FOOD HYGIENE

DEFINATION OF FOOD HYGIENE

- **Food hygiene** is used as a scientific method /discipline describing handing, preparation and storage of food in ways that prevent food-borne illness.
- Food hygiene is the preservation and preparation of food in manner that ensure the food is safe for human consumption.
- Food hygiene is the condition and practices that preserve the quality of food to prevent contamination and foodborne illnesses. Properly handling and preparing food greatly reduces the risks of getting foodborne illnesses.
- Food Hygiene- all sanitary measures, principles and procedures put in place to ensure that food is free from agents of contamination or disease germs in any for

PRINCPLE AND METHOD OF FOOD PROCCESSING

FOOD PROCCESSING is the set of method and techniques used to transformer raw ingredients into food for consumption**.**

Example of food processing method includes

- ✓ Chopping

- ✓ Mixing
- ✓ Homogenizing
- ✓ Cooking
- ✓ pasteurizing
- ✓ emulsifying
- ✓ spray-drying

The method and principle can further classify based on food preservation

These are:

1. **control of water activity**

Water activity of the food can be control the different method which are explained hereunder**.**

a. **Evaporation: frequently** in the food industry a raw material or a potential food stuff contains more water than is required in the final product. When the apply heat to evaporate it.evaporation is thus process that is often used by the food technologist.

The basic factor that affect the rate of evaporation are:

- Rate at which heat can be transferred to the liquid
- Quantity of heat required to evaporate each kg of water

- Maximum allowable temperature of the liquid
- Pressure at which the evaporation takes place
- Change that may occur in the foodstuff during the course of the evaporation process

b. Dehydration: it is defined as the application of heat under controlled condition to remove the majority of the water normally present in a food by evaporation. The main purpose of dehydration is to extend the shelf life of foods by reduction in water activity

c. Osmo-dehydration: in osmo-dehydration the prepared fresh material is soaked in thick liquid sugar solution and or a strong salt solution and then the material.

d. Drying: is the process to remove the moisture content from the food material and therapy reduce the water activity and extend the shelf life.

2. Cold treatment

Is the treatment like fermentation irradiation, di-electric, ohm, infrared heating, freezing, super cooling refrigeration etc.

a. **Fermentation**: during food fermentation the controlled action of selected micro-organism is used to alter the texture of food.
b. **Irradiation**: ionizing radiation takes the form of Rays from sops or commercially to a lesser extent from X_rayand electrons
   Application of irradiant
   - Sterilization
   - Reduction of pathogens
   - Prolonging shelf life
   - Control of ripening
   - Disinfection
   - Inhibition of sprouting
c. **Dielectric, ohmic and infrared heating**: are two forms of electromagnetic energy they are both transmitted as waves which penetrate food and are then absorbed and converted to heat.
d. **Freezing**: is the reduction in temperature generally by super cooling followed by crystallization of water.
   Method of quick freezing
   - Freezing by indirect contact with a refrigerant
   - Freezing in a blast of cold air
   - Freezing by direct immersion in a refrigerating medium

Freezing by indirect contact with refrigerant: food may be frozen by being placed in a contact with a metal surface which is cooled by refrigerant or packaged or packed in a can and cooled by immersion in a refrigerant

Air blast freezing: to obtain very cold air, a blast of air is directed through refrigerating coil.

Freezing by direct immersion: in low temperature drying was the beginning of quick freezing.

e. **Super cooling**: occur when temperature of water is lowered below the freezing point and crystallization does not occur.
f. **Refrigeration**: this is the process by which heat is removed from a confined place and material for the purpose of maintaining a lower temperature.

3. Control of microbial activity

Food material can be stored for period by controlling the microbial activities by pasteurization and sterilization methods

a. **Pasteurization**: is a relatively mild heat treatment. In which food is heated to below 100
b. **Heat sterilization**: it is the unit operation in which foods are heated at a sufficiently high temperature and for sufficiently long time to destroy microbial and enzyme activity.

Food borne disease

- **Food borne disease** is caused by consuming contamination food, beverages or water and can be a variety of bacteria, viruses and /or toxin.
- Many of these pathogens can be acquired through more than just food, beverages or water
- **Classification of Some Food Borne Diseases**

  Food borne diseases classified into two major categories depending on the causative agent:

  Food-borne poisonings/intoxications and food-borne infections.

