UNIT 5  FOOD BORNE DISEASES AND FOOD SAFETY

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5.0 INTRODUCTION

In the previous unit, you have learnt about nutritional deficiency disorders. In India, the concept of food safety is now being considered seriously. The current initiative of ‘Swachh Bharat Abhiyaan’ by the Prime Minister Shri Narender Modi will also benefit the cause of food safety in times to come. Actually the focus of safety must be on entire supply chain production, processing, distribution and marketing.

We often think that home cooked food is always safe, this is a wrong perception. If adequate care is not taken, even home food can also get contaminated. Of course, it is correct to assume that food taken outside home is more likely to be unsafe and contaminated. Actually, food safety can be compromised at any stage from farm (where food is grown) to fork (when it is consumed). Food can easily become unsafe when we do not follow hygienic principles during its transport, storage, cooking, and serving of food. Safe food does not cause any harm to whosoever consumes it.
In the previous units you have learnt different aspects of food and nutrition. Besides being essential for health and survival food also causes many diseases. This includes food borne infections and food poisoning. It may manifest as mild infections to severe disease. These illnesses may even lead to death and disability if not identified early and treated properly. You may also encounter in your field service area outbreaks of such diseases, particularly of food poisoning.

In this unit you will learn how food transmits many diseases; what are the various food borne diseases and how these manifest. You will also learn how to recognise the food borne illnesses including their severity and to take preventive and control measures. In addition, you will also learn components of food safety and how to make people aware about food safety problems.

### 5.1 OBJECTIVES

After completing this unit, you should be able to:

- describe the burden of food borne diseases and their consequences;
- recognise, assess and classify different food borne diseases;
- explain modes of transmission of food-borne pathogens and toxins;
- investigate food poisoning cases/outbreaks;
- describe preventive and control measures for food borne diseases;
- identify the signs and symptoms of food poisoning and refer for management;
- define food safety;
- identify the measures to be taken at various levels to ensure food safety;
- make people aware about practicing Five Keys to Safer Food; and
- describe the food storage, food handling and cooking.

### 5.2 FOOD BORNE DISEASES

Food borne diseases encompass a wide spectrum of illnesses and are growing public health problem worldwide. Let’s discuss in detail about the food borne diseases.

#### 5.2.1 What is Meant by Food Borne Disease?

These illnesses result from ingestion of food contaminated with microorganisms (bacteria, viruses, parasites etc) or harmful chemicals (toxins). The contamination may occur at any stage in the process from food production to consumption. This may result from unhygienic food handling practices or environmental conditions including pollution of water, soil etc.

The terms ‘food borne illnesses’ and ‘food borne diseases’ (FBD) are generally used interchangeably. In this module, we shall use the term FBD to denote both. In most cases isolated episodes of such diseases occur. Outbreaks of CBD's are also frequent when two or more cases of a similar illness resulting from ingestion of a common food.
5.2.2 Burden of Food Borne Diseases

Food Borne Diseases are a major public health problem worldwide. The causal relationship between food contamination and resulting illness or death is difficult to establish. Food hence, most such diseases are not reported.

- Unsafe food containing harmful bacteria, viruses, parasites or chemicals, causes more than 200 diseases – ranging from diarrhoea to cancers.
- An estimated 600 million – almost 1 in 10 people in the world – fall ill after eating contaminated food and 420 000 die every year.
- Children under 5 yrs age carry 40% of FBD burden.

5.2.3 Causes and Classification of Food Borne Diseases

Causative agents for food borne diseases are many. Some of the common agents associated with food borne diseases are as follows:

**Bacteria:** Salmonella, Campylobacter, Escherichia coli, Vibrio cholera, Listeria, Staphylococcus, Clostridium perfringes and botulinum, Bacillus cereus etc.

**Virus:** Norovirus, Rotavirus, Hepatitis A and E virus etc.

**Parasites:** Entamoeba histolytica, Giardia lamblia, Cryptosporidium, Fish-borne trematodes, Echinococcus spp, Taenia solium/saginata, Ascaris lumbricoides etc.

