



Bacterial Food poisoning

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Learning objectives:

- To define food poisoning
- To identify the types of bacterial food poisoning.
- To understand the epidemiology of bacterial food poisoning.
- To discuss the control and prevention of bacterial food poisoning.

Food borne diseases

- Food borne diseases (FBD) are acute illnesses associated with the recent consumption of food
- The food involved is usually **contaminated with a disease pathogen or toxicant.**
- Such food contains enough pathogens or toxicant necessary to make a person sick.

Classification of food borne diseases

Food borne diseases are classified into:

1. Food borne infections .
2. Food borne intoxications (food poisoning).

DEFINITION OF FOOD POISONING

- ▶ Food poisoning is general term for health problem arising from eating **contaminated food by bacteria, viruses, or environment toxins that present within the food it self** characterized by nausea, vomiting with/without diarrhea.
- ▶ The contamination of food may occur at **any stage in the process from the food production to consumption.**



Epidemiology of Food Poisoning

- Food poisoning, occurs commonly throughout the world.
- It is estimated that in the United States alone. Approximately 48 million episodes occur annually, resulting in about 3000 deaths per year.

Incidence Rate and Mortality Rate of Communicable Diseases, (per 100,000 Population)



Communicable Diseases

Incidence Rate

Mortality Rate

Food and Water Borne Diseases

Cholera	0.58	0.00
Dysentery	0.28	0
Food Poisoning	47.79	0.04
Hepatitis A	0.41	0
Typhoid	0.73	0.01



BACTERIAL FOOD POISONING

1. *Staphylococcus aureus* food poisoning
2. *Salmonella* food poisoning
3. *Bacillus cereus* food poisoning
4. *Clostridium perfringens* food poisoning
5. *Clostridium botulinum* food poisoning

Symptoms



- Nausea
- Abdominal pain
- Vomiting
- Diarrhea
- Gastroenteritis
- Fever
- Headache
- Fatigue



Staphylococcus aureus food borne intoxication

- This is a type of food borne intoxication is caused by consumption of food contaminated with **staphylococcal enterotoxins** produced by certain strains of *Staphylococcus aureus* while growing in food.
- The organism produces the following **five serologically different enterotoxins** that are involved in food borne intoxication.

The five enterotoxins are:

1. Staphylococcal enterotoxin A(SEA),
2. Staphylococcal enterotoxin B (SEB),
3. Staphylococcal enterotoxin C (SEC),
4. Staphylococcal enterotoxin D (SED),
5. Staphylococcal enterotoxin E (SEE)

Individual strains of *S. aureus* may produce one or more of enterotoxin types while growing in food

Toxic agent:

- **All** the staphylococcal enterotoxins are **Heat stable** (withstand heating at 100°C for one hour) and ordinary cooking procedures, pasteurization and drying do **not inactivate** these enterotoxins.
- They are **Insensitive to pH** changes (pH stable) and **Resistant to most proteolysis enzymes** (trypsin, renin, and pepsin).
- The enterotoxins are also **Not affected by irradiation.**
- All the five enterotoxins have the **similar potency.**

The organisms may be of:

- **Human origin** from purulent discharges of an infected fingers or eyes, abscesses, acneiform facial eruptions, nasopharyngeal secretions, or apparently normal skin.
- **Bovine origin**, such as **contaminated milk or milk products, especially cheese.**

Occurrence:

- Widespread and relatively frequent.
- About 25% of people are carriers of this pathogen.

Mode of transmission

- By **ingestion** of food product containing staphylococcal enterotoxin.
- Food involved are particularly those that come in contact with food handlers' hands, either without subsequent cooking or with inadequate heating or refrigeration, such as pastries, custards, salad dressings, processed meat and meat products.



Reservoirs:

- Staphylococci are found in varying numbers in **air, dust, water, food, feces** and **sewage**.
- **The primary habitat** of *S. aureus* is the mucous membranes of the nasopharynx and skin of man and animals.
- The organism is found in the nose, skin, saliva, intestinal contents and in feces.
- **Human carriers** of this organism are **numerous** and are undoubtedly the **source** of a number of **outbreaks**.

Incubation period:

- Interval between eating food and onset of symptoms is **30** minutes to **8** hours.
- Usually **1-6** hours.

