenic entity, such as bacteria, fungi, viruses, molds, protozoa, or parasites. Food borne illness frequently referred as food poisoning.

In defining the term “Food borne Diseases,” World Health Organization (WHO) stated that: “any disease of an infectious or toxic nature caused by the consumption of food or water.”

WHO estimates that globally foodborne and waterborne diarrheal diseases cause the deaths of about **2.2 million** people annually, **1.9 million** of them children.

Food Poisoning

Food poisoning happens when a person eats food or drink that is contaminated with bacteria, parasites or viruses.

CLASSIFICATION OF FOOD BORNE DISEASES

Food borne diseases are classified into:

1. Food borne infections
2. Food borne intoxications

1. Food borne infections

Food borne infections are caused by the entrance of pathogenic microorganisms contaminating food into the body, and the reaction of the body tissues to their presence. These can either be fungal, bacterial, viral or parasitic. Food borne infections tend to have long incubation periods and are usually characterized by fever.

2. Food Intoxication:

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The contaminated food contains poisons or toxicants which lead to food poisoning and when ingestion of such foods into the body results in food borne illness.

Food borne Intoxications

These are diseases caused by consumption of food containing:

1. Biotoxins which are found in tissues of certain plants and animals.
2. Metabolic products (toxins) formed and excreted by microorganisms (such as bacteria, fungi and algae), while they multiply in food, or in gastrointestinal tract of man.
3. Poisonous substances, which may be intentionally or unintentionally added to food during production, processing, transportation or storage.

Food borne intoxications have short incubation periods (minutes to hours) and are characterized by lack of fever.

Food borne intoxications can be classified into:

- a. Bacterial intoxications
- b. Fungal intoxications
- c. Chemical intoxication
- d. Plant toxicants
- e. Poisonous animals

FOOD BORN ILLNESS CAUSED BY BACTERIA AND VIRUS

1. Staphylococcus aureus

- a. Staphylococcus is a genus of Gram-positive bacteria. Under the microscope, they appear round, and form in grape-like clusters.
- b. Commonly found in human skin, hands, hair, nose and throat.

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- c. Staphylococcus can cause food poisoning when a food handler contaminates food and then the food is not properly refrigerated.

Common food sources of staphylococcus

- a) Foods made with hand contact and require no additional cooking, such as: salads, egg, chicken, potato, and macaroni
- b) Bakery products, such as cream-filled pastries, cream pies, and chocolate éclairs
- c) Other sources include milk and dairy products, as well as meat, poultry, eggs, and related products.

Symptoms of staphylococcal food poisoning

- a) Staphylococcal toxins are fast-acting, symptoms usually develop within 30 minutes to 6 hours.
- b) Patients typically experience vomiting, nausea, stomach cramps, and diarrhea.
- c) The illness cannot be passed to other people and typically lasts for only 1 day.
- d) Severe illness is rare.

Treatment for staphylococcal food poisoning

- a) The most important treatment is plenty of fluids.
- b) Medicines may be given to decrease vomiting and nausea.
- c) Antibiotics are not useful in treating this illness because the toxin is not affected by antibiotics.

2. Clostridi perfringens

- a) Clostridi perfringens is a spore-forming gram-positive bacterium found in many environmental sources as well as in the intestines of humans and animals.
- b) It prefers to grow in conditions with very little or no oxygen, and under ideal conditions can multiply very rapidly.

Common food sources of C. Perfringens

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- a) Beef, poultry, gravies, and dried or pre-cooked foods.
- b) Infection often occurs when foods are prepared in large quantities and kept warm for a long time before serving.
- c) Outbreaks often happen in institutions, such as hospitals, school cafeterias, prisons, or at events with catered food.

Symptoms of *C. perfringens* food poisoning

- a) People infected develop diarrhea and abdominal cramps within 6 to 24 hours (typically 8 to 12 hours).
- b) The illness usually begins suddenly and lasts for less than 24 hours.
- c) The illness is not passed from one person to another.

Diagnosis and treatment for *C. perfringens*

- a) Laboratories diagnose *C. perfringens* food poisoning by detecting a type of bacterial toxin in feces or by tests to determine the number of bacteria in the feces.
- b) Oral rehydration or, in severe cases, intravenous fluids and electrolyte replacement can be used to prevent or treat dehydration.

3. *Clostridium botulinum*

- a) It is a gram-positive, rod-shaped, anaerobic, spore-forming, motile bacterium with the ability to produce the neurotoxin botulinum.
- b) *C. botulinum* bacteria grows on food and produces toxins that, when ingested, cause paralysis.

Common food sources of *C. Botulinum*

- a) Home-canned vegetables and fruits, corn syrup
- b) Improperly canned commercial foods, home-canned or fermented fish, herb-infused oils, baked potatoes in aluminum foil, cheese sauce, bottled garlic, foods held warm for extended periods of time.