**Toxins:** Mycotoxins (e.g. aflatoxins), Marine biotoxins, Mushroom toxins, Shellyfood toxins, Plant toxicants etc.

**Chemicals:** Pesticides, Polychlorinated biphenyls (PCBs), Heavy metals (lead, cadmium, mercury, copper etc.), Nitrites etc.

Classification of Food Born diseases:

In general the FBD are classified into two groups:

a) **Food-borne infections:** caused by microorganisms

b) **Food-borne intoxications:** caused by toxins and chemicals

Food poisoning as a clinical entity belongs to both food borne intoxications and food borne infections; in this unit, food poisoning will be described separately.

5.2.4 Signs and Symptoms of Food Borne Diseases

Different causes present with different symptoms, so there is no single syndrome that can be labelled as FBD; however, common symptoms include:

- Abdominal cramps, diarrhoea (which may be bloody), nausea, vomiting, fever, headache, fatigue, and body aches. All of us must have experienced these symptoms sometimes or other.

- Signs and symptoms may start within hours after eating the contaminated food, or they may begin days or possibly even weeks later. But we may not link these to unsafe food taken by us. Quite often we overlook and ignore mild FBD.
• Less commonly, neurologic symptoms may develop, such as blurry vision, dizziness or tingling in the arms.

• In some instances, the most life-threatening problems occur several days after the start of intestinal symptoms. These can include kidney failure, pain and swelling of joints and paralysis that can plague victims for the rest of their lives. We feel that these are a part of our routine lives. Many people are not aware that unsafe food may also cause diseases like jaundice, typhoid etc.

The capacity to tolerate FBD varies from person to person. Some may become ill after ingesting only a few harmful bacteria; others may remain symptom free even after ingesting thousands.

It depends upon the age, physical condition (pregnancy) and any existing disease. Chemical agents in food, such as pesticides can cause neurological symptoms, burning sensations in the chest, neck and abdomen. Some chemicals are extremely poisonous and if ingested may result in severe vomiting within a few minutes. Consumption of these chemicals over a long duration can cause cancer, birth defects damage to the nervous, reproductive and immune system. Toxic metals in food if ingested in sufficient quantities can cause metallic taste in mouth, vomiting and abdominal pain, usually within a few hours.

In modern times, increase in variety of foods along with the eating out culture has predisposed the consumers to hazards related to unsafe food. It is difficult to assure the safety of a food item which has travelled miles before reaching our table or has been handled by people in eating establishments. It may be contaminated with harmful chemicals, pesticides, antibiotic residues, pathogenic microorganisms etc. Hence, consumption of contaminated such food may cause FBD. Food safety may be compromised even through kitchen equipment, surroundings, improper waste disposal and unclean water.

**Differences between Food-borne Infections and Intoxication**

<table>
<thead>
<tr>
<th></th>
<th>Infections</th>
<th>Intoxication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cause</strong></td>
<td>Bacteria / Viruses /Parasites</td>
<td>Toxins/Chemicals</td>
</tr>
<tr>
<td><strong>Mechanism</strong></td>
<td>Invade and / or multiply within the lining of the intestines</td>
<td>No invasion or multiplication</td>
</tr>
<tr>
<td><strong>Incubation period</strong></td>
<td>Hours to days</td>
<td>Minutes to hours</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Diarrhoea, Nausea / Vomiting, Abdominal cramps and/or Fever</td>
<td>Vomiting, Nausea, Diarrhoea, Double vision, Weakness Respiratory failure, Numbness, Sensory and motor dysfunction</td>
</tr>
<tr>
<td><strong>Transmission</strong></td>
<td>Can spread from person-to-person via the faeco-oral route</td>
<td>Not communicable</td>
</tr>
<tr>
<td><strong>Factors for food contamination</strong></td>
<td>Inadequate cooking, Cross-contamination, Poor personal hygiene, Bare hand contact</td>
<td>Inadequate cooking, Improper holding temperatures</td>
</tr>
</tbody>
</table>
You need to suspect and identify FBD and take measures for control and prevention.