  1**. Food borne infections**: are diseases whose etiologic agents are viable pathogenic organisms ingested with foods and that can establish infection

  A. Bacterial Food Borne Infections:

i. Typhoid Fever (Enteric fever) and Paratyphoid Fever Typhoid fever is a systemic disease caused by S. typhoid. S. paratyphoid A and B cause paratyphoid fever

Pathogenesis:

Following ingestion, the bacteria enter the epithelial layer of the small intestine, and are carried by macrophages throughout the body. They reach the reticuloendothelial system of the body. During bacteremia phase, they also seed in organs like the gall bladder

Clinical features:

- After an incubation period of 3-21 days, patients present with prolonged fever, headache, anorexia, chills, malaise, abdominal pain, and diarrhea or constipation.
- On examination, one may find enlarged liver and spleen and abdominal tenderness.
- Untreated patients may develop different complications, mainly gastrointestinal hemorrhage and/or perforation.

ii. Non-typhoid Salmonellosis

Pathogenesis

- Following ingestion, the non-typhoid salmonella organisms reach the bowel where

they cause damage to the intestinal mucosa causing inflammatory diarrhea.

Clinical Features

- The major clinical features are loose, non-bloody stools of moderate volume, nausea, vomiting, fever and abdominal cramps, which are seen following an incubation period of 6 – 48 hours.
- Large-volume watery diarrhea or dysentery can also occur.

iii. Shigellosis/Bacillary dysentery

It is an acute inflammatory colitis caused by a number of Shigella species.

Pathogenesis

- Orally ingested organisms invade colonic epithelial cells. Following this they multiply within the cells causing cell damage and death. This results in mucosal ulcerations.

Clinical Features:

- After an incubation period of 1-7 days, patients present with non-bloody watery diarrhea or gross dysentery with tenesmus accompanied by fever which is particularly severe in children (40 – 41o C) and abdominal pain.

- Some of the complications of shigellosis are dehydration and bacteremia.

iv. Cholera

Cholera is an acute diarrheal disease caused by toxin released by Vibrio cholera. It may result in death within hours if not treated.

Pathogenesis:

- Following colonization of small intestine, the organism releases a potent enterotoxin called cholera toxin.
- This toxin inhibits sodium absorption and activates chloride excretion resulting in the accumulation of sodium chloride in the intestinal lumen, which attracts water passively.

Clinical features:

- After an incubation period of 24 – 48 hours, patients experience sudden onset of profuse watery diarrhea accompanied by vomiting.
- Fever and abdominal pain are usually absent.
- Important complications include dehydration up to hypovolemic shock, electrolyte disturbances and acute renal failure.

v. Escherichia coli Infection

There are different strains of Escherichia coli which give rise to diarrhea by different mechanisms:

1. **Entero toxigenic E.coli (ETEC)**

Pathogenesis:

- Colonizes the small bowel and releases heat labile (LT) and heat stable (ST) toxins which stimulate fluid secretion.

Clinical Features:

- The clinical features are watery diarrhea without mucus or blood and abdominal cramps.

2. . **Enter hemorrhagic E.coli (EHEC)**

Pathogenesis:

- Colonizes the colon and the ileum and produces Shiga-like toxin which results in inflammatory response in colonic mucosa.

Clinical Features:

- The clinical features include initial watery diarrhea followed by grossly bloody diarrhea and significant abdominal pain. Hemolytic uremic syndrome may complicate EHEC infection.

3. **Enteropathogenic E-coli (EPEC)**

Pathogenesis:

- Colonize the small bowel and adhere to the mucosa causing effacement of microvilli.

Clinical Features:

- Manifests with diarrhea with mucus but no blood.

4. **Enteroinvasive E.coli (EIEC**)

Pathogenesis:

- Invades and replicates within the colonic mucosa.

Clinical Features:

- Produces a clinical disease that shares many features of Shigella infection.

vi. Brucellosis

Pathogenesis:

- The organism invades the blood stream and localizes in the liver, spleen, bones, etc. In these tissues it induces inflammatory responses.

Clinical Features

- The incubation period 1 week to several months and then patients manifest with many different symptoms and signs most common of which include fever, chills, sweating, myalgia, arthralgia, headaches, anorexia, weight loss, dry cough, etc.

- Patients may appear well or may be very ill with any of the following manifestations: pallor, lymphadenopathy, enlarged liver and spleen, evidences of joint inflammation, rash, etc.

vii. Anthrax

Pathogenesis:

The organisms release anthrax toxin, which is responsible for the different manifestations of the disease.

There are three major clinical forms of anthrax:

1. Cutaneous anthrax (95%), which is the most common characterized by localized skin lesion with black central eschar of necrosis and non-pitting edema.

2. Inhalation anthrax (Wool sorter's diseases) characterized by hemorrhagic mediastinitis with high mortality rate.

3. Gastrointestinal anthrax, which is common in Ethiopia, and has high mortality rate. Since gastrointestinal anthrax is the most important form of anthrax with respect to acquisition through contaminated food, the following discussion focuses on this form of anthrax.

