

Introduction To Food Science and Engineering

Food Borne Diseases and Food Poisoning

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Food Borne Diseases

Food borne diseases: Food borne diseases (also called food borne illness) are those diseases that are caused by ingestion of infected or contaminated foods.

Food **infection** or **contamination** are usually caused by **different organisms**.

Causes of food borne diseases:

Contamination of food can happen at any point during its production, growing, harvesting, processing, storing, shipping or preparing. Cross-contamination, the transfer of harmful organisms from one surface to another, is often the cause. Specially the raw food (carrot), ready-to-eat foods (salad) are sometimes troublesome as these are not cooked.

Infectious organisms or their toxins are the most common causes of food poisoning. Infectious organisms include:

1. Bacteria,
2. Viruses,
3. Parasites, and
4. Fungus or mold

Food Borne Diseases

Classification of food infections

Food infections may be broadly classified into 2 types:

1. Food infection in which the contaminated food does not usually support the growth of pathogenic organisms but merely carries them. Such food infections include diseases such as [diphtheria](#), [dysentery](#), [typhoid](#), [cholera](#), [tuberculosis](#), [infectious hepatitis](#), etc.
2. Food infections in which the food serves as a culture medium for the growth of pathogens to increase the number and cause infection. When such food is consumed leads to diseases such as [salmonellosis](#), [shigellosis](#), [gastroenteritis](#), etc.

Food infections may also be classified as:

1. **Pathogenic infection:** When a pathogen is a specific cause of a disease,
2. **Nonpathogenic infection:** while a non-pathogen is considered not causing disease or harmless, but may cause illness.

Food Poisoning

Food poisoning: Food poisoning is an illness caused by eating contaminated, spoiled, or toxic food. It is not usually serious and most people get better within a few days without treatment. In most cases of **food poisoning**, the food is contaminated by bacteria, such as salmonella or Escherichia coli (E. coli), or a virus, such as the norovirus. The most common symptoms of **food poisoning** include nausea, vomiting, and diarrhea.

Classification of food poisoning

Food poisonings may be classified into 4 types depending on the types of poison contaminating the food.

- 1. Bacterial food poisoning
- 2. Fungal food poisoning
- 3. Biological food poisoning, and
- 4. Chemical food poisoning

Food Poisoning

1. Bacterial food poisoning: Bacterial food poisoning or intoxication refers to food borne illness caused by the presence of a **bacterial toxic** formed in the food. Those include botulism and staphylococcal intoxication.

The disease botulism is caused by the ingestion of food containing the **neurotoxin** produced by *Clostridium botulinum*.

Food Poisoning

2. Fungal food poisoning (Fungal Toxins), Mycotoxins: Mycotoxins are fungal metabolites, which are toxic to many animals and potentially toxic to humans. Fungi include molds, yeasts, mildews, rusts, mushrooms and blights. Some are edible (e.g. Mushrooms) while others are used in food processing. Species of the genera *penicillium* and *Aspergillus* are known to produce mycotoxins. For example, Aflatoxins are produced by certain strains of the fungi *Aspergillus flavus* and *A. parasiticus*. Patulin is produced by several molds such as *Penicillium expansum*, *P. claviforme* etc.

3. Biological poisoning (Biological Toxins): A significant number of foods in their natural state contain toxic substances in small amount and biological food poisoning occurs when such foods of plant or animal origin is consumed in excess. For example:

1. Cabbage contains goitrogens that interferes with iodine adsorption.
2. Bread and cereal products contain phytic acid that interferes with iron and calcium absorption.
3. Mushroom contain amanitin that inactivates metabolic enzymes.
4. Tea, coffee, cola drinks contain caffeine which is diuretic and stimulant.
5. Cheese, red wine, yeast extract contain tyramine that causes migraine, increased blood pressure

Food Poisoning

4. Chemical poisoning

- **Poisoning by chemicals:** Chemical poisons like arsenic (As), antimony, cadmium, chlorinated hydrocarbons, copper, cyanide, fluoride, lead, zinc and nicotinic acid may enter foods from soils (where plants are produced), utensils and processing equipment.
 - Many people have been affected from drinking arsenic mixed ground water in Bangladesh.
- **Poisoning by pesticide residue:** Pesticide or insecticide spray residues may also remain on vegetables and fruits. Thus food contaminated with chemical poisons when ingested shows symptoms of food poisoning.
 - Fruits and vegetables with pesticide or insecticide spray residues may enter body and can damage vital organs like kidney, liver etc. and even can cause cancer.

National Food Safety Laboratory Report

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ন্যাশনাল ফুড সেফটি ল্যাবরেটরির গবেষণা



২৭টি ফুলকপির মধ্যে ৮টিতে সহনীয় মাত্রার ১২ থেকে ৩৬ গুণ ক্ষতিকর কীটনাশক পাওয়া গেছে



২৭টি বেগুনের মধ্যে ১২টিতে সহনীয় মাত্রার ১৪ গুণ বেশি ক্ষতিকর কুইনালফস পাওয়া গেছে



শিমের ২৭টি নমুনার মধ্যে ৯টিতে সহনীয় মাত্রার ২০ গুণ ডাইমেথয়েট পাওয়া গেছে



লালশাকের ২৭টি নমুনার মাত্র ৩টিতে সহনীয় মাত্রার ২৮-৩১ গুণ ক্লোরোপাইরিফস পাওয়া গেছে

Arsenic Poisoning and Causes

Arsenic poisoning: Arsenic poisoning is a medical condition that occurs due to elevated levels of arsenic in the body. Recommended levels of arsenic in water are less than 10–50 ug/l (10–50 parts per billion). WHO has set a provisional guideline value of 10 µg/litre (or 0.01mg/liter) for arsenic in drinking-water.