5.2.5 Transmission of Food Borne Pathogens and Toxins

Food may become contaminated during production and processing, during food preparation and handling or due to improper storage. (Fig. 5.1)

Mishandling of food has been implicated in 97% of all FBD. However, it is preventable through proper implementation of food safety measures and strict enforcement of food hygiene.

**Food production and processing**

Foods, such as fruits and vegetables, may be contaminated if washed or irrigated with water that is contaminated with pathogens from animal or human faeces. Animals naturally harbour many food-borne bacteria in their intestines that can cause illness in humans. But often these do not cause illness in the animals. During slaughter, meat and poultry carcasses can become contaminated if they are exposed to small amounts of intestinal contents.

**Food preparation and handling**

- Infected individuals – Most food-borne pathogens are shed in the faeces of infected persons. These are then transferred to others through food via the faecal-oral route. Bacteria present in infected lesions and our nose may also be transmitted from an infected food-handler to ready-to-eat foods.

- Cross-contamination – Pathogens present in one food may be transferred to other foods during cooking if same equipment and utensils are used without washing and disinfecting, especially in case of ready-to-eat foods.

- Inadequate cooking temperature – With insufficient cooking bacteria can multiply and produce toxins within the food. Many bacterial toxins are heat stable and may not be destroyed by cooking. This is particularly true for ‘re-heating’ of stored food (more so for Non-Veg. items)

**Food storage**

Food held or stored at more than 25°C to 60°C) temperature allows multiplication of pathogens. It is an important cause of food-borne outbreaks.
### Check Your Progress 1

1) What proportion of Food Borne Diseases is constituted by children under 5 years of age?

2) What are the two major types of food borne diseases?

3) Enlist the causative agents for food borne diseases.

4) List the common signs & symptoms of food borne diseases.

### 5.3 FOOD POISONING AND FOOD INTOXICATIONS

Now we will discuss about Food Poisoning and Food Intoxication, which shares a large portion of the burden of food borne diseases.

#### 5.3.1 Epidemiological Features / Clinical Characteristics

Food poisoning is an acute inflammatory disease of the gastrointestinal tract. It is caused by the ingestion of food contaminated with toxin producing bacteria, their pre-formed toxins, chemical substances or other poisonous substances. Food poisoning is very common. More than 10 million cases occur in India per year. You might have heard of various food poisoning outbreaks.

Some incidents drawn the attention in recent years are discussed here.

An outbreak of Staphylococcal aureus food poisoning due to contaminated “bhalla” (a snack made up of urad dal balls fried in vegetable oil) affected more than 100 children and adults in Madhya Pradesh in 2007. An outbreak of food poisoning due to epidemic dropsy (mustard oil contaminated with argemone oil) was reported from Delhi in 1998 in which 60 persons lost their lives and more than 3000 cases were hospitalised. These are just two examples. Such outbreaks keep on occurring.

Following news cuttings describe the recent ‘Bihar midday meal tragedy’. It may give you an instant look over the severity of the case.

### Bihar midday meal tragedy:

“On 16 July 2013, children aged between four and twelve years at primary school complained that their lunch, served as a part of the Midday Meal Scheme, tasted odd. Children who questioned the food were rebuked by the headmistress. Earlier, headmistress Mrs. Kumari had been informed by the school’s cook that the new cooking oil was discoloured and smelled odd. Kumari replied that the oil was purchased at a local grocery store and safe to use. The cook, who was also hospitalised by the poisoning, later told reporters..."
that it looked like there was "an accumulation of residual waste at the bottom of the oil jar". The meal cooked at the school that day consisted of soya beans, rice and potato curry. Thirty minutes after eating the meal the children complained of stomach pain and soon after were taken ill with vomiting and diarrhoea. The number of sick children overwhelmed the school and local medical system.

Some of the sick children were sent home, forcing their parents to seek help on their own. According to the official count, 23 children died as a result of the contaminated food. Parents and local villagers said at least 27 had died. Sixteen children died on site, and four others were declared dead upon arrival at the local hospital. Others died in hospital. Among the dead were two children of a female cook, Panna Devi; her third child survived. A total of 48 students fell ill from the contaminated food. Three remained in a critical condition as of 17 July. Thirty-one children were moved from the local hospital to the Medical College Hospital for further treatment.