- **Period of communicability :**
Not applicable.
- **Susceptibility and resistance:**
Most people are susceptible.

Prevention & control:

A. Preventive measures:

1) **Educate** food handlers about:

- strict food hygiene
- the danger of working with exposed skin or infected uncovered wound.

2) **Reduce food handling time** (initial preparation to serve)

3) Temporarily **exclude** people with boils, abscesses and other purulent lesions of hands, face or nose from food handling.

- There is a general consensus in the public health community that **regular hand-washing** is one of the most effective defences against the spread of foodborne illness.



B. Control of patient contacts and the immediate environment:

- 1) **Report** to local health authority: **Obligatory** report of outbreaks of suspected or confirmed cases
- 2) Specific treatment: Fluid replacement when indicated.

C. Epidemic measures:

- 1) By quick review of reported cases,
- 2) Inquire about the origin of the incriminated food and the manner of its preparation and storage before serving.
- 3) Search for food handlers with skin infections, particularly of the hands. Culture all purulent lesions and collect nasal swabs from all foodhandlers.

D. Disaster implications:

- A potential hazard in situations involving mass feeding and lack of refrigeration facilities. A particular problem of air travel.

E. International measures:

- WHO Collaborating Centres.

Salmonella

- 🍴 One of the most common causes of food poisoning.
- 🍴 Symptoms last 4-7 days without treatment.
- 🍴 *Salmonella* is killed by **cooking** and **pasteurization**,
- 🍴 But it can **contaminate the food processing** area and transmitted to another food item.

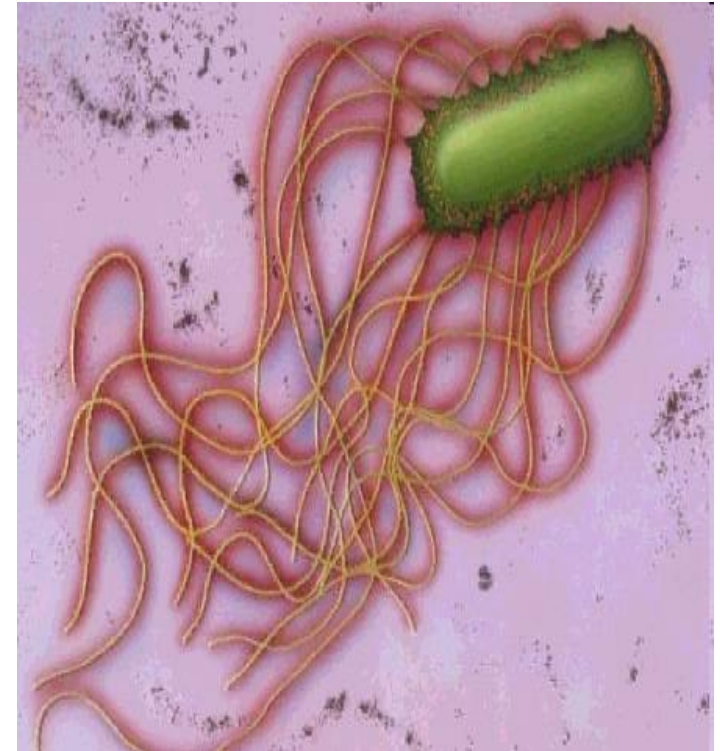


Salmonella

Gram negative rod shaped bacteria that are classified under family enterobacteriaceae

Involve:

- non-typhoidal salmonella
- S. typhimurium*,
- S. enteritidis* (mostly cause food poisoning)



Salmonellosis

- People who are carriers of the salmonellae contaminate the food.
- A heavy dose up to 10,000 -1,000,000 organisms per gram of food is required to cause infection.

- The salmonellae are **killed by temperatures** attained in commercial pasteurization.
- They are not **destroyed in chilling or freezing temperatures**, or in the usual **pickling solutions**.

Clinical symptoms

- The ordinary symptoms include abdominal pain, headache, diarrhea, fever, vomiting and malaise.
- In severe cases there is septicemia with leucopenia, endocarditis, pericarditis.
- Severe cases are encountered in babies, young children & the sick and in elderly persons.
- **The mortality is up to 13 %.**

Transmission

- Salmonellae reach food in many different ways;
 - a) Directly from slaughter animals to food
 - b) From human excreta, and transferred to food through hands, utensils, equipments, flies etc.