- **Causes of Arsenic Poisoning:** The most common reason of arsenic poisoning is long term exposure in contaminated drinking water. Groundwater most often becomes contaminated naturally; however, contamination may also occur from mining or agriculture.
- **Arsenic acid (H_3AsO_4), and arsenous acid (H_3AsO_3)** and their derivatives are typically encountered in arsenic contaminated ground water. **Arsenic acts via changing the functioning of around 200 enzymes.**
- Through drinking water, **more than 200 million people globally** are exposed to higher than safe levels of arsenic. The areas most affected are **Bangladesh and West Bengal**. Other countries include **Argentina, Chile, China, India, Mexico, and the USA.**

Arsenic Poisoning: Symptoms

- **Symptoms of arsenic poisoning:** Symptoms of arsenic poisoning begin with headaches, confusion, severe diarrhea, and drowsiness.
- The symptoms of short term exposure may include vomiting, abdominal pain, encephalopathy, and watery diarrhea that contains blood.
- Symptoms of long term exposure can result in
 - thickening of the skin,
 - darker skin,
 - abdominal pain,
 - diarrhea,
 - heart disease,
 - numbness (lack of feeling), and
 - cancer.
- **Diagnosis:** Diagnosis is done by testing the urine, blood, or hair.

Effect of Arsenic poisoning on human body



Keratosis



Keratosis



Melanosis



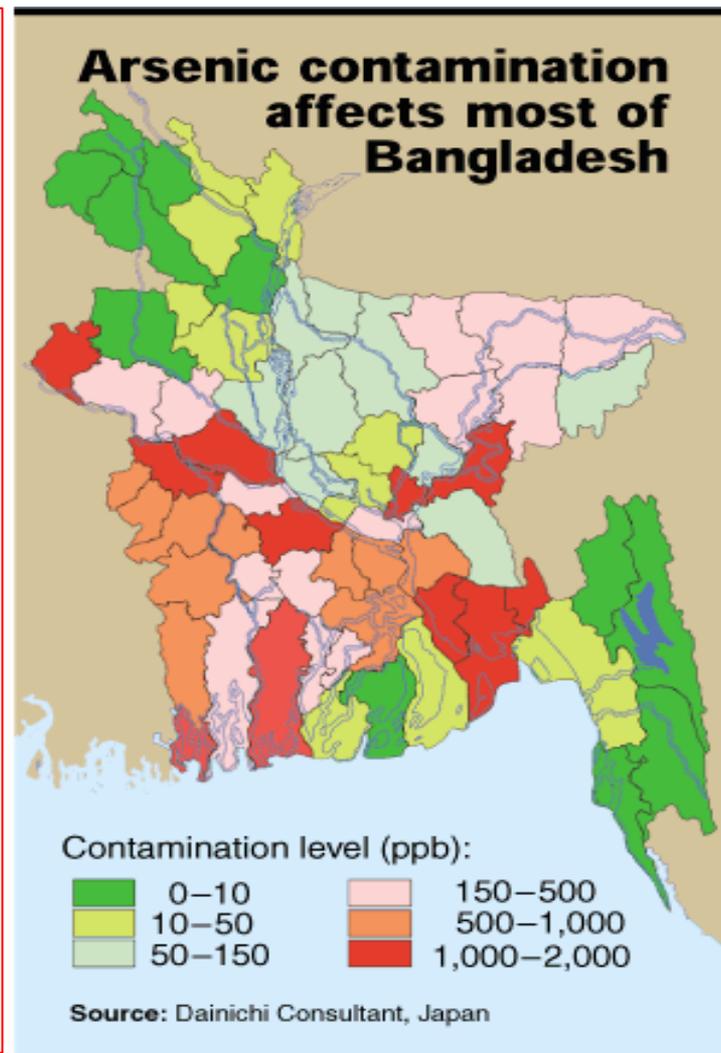
Cancer



Arsenic Contamination in Bangladesh

- **Arsenic Contamination of GW:** The serious arsenic contamination of groundwater in Bangladesh has come out recently as the biggest natural calamity in the world.
- The people in **59 out of 64 districts** comprising **126,134 km² (85%)** of Bangladesh are suffering due to the arsenic contamination in drinking water.
- 75 million people are at risk and 24 million are potentially exposed to arsenic contamination.
- Most of the recognized stages of arsenic poisoning have been identified in Bangladesh and the risk of arsenic poisoning in the population is increasing everyday.

Ref: <http://eng-consult.com/pub/ArsenicIEB.pdf>



Symptoms of Food Poisoning

Symptoms:

- Food poisoning symptoms can start within hours of eating contaminated food Or they may begin days or even weeks later.
- Most types of food poisoning cause one or more of the following signs and symptoms:
 1. **Nausea** (the unsettling feeling in the stomach that accompanies the urge to vomit)
 1. **Vomiting**
 2. **Diarrhoea**
 3. **Abdominal pain and cramps** (contractions), and
 4. **Fever**

Food Poisoning (Risk factors)

Risk Factors: Whether you become ill after eating contaminated food depends on the **organism**, the **amount of exposure**, your **age** and your **health**.

High-risk groups include:

- **Older adults:** Older people are more susceptible than young people.
- **Pregnant women:** During pregnancy, changes in metabolism and circulation may increase the risk of food poisoning.
- **Infants and young children:** Their immune systems haven't developed.
- **People with chronic disease:** Having a chronic condition such as diabetes, liver disease or AIDS reduces immune response.

Prevention: Sickness caused by food poisoning generally lasts from a few hours to several days. Effect can be mild and illness is recovered within a day or two, or the effect can be devastating and even deadly. Sick persons from food poisoning should go to hospital or doctors immediately after being affected.

Thanks