Initial indications were that the food was contaminated by an organophosphate, a class of chemicals commonly found in insecticides. A local government administrator commented "It appears to be a case of poisoning but we will have to wait for forensic reports. Had it been a case of natural food poisoning, so many children would not have died." As per Hospitals authorities the survivors were emitting toxic vapours, which led his team to suspect almost immediately that they had been poisoned by an organophosphate.

Late on 17 July, officials stated that they believed the cooking oil had been placed in a container formerly used to store insecticides. According to state officials, the school’s headmistress had bought the cooking oil used in the food from a grocery store owned by her husband. On 20 July police said that a forensic report confirmed the cooking oil contained “very toxic” levels of ‘monocrotophos’, an organophosphate in Secticide pesticide.”

This news story may have given you a glimpse how the food poisoning can be so disastrous.

You can identify the food poisoning cases based on the following epidemiological features characteristics:

- History of ingestion of common food (as in family functions, hostels/hotels etc)
- A group of persons being affected simultaneously
- Similarity of signs and symptoms in the majority of cases
- Common symptoms are vomiting, diarrhoea, pain in the abdomen, fever etc.
- Short incubation period
- Absence of secondary cases
- Laboratory tests are rarely required

5.3.2 Types of Food Poisoning

a) **Bacterial food poisoning:**

This is caused by taking contaminated food. It may be –
Infective: Organism enters the body through the food, produce toxin, cause pathology and result in clinical manifestations, e.g., *Salmonella*, *Clostridium perfringes*, *Vibrio parahaemolyticus* OR

Toxic: Due to already formed toxin in the food, e.g., *Staphylococcus aureus*, *Clostridium botulinum*, *Bacillus cereus* etc.

b) **Non bacterial food poisoning:**

Chemical poisoning: Due to pesticides, arsenic, mercury etc.

c) **Certain plants and sea foods:** Due to mushrooms, solanine (green potatoes)

<table>
<thead>
<tr>
<th>Common bacterial food poisoning: source / common foods and clinical features:</th>
<th>Cause</th>
<th>Source / Common Foods</th>
<th>Clinical Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella food poisoning</td>
<td>Man gets infection from animals and poultry. Contaminated major foods - meat, milk and milk products, sausages, custards, egg and egg products. Food contaminated with urine of rats and mice is also responsible.</td>
<td>Sudden onset with chills, fever, nausea, vomiting and profuse watery diarrhoea, may be associated with blood.</td>
<td></td>
</tr>
<tr>
<td>Staphylococcal food poisoning</td>
<td>Cutaneous infections (boils, carbuncle etc) of human and animals (particularly cows). Foods involved - salads, custards, milk &amp; milk products etc.</td>
<td>Sudden onset of vomiting, severe and violent is the main feature. Abdominal cramps and diarrhoea also occur, but rarely fever.</td>
<td></td>
</tr>
<tr>
<td>Botulism</td>
<td>Soil and dust and the intestinal tract of animals. Foods mostly responsible – home-canned vegetables, smoked or pickled fish, home-made cheese etc.</td>
<td>Major symptoms- dysphagia, diplopia, ptosis, dysarthria, blurring of vision, muscle weakness, quadriplegia. Gastrointestinal symptoms very slight, no fever.</td>
<td></td>
</tr>
<tr>
<td>Cl. perfringes food poisoning</td>
<td>Dust and soil is the reservoir of spores. Reheating the stale cooked foods (meat, poultry) prior to consumption is the critical factor.</td>
<td>Moderate diarrhoea with nagging abdominal pain and prostration. Nausea/vomiting and fever rarely occur.</td>
<td></td>
</tr>
<tr>
<td>B. cereus food poisoning</td>
<td>Soil and food grains mainly cereals (raw, dried and processed). Cereal based diet – spores can survive cooking and germinate and multiply in favourable temperature.</td>
<td>Manifests in two forms – emetic form with symptoms like staphylococcal food poisoning and enteric form with symptoms like Cl. perfringes food poisoning.</td>
<td></td>
</tr>
</tbody>
</table>

### 5.3.3 Food Intoxications – Features, Preventive and Control Measures

Besides food poisoning, other commonly occurring intoxications are of two categories:
a) Due to naturally occurring toxins in the food grains: Lathyism, Epidemic dropsy, Endemic ascites, Toxid polyphenol etc.

b) Due to toxins produced by the fungi in the food grains: Aflatoxicosis, Ergotism.