Clinical features of gastrointestinal anthrax:

There are two major forms:

- Gastrointestinal anthrax manifesting with fever, nausea, vomiting, abdominal pain, massive and/or bloody diarrhea and occasional ascites.
- Or pharyngeal anthrax manifests with fever, sore throat and difficulty of swallowing, painful regional lymphadenopathy and respiratory distress.

B. Parasitic Food Borne Infections

Most common food-borne parasitic diseases to be considered are Amebiasis, ascariasis, taeniasis and giardiasis.

i. Amebiasis

Pathogenesis:

- Motile trophozoites released from ingested cysts invade large bowel mucosa and cause mucosal ulcerations; they may also spread to other organs via the bloodstream to cause metastatic lesions (most commonly in the liver).
- Intestinal infections rarely cause mass lesion (amoeba). Clinical features there are various clinical syndromes Symptomatic intestinal amebiasis manifests with abdominal pain and mild diarrhea followed by diffuse abdominal pain, weight loss,

malaise, and bloody-mucoid diarrhea. Fever occurs in less than 40% of patients.

- Amoebic liver abscess manifests with fever, abdominal and/or right lower chest pain, and point tenderness over the liver and right-sided pleural effusion. Less than 30% have diarrhea. Complications include rupture of the abscess and formation of abnormal communications between the abscess cavity and the bronchi.

ii. Giardiasis

Pathogenesis:

- Ingested cysts release trophozoites in the small intestine.
- The trophozoites multiply by binary fission, adhere to the intestinal mucosa and lead to diarrhea and malabsorption; however, the exact mechanism by which G. lamblia produces diarrhea is not clear.

Clinical features

- Most patients are asymptomatic. But in symptomatic individuals, the clinical features range widely and include diarrhea, abdominal pain, flatulence, anorexia, weight loss, nausea and vomiting.

ii. Taeniasis a. Taeniasis Saginata

Pathogenesis:

- This is the common form of taeniasis in Ethiopia.
- Cysticerci deposited in the striated muscles of cattle infect humans when they are ingested together with raw or undercooked beef and they develop into adults in the small intestine.

Clinical features:

- Patients notice passage of proglottids in the feces, perianal discomfort, abdominal discomfort or mild pain, nausea and anorexia.

b. Taeniasis solium

Pathogenesis:

- T. solium is able to cause two different forms of infection in humans.
- Intestinal disease is infection with adult tape worms, acquired by ingestion of undercooked pork containing cysticerci.
- Cysticercosis is infection with larval forms in the tissues, most commonly the brain and skeletal muscles, and follows ingestion of T. solium eggs. Fecal-oral autoinfection is possible.

Clinical Features:

- Intestinal infection may be asymptomatic or may manifest with epigastric discomfort, nausea, hunger sensation, diarrhea, etc.

- Cysticercosis: the clinical features depend on the location and number of cysticerci and the degree of inflammatory response they induce in the tissue.

iii. Ascariasis

Pathogenesis:

- Eggs released with feces mature in the soil and become infective in weeks.
- When swallowed with contaminated food, they release larvae in the intestines, which enter blood, go to the lungs, enter the alveoli, ascend the bronchial tree and are swallowed into the bowel.
- In the small intestine, they develop into adult worms.

Clinical features:

Clinical manifestations result from:

- Larval migration in the lungs: cough, shortness of breath, blood-tinged sputum
- Effect of adult worms in the intestine: usually asymptomatic, but may produce intestinal obstruction, perforation; or worms may migrate to ectopic sites to produce other manifestations like biliary colic.

C. Viral Food Borne Infections

Different viruses may be transmitted via contaminated food; most produce mild self-limiting illness, but occasional severe illnesses and even deaths may also occur.

i. Viral gastroenteritis

Pathogenesis:

- Rota virus causes osmotic diarrhea due to nutrient malabsorption. Caliciviruses such as the Norwalk virus also produce diarrhea in a similar but slightly different mechanism that culminates in nutrient malabsorption.

Clinical Features:

- Rota virus infection causes sudden onset of vomiting followed by mild to very severe diarrhea mixed with mucus and fever.
- Norwalk illness results in abrupt onset of nausea and abdominal cramps followed by vomiting and /or diarrhea, low-grade fever, headache, myalgia after an incubation period of 18 to 72 hours.

ii. Viral hepatitis.

Pathogenesis:

- Almost exclusively the fecal-oral route transmits Hepatitis A and E viruses.

None of the hepatitis viruses directly damages liver cells. Immunologic response of the host plays important role in the pathogenesis .

Clinical features:

- The incubation period varies according to the responsible agent.
- Prodromal symptoms include anorexia, nausea and vomiting, fatigue and malaise, arthralgia and myalgia, headache, photophobia, low-grade fever (38 – 39o C).
- These are followed by development of clinical jaundice; possibly accompanied by mild weight loss, tender enlarged liver, right upper quadrant pain.

