BIOLOGICAL FACTORS AND HEALTH CONSEQUENCES

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FOOD POLLUTION

• Some pollutants can initiate disease and weaken your brain.

• Other pollutants can weaken your immune system that is your main defense against bacteria, viruses, and parasites.

• Pollutants in the soil, such as lead, mercury and arsenic are drawn up through the roots and become part of the plant.
FOOD POLLUTION

• The soil becomes polluted when:
  ♣ **Air pollutants fall** to the ground as particles or dissolved in rain.
  ♣ **Polluted fertilizer** is spread on fields. (Some fertilizers contain polluted ash from coal fired power plants and/or toxic materials from sewage plants).

• Crops also become polluted when:
  ♣ Farmers **apply dangerous chemicals** that remain on or in the food when eaten.
CLASSIFICATION OF FOOD POISONING

• Food Intoxication
  This condition would occur if an individual consumed foods containing toxins released by living bacteria in the food.

• Food Infection
  This condition would happen if an individual consumed foods that contain high amount of bacteria or pathogens till it cause pain at the gastrointestinal section.

These foods have suitable nutrients, pH, and temperature and moist that facilitates the reproduction of bacteria, which make it suitable for pathogens or bacteria.
FOOD-BORNE ILLNESS

• Food borne illness (also food borne disease) is any illness resulting from the consumption of contaminated food.

• Food borne illness is commonly called food poisoning, even though most cases are caused by a variety of pathogenic bacteria, viruses, or parasites that contaminate food, rather than chemical or natural.
CONDITIONS THAT FACILITATE THE GROWTH OF BACTERIA (FAT-TOM)

• Food
  Food contains high protein and carbohydrate like beef, chicken, seafood, rice and bean contribute towards the growth of diseases causing bacteria.

• Acidity
  Most of the bacteria can grow between the pH of 4 to 9.
Time
- Less than 2 hours after cook is the safe time to eat the dishes.
- Food disease causing bacteria would undergo 2 times the normal growth in every 15-20 minutes.

Temperature
- Temperature between 5°C and 60°C (dangerous temperature zone) facilitates the growth of bacteria.
- Temperature below 5°C does not facilitate growth of bacteria or basically no growth process.
Oxygen

▲ Food disease causing bacteria depend on oxygen. Bacteria can be categorised into 3 groups, (i.e. aerobic, anaerobic and facultative).

▲ Aerobic bacteria require oxygen in order to live and expand.

▲ Anaerobic bacteria cannot grow in a free oxygen flowing environment, but can reproduce in depleting or lack of oxygen environment.

▲ Facultative bacteria can reproduce in both aerobic and anaerobic environment.

Moisture

▲ Bacteria cannot expand without the presence of air. In foods, over 0.85 of water level ($A_w$) is required by food disease causing bacteria to grow.

▲ Water level that is between 0-1 is enough for bacteria to undergo growing process.
CAUSES

• Improper handling, preparation, or food storage
  ● Good hygiene practices before, during, and after food preparation can reduce the chances of contracting an illness.
  ● The action of monitoring food to ensure that it will not cause food borne illness is known as food safety.

• Large variety of toxins that affect the environment.
  ● Food borne illness caused by chemicals, called as Food contaminants.
# Biological Agents and Effects

<table>
<thead>
<tr>
<th>Biological Agent</th>
<th>Effect/Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Bacteria</strong></td>
<td></td>
</tr>
<tr>
<td>i. Cause of Food Infection</td>
<td></td>
</tr>
<tr>
<td>a. <em>Salmonella typhimurium</em></td>
<td>Salmonelosis</td>
</tr>
<tr>
<td>b. <em>Salmonella typhi</em></td>
<td>Typhoid Fever</td>
</tr>
<tr>
<td>c. <em>Salmonella paratyphi</em></td>
<td>Paratyphoid</td>
</tr>
<tr>
<td>d. <em>Vibrio cholera</em></td>
<td>Cholera</td>
</tr>
<tr>
<td>e. <em>Mycobacterium tuberculosis</em></td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>ii. Cause of Food Poison</td>
<td></td>
</tr>
<tr>
<td>a. <em>Staphylococcus aurens</em></td>
<td>Food Poison</td>
</tr>
<tr>
<td>b. <em>Clostridium botulinum</em></td>
<td>Food Poison</td>
</tr>
<tr>
<td>c. <em>Clostridium perfringens</em></td>
<td>Food Poison</td>
</tr>
<tr>
<td><strong>2. Parasite</strong></td>
<td></td>
</tr>
<tr>
<td>a. <em>Trichinella spiralis</em></td>
<td>Trichinosis</td>
</tr>
<tr>
<td>b. <em>Taenia solium</em></td>
<td>Taeniasis</td>
</tr>
<tr>
<td>c. <em>Ascaris lumbricoides</em></td>
<td>Ascariasis</td>
</tr>
<tr>
<td><strong>3. Others Pathogen</strong></td>
<td></td>
</tr>
<tr>
<td>a. <em>Coxiella burnetii</em></td>
<td>Q Fever</td>
</tr>
<tr>
<td>b. Hepatitis A virus</td>
<td>Hepatitis A Infection</td>
</tr>
<tr>
<td>c. Poisonous Mushroom</td>
<td>Food Poison</td>
</tr>
<tr>
<td>d. Poisonous Fish</td>
<td>Food Poison</td>
</tr>
</tbody>
</table>
FOOD CONTIMANATION