<table>
<thead>
<tr>
<th>Food Intoxications</th>
<th>Toxins and Foods Involved - Characteristic Features</th>
<th>Preventive and Control Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lathyism</td>
<td>Consumption of the pulse - lathyrus sativus (‘Kesari dal’) which contains the toxin - Beta oxalyl amino alanine (BOAA). Neurolathyrism affecting nervous system, gradually developing paralysis of legs. Manifest in stages-latent, no-stick, one-stick, two-stick and finally crawler stage.</td>
<td>Health Education on dangers of consuming this pulse. Removal of toxin by soaking the pulse in hot water (steeping method) and parboiling Vitamin C prophylaxis. Banning the crop and/or selective cultivation of pulse strains with low levels of toxin.</td>
</tr>
<tr>
<td>Epidemic dropsy</td>
<td>Contamination of mustard oil with argemone oil containing a toxic alkaloid, sanguinarine. Argemone seeds closely resemble mustard seeds and contamination may be accidental and deliberate. The symptoms consist of sudden, non-inflammatory, bilateral swelling of legs, often associated with diarrhoea. Dyspnoea, cardiac failure and death may follow. Nitric acid test and Paper chromatography for detection of argemone oil.</td>
<td>Ensuring supply of pure mustard oil by strict enforcement of laws. Avoiding the use of mustard oil altogether when the disease is prevalent in the locality. Health education about argemone seeds and oil; removing argemone weeds growing among oil-seeds crops. All packed cooking oils may have a label ‘Argemone Free’.</td>
</tr>
<tr>
<td>Endemic ascites</td>
<td>The millet Panicum miliare (locally known as Gandhte) contaminated with seeds of Crotalaria (locally known as Jhunjhunia), which contain hepatotoxins – pyrrolizidine alkaloids. Manifests with rapidly developing ascites and jaundice.</td>
<td>Educating the people in the affected area, Deweeding of the Jhunjhunia plants which grow along with the staple Simple sieving of the millet at the household level to remove the seeds of Jhunjhunia.</td>
</tr>
<tr>
<td>Aflatoxicosis</td>
<td>Fungi Aspergillus flavus, parasiticus infests food grains such as ground nut, maize, parboiled rice, sorghum, wheat,</td>
<td>Proper storage of food grains in dry containers, moisture content should be below 10 per cent.</td>
</tr>
</tbody>
</table>
Food Borne Diseases and Food Safety

<table>
<thead>
<tr>
<th>Foods and Conditions</th>
<th>Health Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>rice, tapioca under conditions of improper storage and produce Aflatoxins.</td>
<td>Not to consume fungi contaminated food grains.</td>
</tr>
<tr>
<td>Characterised by hepatitis, cirrhosis of liver, and/or enteritis.</td>
<td>Health education to the local people about health hazards.</td>
</tr>
</tbody>
</table>

**Ergotism**

- The ergot fungus, claviceps fusiformis infests food grains such as bajra, rye, sorghum and wheat during flowering stage.
- Symptoms are acute but rarely fatal; includes – nausea, repeated vomiting, giddiness, drowsiness.
- Removal of ergot infested grains by floating in salt water, hand-picking or air floatation.

### 5.4 PUBLIC HEALTH RESPONSE TO FOOD BORNE DISEASES

As a nurse you may encounter food borne diseases / poisoning cases or outbreaks. Here your tasks would be:

- **Early detection, management and referral:** Identify the cases and assess for severity. Refer the severe cases urgently to health centre for proper management. Most such cases are mild, self-limiting and resolve without treatment. Assure and help patients accordingly. Ensuring hydration is the mainstay of treatment. Focus on assessment and reversal of dehydration, through ORS or IV fluids in serious cases.

