

### Lec 3:

## Microbial Contamination of Food

The raw food usually produced, contaminated with microorganisms (m- ms), because the plants and animals from which the raw food is produced grow in natural environments in contact with soil, water rich in m-ms in addition to the microbial flora of plant and animal from which produced, which are considered as: natural sources of food contamination. Foods also get heavy contamination during handling and processing.

### I- Natural Sources of Food Contamination:

1- The Water: The water is in continuous contact with foods from the field or farm of production to the table of food in the restaurants and houses (FFTT) as a: a) Irrigation Water b) Cleaning Water c) Processing Water d) Cooling Water.

Irrigation water is highly loaded with m-ms because it is raw water rich in organic matter; moreover in the field this water gains more organic residues from plant, sewage, manure, soil, so this water in shallow field streams converted to the optimum medium for microbial growth. This water contaminates the raw food with two groups of m- ms:

**A))** Psychrophilic normal bacterial flora of water, which will be responsible for food spoilage during refrigeration.

**B))** Mesophilic contaminating flora which reached the water from soil, sewage, animals, humans, etc. which will be responsible for food- borne diseases and poisonings. Cleaning process and cooling water if they are not disinfected also contributed in the food contamination.

**2- The Soil, Manure and Sewage:** The soil is rich in microbial spores and continuously contaminate the raw food with bacterial and fungal spores, particularly heat-resistant spores that resist the heat treatment of food. Sewage and animal manure used as fertilizers contaminate the food with very dangerous bacteria, viruses and parasites.

**3- The animals and plants:** The plants particularly leafy vegetables loaded with m-ms because in contact with sources of contamination such as: soil, sewage, water, manure, rodents etc. These m-ms reach the food produced from raw plants.

Animals carry many m-ms causing the dangerous diseases to the human such as brucellosis, tuberculosis, anthrax etc. the food gains the m-ms through meat, milk, eggs etc.

Generally the animal origin foods more dangerous than plant origin foods because:

- a)** There are hundreds microbial diseases associated between animal and humans, so these microbes transferred to the human through food.
- b)** Microbial spoilage of animal origin food leads to production chemical compounds toxic to human such as toxic polypeptides, fatty acids, ketones, aldehydes etc.

**4- The air:** The air of open production field usually poor in m-ms and not suitable for growth of m-ms because:

- 1)** Poor in organic matter.
- 2)** Low moisture because of the sun heat.
- 3)** Bactericidal effect of sun U. V. light.
- 4)** Continuously removing of m-ms by winds current.

However the air of closed food plants, restaurants, food stores; loaded with m-ms and may be served as a source of contamination of food and prepared meals. In such case it is necessary to disinfect the air of closed buildings by bactericidal chemicals or bactericidal U.V. lamps and using special cooling-system and other sanitary particles (replace the oxygen by nitrogen in food stores).

## **II- The food contamination during handling and processing**

In addition to the natural sources of contamination, the food expose to the heavy contamination during a long way from the field of production to the table of eating (FFTT) through the following stages:

- 1 - Harvesting or collection of raw foods in the farms.** The raw food may be contaminated from the soil of the field, manures, insects, rodents, birds, collectors, boxes, equipments etc.
- 2 - Transportation.** The food contaminates from the boxes, bags, truck, cars particularly from permanent societies of contamination which formed from food-residues in the boxes, containers or cars. Also the raw food may be contaminated with toxic chemicals if the same car; container used for transportation of fertilizers, pesticides, fuel etc.
- 3 - Manufacturing in the food plants**
- 4 - Marketing and Distribution**

The most important stage of these four stages is the stage of food processing in the food plant for this reason a strict constructions and rules of food plant sanitation was issued for long time.

## Food Plant Sanitation

Food exposed to all sources of contamination in the food plant: air, water, soil, sewage, rodents, insects, food handlers, surfaces, equipments, containers, etc. so plant manager hold a big responsibility for production a food with following characteristics:

- 1) Clean food
- 2) Fresh food
- 3) Pure food
- 4) Safe food
- 5) Food with normal character
- 6) Food with high nutritive value.

In order to achieve these goals, there are many quality control section established in each plant:

- ✘ 1 Pest control section
- ✘ 2 Chemicals control section
- ✘ 3 Cleaning and Sanitizing control section
- ✘ 4 Microbiological control section
- ✘ 5 Food handlers, employees, workers health section

### Microbiology – Quality control in food plant

Microbiological section of quality control responsible for microbiological examinations of the following items:

#### **I) Sites and materials of food plant**

- 1) Microbiology of processing water and drinking water

In addition to pathogenic m-m's it is necessary to examine the iron and manganese bacteria, slime producing bacteria and other undesirable bacteria.

Chemical composition also needed particularly the hardness of water, iron & manganese content and excessive organic matter.

- 2) Microbiology of products: Raw materials, ingredients, additives, end product, packaging materials, etc
- 3) Microbiology of sewage and waste-treatment units.
- 4) Microbiology of food plant and equipments: Floor, ceiling, walls, windows, doors, sinks, air, processing surfaces and equipments  
...etc.
- 5) Microbiology of food stores, cartons, bags, containers, cars, trucks  
...etc.

## **II) Microbiological examinations of food handlers, workers, employees.**

Food handlers are very dangerous source of food contamination especially in our country; because they are closely contact with the food from the field of production to the fork of consumer (FFF). They contaminate the food by their dirty hand, acne on the face mostly contaminate food & prepared meals with two groups of pathogenic m-ms:

- 1- Respiratory system pathogens through sneezing, coughing, laughing, chatting; by droplets.
- 2- Enteric pathogenic m-ms. Due to improper hygiene habits.

For these reasons a special care must be taken with the food handlers from the health point of view. So they must wear a special head cover, mask, gloves, work coat, shoes.. etc. Food handlers' external feature must be similar to the heart surgeon, moreover food handler is more dangerous than surgeon; because if he contaminates the food, hundreds consumers may be killed, while the surgeon may kill only one person (patient) in such case.

### **The main microbiological tests in food plant**

The tests are determined according to the food type from this list of tests:

- 1) TBC : Total Bacterial Count
- 2) TYMC: Total Yeast Mold Count
- 3) TPBC: Total Psychrophilic Bacterial Count
- 4) TTBC: Total Thermophilic Bacterial Count
- 5) TSC : Total Spore Count
- 6) TCC: Total Coliform Count and Fecal E. coli
- 7) Enterococci
- 8) Clostridium perfringens
- 9) Test for Pathogenic Bacteria
- 10) Test for Parasites
- 11) Test for Viruses
- 12) Test for Bacterial Toxins
- 13) Test for Mycotoxins

## **Food Adulteration**

The famous world-wide organization Food and Drug Administration (FDA) considered the food product in food plants as (Adulterated food) in the one of the following cases:

- 1-** If the food contains: Filthy, Putrid, or decomposed substances.
- 2-** If the food contains: Poisonous or unsafe chemicals & food additives
- 3-** If food has been prepared, handled or packed under unsanitary conditions whereby become contaminated with m-ms. and chemicals.
- 4-** If food is a product of diseased animal or an animal was died not by slaughtering.
- 5-** If food container is composed of poisonous substances.