Symptoms of *C. Botulinum* food poisoning

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- a) Weakness, poor feeding, constipation, poor head control
- b) Double vision, blurred vision, drooping eyelids, difficulty swallowing, dry mouth and muscle weakness

Treatment for C. Botulinum food poisoning

- a) The respiratory failure and paralysis that occur with severe botulism may require a patient to be on a ventilator for weeks or months, plus intensive medical and nursing care. The paralysis slowly improves.
- b) Botulism can be treated with an antitoxin which blocks the action of toxin circulating in the blood.

4. SALMONELLOSIS

- a) Salmonella is a genus of rod-shaped gram-negative bacteria of the Enterobacteria family.
- b) WHO that approximately 1.2 million illnesses and 450 deaths occur due to Salmonella annually in the United States.

Common food sources of Salmonella

- a) Poultry, beef, and fish (seafood), if the meat is prepared incorrectly or is infected with the bacteria after preparation.
- b) Infected eggs, egg products, and milk when not prepared, handled, or refrigerated properly.

Symptoms of Salmonella food poisoning

- a) Most people infected develop diarrhea, fever, and abdominal cramps between 12 and 72 hours after infection.
- b) The illness usually lasts 4 to 7 days, and most individuals recover without treatment.
- c) The elderly, infants, and those with impaired immune systems are more likely to have a severe illness.

Treatment for Salmonella food poisoning

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- a) People with severe dehydration may need rehydration through an Intravenous fluids.
- b) Antibiotics are recommended for those at risk of invasive disease, including infants under three months old.
- c) Typhoid fever is treated with a 14-day course of antibiotics.

5. ESCHERICHIA COLI

- a) Escherichia coli (or E. coli) is the most prevalent infecting organism in the family of gram-negative bacteria known as enterobacteria.
- b) The best-known and also most notorious toxin-producing E. coli (STEC) cause approximately 100,000 illnesses, 3,000 hospitalizations, and 90 deaths annually in the world.

Common food sources of E. coli

- a) Contaminated food, especially undercooked ground beef, unpasteurized (raw) milk and juice, soft cheeses made from raw milk, and raw fruits and vegetables.
- b) Contaminated water, including drinking untreated water and swimming in contaminated water.

Symptoms of E. coli food poisoning

- a) The first symptom of E. coli infection is sudden onset of abdominal pain and severe cramps.
- b) Such symptoms are typically followed within 24 hours by diarrhea, sometimes fever.
- c) As the infection progresses, diarrhea becomes watery and then may become grossly bloody.

Treatment for E. coli food poisoning

- a) Apart from supportive care, such as close attention to hydration and nutrition, there is no specific therapy to halt E. coli symptoms.
- b) If your symptoms are severe (including blood in your stools or severe abdominal pain), call your doctor.

- c) Antibiotics should not be used to treat this infection.

6. CAMPYLOBACTER

- a) Campylobacter is a genus of Gram-negative bacteria which typically appear comma or s-shaped and motile.
- b) Campylobacter is 1 of 4 key global causes of diarrheal diseases. It is considered to be the most common bacterial cause of human gastroenteritis in the world.

Common food sources of campylobacter

- a) Campylobacter is prevalent in food animals such as poultry, cattle, pigs, sheep and ostriches and shellfish.
- b) The main route of transmission is foodborne, via undercooked meat and meat products, as well as raw or contaminated milk.
- c) Contaminated water or ice is also a source of infection.

Symptoms of campylobacter food poisoning

- a) The most common symptoms include diarrhea (frequently bloody), abdominal pain, fever, headache, nausea, and/or vomiting.
- b) The symptoms typically last 3 to 6 days.
- c) Death from campylobacteriosis is rare and is usually confined to very young children or elderly patients, or to those already suffering from another serious disease such as AIDS.

Treatment for campylobacter food poisoning

- a) Treatment is not generally required, except electrolyte replacement and rehydration.
- b) Patients should drink extra fluids as long as the diarrhea lasts.
- c) Antimicrobial treatment is recommended to eliminate the carrier state.

7. HEPATITIS A

- a) Hepatitis A (infectious hepatitis) is an infectious disease of the liver caused by the hepatitis A virus (HAV).

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- b) It is usually spread by eating food or drinking water contaminated with infected feces.

Symptoms of hepatitis A food poisoning

- a) Symptoms include a sudden onset of fever, tiredness, loss of appetite, nausea, vomiting, stomach pain, and jaundice.
- b) Some people have no symptoms, while others have symptoms that last 1-6 months.
- c) Most people recover with no lasting liver damage.

Food sources of hepatitis A food poisoning

- a) Raw or undercooked shellfish from contaminated waters, raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with an infected food handler.

Treatment for hepatitis A food poisoning

- a) Once the symptoms for hepatitis A appear, there is no direct treatment for the virus.
- b) Patients should rest according to how tired they feel, and should receive enough nutrition either by eating or through fluids, since the disease can cause a lack of appetite.

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MAIN CAUSES OF FOOD BORNE DISEASE

1. Cross Contamination - occurs when microorganisms are transferred from one surface or food to another.
2. Time temperature abuse– Happens when the food is exposed to Temperature Danger Zone (41°F - 140°F) for more than 4 hrs.
3. Poor personnel hygiene– Food handlers are carriers of disease causing bacteria. Food service personnel can contaminate food.