- **Reporting of any case /outbreak and investigation:** Inform any case/outbreak immediately to higher level as per the existing programme/project (e.g. IDSP) guidelines. Outbreaks of food poisoning need to be investigated by a team and take part in such investigations (as has been discussed elsewhere in other units). Investigations will help to identify appropriate control and preventive measures.

- **Health Education:** Educating people about reservoir/source of contamination and transmission, common foods involved, signs/symptoms and danger signs, personal hygiene and food hygiene. Most FBD are preventable by simple behavioural changes. Emphasising the measures for prevention and control including food safety is an appropriate response.

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**Check Your Progress 2**

1) Which is not an epidemiological feature of food poisoning?
   a) Group of persons being affected simultaneously
   b) Similar signs and symptoms
   c) Secondary cases are common
   d) Short incubation period
2) Outbreak of epidemic dropsy may occur due to contamination of which food item and with what?

3) *Khesari dal* (*Lathyrus sativus*) is associated with which food intoxications?

4) Canned food is mostly associated with which bacterial food poisoning –
   a) Salmonella
   b) Staphylococcal
   c) Botulism
   d) Bacillus

5) Mention four common symptoms of food-borne infections.

6) What are the levels in the food chain when food can be contaminated?

5.5 FOOD SAFETY

We shall now discuss about the food safety, regulatory measures and the key points to have a safer food.

5.5.1 What is Food Safety?

Food safety describes handling, preparation, and storage of food in ways that prevent FBD. The main idea is a concept of defence to prevent harm to the consumers. Unsafe food poses health threats; endangering everyone. It creates a vicious cycle of illness and malnutrition. Worldwide the importance of food safety has long been recognised and various measures/initiatives undertaken. Today food safety is a public health priority both in developed and developing countries.

5.5.2 Food Safety Considerations and Measures

As you know, food can be contaminated at any point of production, distribution, handling/ preparation and consumption. So, responsibility also lies with concerned people involved at different levels for making food safe. Policy makers, food handlers and consumers can contribute to ensure food safety:

- **Policy making/administrative level:** This role is of the government. It includes developing policies and regulatory frameworks (Laws, Acts etc); establishing and implementing effective food safety systems (e.g. laboratories, monitoring and surveillance etc) to respond to and manage food safety risks along the entire food chain; fostering collaboration among health and other sectors; etc.

- **Food handlers and consumers level:** Both need to be aware about the common hazards linked with the food they use; handle and prepare food safely, practicing the WHO Five Keys to Safer Food at home, or when selling...
at restaurants or at local markets; grow fruits and vegetables using the WHO Five Keys to Growing Safer Fruits and Vegetables to decrease microbial contamination etc.

- A new era in food safety has been initiated by formulation of the Food Safety and Standards Act (FSSA) 2006. While eating our favourite panipuri / puri bhaji / Pao bhaji with the street vendor we tend to overlook hygiene. However, the government has included even the small vendors selling food items under the purview of this Act.

- The Act established a new national regulatory body, Food Safety and Standards Authority of India (FSSAI), to develop science based standards for food and to regulate and monitor the manufacture, processing, storage, distribution, sale and import of food so as to ensure the availability of safe and wholesome food for countrymen.

- The main intent of this endeavour was to ensure availability of safe and wholesome food for human consumption. The food manufacturers, suppliers, vendors, eateries, storage, distribution, imports and exports, food services and other related businesses would now be governed by new rules under Food Safety and Standards Regulations (FSSR) 2011. 12th five year plan (2012–2017) also emphasised strengthening of food safety systems.

- Here, it is important to understand that any law is framed with a view to improve the quality of life in society. It is always made keeping in view the future of society. The real impact of any law takes time to show. It is often said that it takes about fifty years after any legislation to bring about any worthwhile intended change in society. Hence, despite the formulation of FSSA 2006, the present status of food hygiene in eating establishments in India is dismal. However, the process has started. Sooner or later, all the Eating Establishments in India will have to comply with the prescribed standards of FSSR 2011.