Salmonella food poisoning outbreaks

Outbreaks occur in different forms:

- a). Sporadic cases involving only one or two persons in a household
- b). Family outbreaks in which several members of the family are affected
- c). Institutional outbreaks which may be caused by a contaminated single food item.
- d). Large outbreaks caused by a widely distributed infective food item

Factors associated with Salmonella food poisoning outbreaks

- Consumption of inadequately cooked or thawed meat or poultry,
- Cross-contamination of food from infected food handlers.
- Presence of flies, cockroaches, rats, in the food environment that act as vectors of the disease.

Salmonella

Food Poisoning



Salmonella

Food Poisoning



Control measures

- Efficient refrigeration and hygienic handling of food.
- Consumption of properly cooked meat,
- Complete thawing of frozen meats and adequate cooking.
- Heat processing of meat, milk , fish and poultry to destroy salmonella organisms in food.

Clostridium botulinum foodborne Intoxication (botulism)

- *Clostridium botulinum* food borne intoxication (**botulism**) is a type of food poisoning caused by consumption of **enterotoxins produced by strains of *Clostridium botulinum***.
- *C. botulinum* is an obligate, spore-forming **anaerobe**, and Gram positive bacilli
- The strains are divided into proteolytic and non-proteolytic types according to whether they **hydrolyze proteins or not**.

Growth characteristics

- Toxin production occurs at temperature range between **25-30°C**.
- Both strains grow at minimum pH of **4.5**.
- Proteolytic strains produce an **active botulinal toxin**, while non-proteolytic strains produce inactive pro-toxin that require activation by trypsin.

Characteristic of Botulinal toxins

- These toxins are **neurotoxins**, that are highly toxic, **heat labile** (inactivated by heating at 80°C for 10 min), **unstable at alkaline pH** (but stable below pH 7.0) but **resistant** to pepsin and acidic environment.
- The toxins can resist the action of the gastric and intestinal juices.
- **Botulinum toxin is one of the most lethal poisons known.** The calculated lethal dose for an adult person is **10 µg.**

Botulism

- Death may occur due to **respiratory paralysis** within **7 days**.



Types of foods implicated

- Foods associated with anaerobic conditions such as **spoiled canned meat**, or hams and bacon stacked without air access, are particularly liable to be infective.
- Home made **fermented foods** have been incriminated, together with **smoked, pickled and canned foods** that are allowed to stand and then eaten without adequate cooking.
- Uncooked fresh foods are safe because they are eaten before the toxin has had time to develop, while, if foods are cooked, the toxin is destroyed.

Mode of transmission

1. Contamination of food due to improper handling.
2. Insufficient heating of food to destroy spores.
3. Spores present in animal tissues e.g. meat and fish.

Symptoms of the disease in human

- The period of incubation in man is usually **(12-72 hrs)**.
- Symptoms include nausea, vomiting, fatigue, dizziness, headache, dryness of skin, mouth and throat, constipation, lack of fever, nerve paralysis and great muscular weakness, double vision, respiratory failure and death.
- Duration of **illness 1-10 days** and mortality is high up to **60-100%** of affected persons.
- **The earlier the appearance of symptoms, the higher the mortality rate.**

Role of preservatives in meat

- **Nitrites** are used in canned meat as preservatives. The salts reduce chances of growth of *C. botulinum* and inhibit toxin production.
- **The danger of botulism has been the deciding factor in the formulation of food processing techniques, especially canned meat .**

Preventive measures

- Ensuring **proper manufacturing practices** e.g. ensure proper sterilization and preservation of canned meat
- Preserved food possessing rancid or other odors should be **rejected**
- **Proper heating of food** before consumption to destroy heat labile neurotoxins. Food should be heated to 80°C and temperature maintained for at least 10 min before eating.

Prevention cont...

- Ensuring **fast cooling** of food. This will ensure that spores that may be remaining do not germinate in food.
- Utmost **care should be taken** in the manufacture of cans, their transport, handling, storage and subsequent use during packaging of product.

**Thank you
That's ALL**



**WOULD YOU LIKE IT WITH EXTRA BOTTULISM AND A
TOUCH OF SALMONELLA**