Food borne poisonings/ intoxications:

Diseases arising from the ingestion of toxins released by microorganisms, intoxications from poisonous plants or toxic animal tissues: or due to consumption of food contaminated by chemical poisons.

A. Bacterial Food Poisoning

- ✓ Clostridium perfringens
- ✓ Escherichia Coli

- ✓ Bacillus Cereus
- ✓ Staphylococcal Food Poisoning
- ✓ Botulism

B. Chemical Food Poisoning

- ✓ Heavy Metals
- ✓ Lead poisoning
- ✓ Mercury Poisoning
- ✓ Arsenic

Factors implicated in Food-borne Outbreaks:

- Failure to thoroughly heat or cook food to a temperature which kills bacteria
- Infected employees (Typhoid Mary)
- Food vendors who practice poor personal hygiene at home and at work
- Preparing food a day or more in advance of being served
- Raw food is mixed with food that has already been cooked
- Allowing foods to stay for too long at temperatures that favor bacterial growth
- Failure to reheat cooked foods to temperatures that kill bacteria
- Cross-contamination of cooked food by raw food
- Inadequate cleaning of equipment

PREVENTION AND MANAGEMENT OF FOOD BORNE DISEASE

Prevention of food–borne diseases, regardless of the specific cause, are based on the same principles:

1. Avoidance of food contamination
2. Destruction or prevention of contaminants
3. Prevention of further spread or multiplication of contaminants.

Specific modes of intervention vary from area to area depending on environmental, economic, political, technology and socio cultural factors.

The preventive and control strategies may be approached based on the major site in the cycle of transmission or acquisition where they are implemented. These involve the following activities performed at the source of infection, environment and host.

1. **Interventions at the source of infection include**:
   - Thorough cooking of raw food
   - Thorough washing of raw vegetables with clean water
   - Keeping uncooked animal products far separate from cooked and ready-to-eat foods.

- Avoiding raw milk or foods made from raw milk.
- Appropriate treatment of food items before consumption
- Active immunization of animals
- Inspection of food
- Sanitary disposal of human wastes
- Treatment of cases ¾ Washing hands, knives, cutting boards, etc. after handling uncooked foods.
- Avoiding contact with materials contaminated with pet excreta or soil.
- Decontamination of animal products, e.g., wool, goat hair
- Burying intact or cremating of infected animal carcasses.
- Isolation
- Recognizing, preventing, and controlling of infections in domestic animals, pets.
- Washing hands after contact with animals
- Training and supervision of food handlers and homemakers
- Treatment of carriers.
- Proper care for patients with food-borne illnesses.
- Avoidance of food from animals with obvious infection, e.g., mastitis in cows

- Treatment of infections in food handlers such as skin and throat infections

2. **Environment interventions**: involve stringent follow-up from production to consumption. Some of the interventions include:
   - Freezing, salting, etc. of food items during storage
   - Control of flies, rats, cockroaches
   - Public education on environmental and personal cleanliness
   - Surveillance of food establishments
   - Avoiding contamination of food after cooking.
   - Maintenance of sanitary food area.
   - Proper handling and storage of leftover foods
   - Kitchen cleanliness
   - Safe canning at home
   - Careful storage and use of chemicals (storage away from foods)

3. **Host:**
   - Active or passive immunization of susceptible hosts
   - Health education on the above areas.

   “The Ten Golden Rules” of WHO for Safe Food Preparation (10)

   1. Choose foods processed for safety
   2. Cook food thoroughly

3. Eat cooked foods immediately
4. Store cooked foods carefully
5. Reheat cooked foods thoroughly
6. Avoid contact between raw and cooked food
7. Wash hands repeatedly
8. Keep all kitchen surfaces meticulously clean
9. Protect food from insects, rodents and other animals
10. Use safe water

Management of food borne disease

The management approach to food-borne diseases depends on the identification of specific causative agent, whether microbial, chemical or other. In addition determination of whether specific therapy is available and / or necessary or not is very important issue to consider. The management interventions for food borne diseases may involve one or more of the following.

- ✓ Symptomatic and supportive therapy
- ✓ Specific antimicrobial, antitoxin, or antidotes, etc. therapy.
- ✓ Surgical therapy

Many episodes of acute gastroenteritis are self-limiting and require only fluid replacement and

supportive care. If an antimicrobial is required the choice should be based on:

- ✓ Clinical symptoms and signs
- ✓ Organism identified from specimens
- ✓ Antimicrobial susceptibility test, and
- ✓ Availability of drugs for the identified organisms. However, the limitation of facilities will have a negative impact on the choice of the specific management approach.