TYPES OF FOOD CONTAMINANTS

1. Biological Contaminants

A microbial contaminant that may cause a food borne illness (bacteria, viruses, fungi, parasites, biological toxins) Examples: Sea food toxins, Mushroom toxins

2. Chemical Contaminant

A chemical substance that can cause food borne illness. Substances normally found in restaurant Examples: Toxic metals, Pesticides

Physical Contaminants: Any foreign object that accidentally find its way into food Examples: Hair, Staple wire, Dust

PREVENTING FOOD BORNE ILLNESSES

Keep clean

- a) Wash your hands before handling food and often during food preparation
- b) Wash your hands after going to the toilet
- c) Wash and sanitize all surfaces and equipment used for food preparation
- d) Protect kitchen areas and food from insects, pests and other animals

Separate raw and cooked

- a) Separate raw meat, poultry and seafood from other foods
- b) Use separate equipment and utensils such as knives and cutting boards for handling raw foods
- c) Store food in containers to avoid contact between raw and prepared foods

Cook thoroughly

- a) Cook food thoroughly, especially meat, poultry, eggs and seafood
- b) Bring foods like soups and stews to boiling to make sure that they have reached 70°C.
- c) For meat and poultry, make sure that juices are clear, not pink.
- d) Reheat cooked food thoroughly

Keep food at safe temperatures

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- a) Do not leave cooked food at room temperature for more than 2 hours
- b) Refrigerate promptly all cooked and perishable food (preferably below 5°C)
- c) Do not store food too long even in the refrigerator
- d) Do not thaw frozen food at room temperature

FOOD SPOILAGE

Food spoilage is any change in the appearance, smell, or taste of a food product that makes it unacceptable to the consumer, whether or not it is due to microbial growth.

Food products falls into one of three categories:

- 1. Perishable foods include many fresh food items such as meats and many vegetables.
- 2. Semi perishable foods include foods such as potatoes, some apples, and nuts.
- 3. Nonperishable foods, such as sugar and flour.

FOOD PRESERVATION

Food preservation is to prevent the growth of bacteria, fungi, or other micro-organisms, as well as slowing the oxidation of fats that cause rancidity.

Many processes designed to preserve food will involve a number of food preservation techniques.

FOOD PRESERVATION TECHNIQUES

1. Drying

Drying is one of the oldest techniques used to hamper the decomposition of food products.

Vegetables and fruits are naturally dried by the sun and wind, but "still houses" were built in areas that did not have enough sunlight to dry things.

2. Cooling

Cooling preserves food by slowing down the growth and reproduction of micro-organisms and the action of enzymes that causes the food to rot.

Before the era of mechanical refrigeration, cooling for food storage occurred in the forms of root cellars and iceboxes.

3. Freezing

Freezing is also one of the most commonly used processes, both commercially and domestically, for preserving a very wide range of foods, including prepared foods that would not have required freezing in their unprepared state.

4. Boiling

Boiling liquid food items can kill any existing microbes.

Milk and water are often boiled to kill any harmful microbes that may be present in them.

5. Heating

Heating to temperatures which are sufficient to kill microorganisms inside the food is a method used to preserve the food items.

Milk is also boiled before storing to kill many microorganisms.

6. Sugaring

Sugaring tends to draw water from the microbes (plasmolysis).

This process leaves the microbial cells dehydrated, thus killing them. In this way, the food will remain safe from microbial spoilage.

7. Pickling

Pickling is a method of preserving food in an edible, anti-microbial liquid.

Chemical pickling, the food is placed in an edible liquid that inhibits or kills bacteria and other micro-organisms.

Fermentation pickling, the food itself produces the preservation agent, typically by a process that produces lactic acid.

8. Canning

Canning involves cooking food, sealing it in sterile cans or jars, and boiling the containers to kill or weaken any remaining bacteria as a form of sterilization.

Foods have varying degrees of natural protection against spoilage and may require that the final step occur in a pressure cooker.

9. Curing

Curing draws moisture from a substance by osmosis. Substances are cured with salt, sugar or a combination of the two.

Nitrates and nitrites are also often used to cure meat and contribute the characteristic pink colour.

10. Fermentation

Some foods, such as many cheeses, wines, and beers, use specific micro-organisms that combat spoilage from other organisms.

These micro-organisms keep pathogens in check by creating an environment toxic for themselves and other micro-organisms by producing acid or alcohol.

11. Pasteurization

Pasteurization is a process for preservation of liquid food. In this method, milk is heated at about 70 °C for 15 to 30 seconds to kill the bacteria present in it and cooling it quickly to 10°C to prevent the remaining bacteria from growing.

12. Irradiation

Irradiation of food is the exposure of food to ionizing radiation.

Treatment effects include killing bacteria, molds, and insect pests, reducing the ripening and spoiling of fruits, and at higher doses inducing sterility.

13. Biopreservation

Biopreservation is the use of natural or controlled microbiota or antimicrobials as a way of preserving food and extending its shelf life.

Beneficial bacteria or the fermentation products produced by these bacteria are used in biopreservation to control spoilage and render pathogens inactive in food.