• Caused by **pesticides** or **medicines** in food and naturally toxic substances like **poisonous mushrooms** or **fish**

• Some could even come from the **skin and nose**, like **staphylococcus aureus**, which could lead to death.
<table>
<thead>
<tr>
<th>Chemical</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony</td>
<td>Use enamel coated container while cooking.</td>
</tr>
<tr>
<td>Fluoride</td>
<td>Touched cockroach pesticide spray that contains this chemical compound.</td>
</tr>
<tr>
<td>Methyl Chloride</td>
<td>Leakage in the refrigerator that contains methyl chloride. Foods inside the refrigerator would cracked by the gas.</td>
</tr>
<tr>
<td>Nitrate</td>
<td>Excessive usage of nitrate in preserving meats or water that contains high amount of nitrate.</td>
</tr>
<tr>
<td>Pesticide</td>
<td>Fruits and vegetables that were being sprayed with pesticide can be plucked only after 7-14 days depending on the type of pesticide was used. If the plucking process is being brought forward, there will be residue of the pesticide on the plant and would endanger consumers’ health.</td>
</tr>
</tbody>
</table>
SYMPTOMS AND MORTALITY

• Symptoms typically begin several hours to several days after consumption and depending on the agent involved:

♣ Include one or more of the following:

   nausea, abdominal pain, vomiting, diarrhea, gastroenteritis, fever, headache or fatigue.
Food borne illness can result in permanent health problems or even death, especially for people at high risk, including:

- babies
- young children
- pregnant women (and their fetuses)
- elderly people
- sick people and others with weak immune systems
BACTERIA

• They are usually not seen until 12–72 hours or more after eating contaminated food.

• **Most common** bacterial food borne pathogens are:
  – *Campylobacter jejuni*
  – *Clostridium perfringens*
  – *Salmonella* spp.
    • *S. Typhimurium* infection is caused by consumption of eggs that are not adequately cooked or by other interactive human-animal pathogens
  – *Escherichia coli*
  – *Staphylococcus aureus*
  – *Streptococcus*
Salmonella spp
VIRUS

- **Viral** infections make up perhaps one third of cases of food poisoning in developed countries.

- Foodborne viral infection are usually of intermediate (1–3 days) **incubation period**.

- **Hepatitis A**
  - is distinguished from other viral causes by its prolonged (2–6 week) **incubation period**
  - ability to **spread** beyond the stomach and intestines, into the **liver**. It often induces **jaundice**, or yellowing of the skin, and rarely leads to chronic liver dysfunction.
  - The virus has been found to cause the infection **due to the consumption of fresh-cut produce which has fecal contamination**
ROTAVIRUS
PARASITES (*Diphyllobothrium* sp.)

- Most foodborne parasites are zoonoses
  - *Diphyllobothrium* sp.
  - *Nanophyetus* sp.
  - *Taenia saginata*
  - *Taenia solium*
  - *Fasciola hepatica*
PROTOZOA

Giardia lamblia
PREVENTING FOOD POISONING

- In the food service industry: FAT-TOM: Food, Acidity, Time, temperature, Oxygen, Moisture.

- Potentially hazardous foods: Foods that have the ability to support rapid growth of pathogenic food-borne bacteria.

- Principles of food safety: Cleanliness, temperature control, cross-contamination, personal hygiene, food safety management.
PREVENTING FOOD POISONING

► Hazard Analysis Critical Control Point (HACCP)
  - consists of 7 steps or principles to managing and identify potential problem before food-borne illness occur and control or eliminate the problem.

♣ Identifying potential food hazards.
♣ Determine CCP in the food preparation process.
♣ Establish critical limits for each CCP.
♣ Establish a monitoring system for each CCP.
♣ Establish corrective actions.
♣ Establish verification procedures.
♣ Establish documentation and record keeping.
LAW AND REGULATION

► Regulatory scheme for food safety
► Food Act 1983.
► Food Regulation 1985.
THANK YOU