- Another menace in our country jeopardising food safety is that of Food Adulteration. This is done by perpetrators at various levels, e.g., producers/ manufacturers, Food Business Operators (FBO), grocery merchants for petty monetary gains. Food is adulterated, if there is evidence of substandard quality/substitution by cheaper substance/abstraction of any constituent of article/preparation or storage in unsanitary conditions/presence of poisonous ingredients, use of colouring agents/preservatives above prescribed limits/quantity or purity below the prescribed standards.

- For example, most of the country milk is adulterated with products. The culprits use fertilizers, bleaching and detergents to thicken the milk and give it a frothy appearance. Milk adulteration also involves adding water and removing fats from milk. Often adulterants like starch, wheat flour are added to milk. This lowers the nutritional content of milk and makes it even unfit for consumption. Food can also get adulterated unintentionally due to inappropriate food handling. This includes use of pesticides and fertilizers during farming or harvesting or improper storage, processing, packaging and transportation methods. The impact of food adulteration is grievous as it affects the finances as well as health of people.
Specific checks required for Food Adulteration are given in the following tables – 5.1a, 5.1b, 5.1c, 5.1d, 5.1e.

### Table 5.1 (a): Specific check for procurement of rice and tins

<table>
<thead>
<tr>
<th>Item</th>
<th>Accept</th>
<th>Reject</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td><img src="image1" alt="Accept" /></td>
<td><img src="image2" alt="Reject" /></td>
<td>Check for infestation, grain size, colour, unwanted polishing and any foreign material in the grains</td>
</tr>
<tr>
<td>Tins</td>
<td><img src="image3" alt="Accept" /></td>
<td><img src="image4" alt="Reject" /></td>
<td>Check for dentin/puffing/leakage • date of Packing • date of Expiry</td>
</tr>
</tbody>
</table>

### Table 5.1 (b): Specific check for procurement of pulses

<table>
<thead>
<tr>
<th>Item</th>
<th>Accept</th>
<th>Reject</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulses (black bean)</td>
<td><img src="image5" alt="Accept" /></td>
<td><img src="image6" alt="Reject" /></td>
<td>Check for infestation, ration, stones, split, rotten ones</td>
</tr>
<tr>
<td>Yellow peas</td>
<td><img src="image7" alt="Accept" /></td>
<td><img src="image8" alt="Reject" /></td>
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</tr>
</tbody>
</table>
### Table 5.1 (c): Specific check for procurement of spices

<table>
<thead>
<tr>
<th>Item</th>
<th>Accept</th>
<th>Reject</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spices Fennugreek</td>
<td>![Image]</td>
<td>![Image]</td>
<td>Check for Light, brown and dark defects, foreign materials such as stones or plastics and animal matter such as mouse and bird droppings.</td>
</tr>
<tr>
<td>Cumin</td>
<td>![Image]</td>
<td>![Image]</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5.1 (d): Specific check for procurement of bread and cheese

<table>
<thead>
<tr>
<th>Item</th>
<th>Accept</th>
<th>Reject</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread</td>
<td>![Image]</td>
<td>![Image]</td>
<td>Check for moulds</td>
</tr>
<tr>
<td>Cheese</td>
<td>![Image]</td>
<td>![Image]</td>
<td>Check for moulds/ rancid smell If packed checked for the packing</td>
</tr>
</tbody>
</table>
Food safety is essentially an issue of prevention. For ensuring food safety, basic hygiene and cleanliness in manufacturing units or kitchens can immensely contribute towards food safety. Good infrastructure with adequate lighting, ventilation, hand washing and toilet facilities for food handlers, adequate and clean storage facilities, clean and maintained equipment and utensils etc. are the most important factors that facilitate food safety. If kitchen has good food storage facilities, clean water supply, if food handlers are healthy, if for public eating establishments good standard are maintained food safety can be, more or less, taken for granted.

Under FSSA 2006, it is mandatory to get a license for any food business.

However, new law alone cannot ensure food safety. The need of the hour is also to have an integrated approach to change the mind set of people.

### 5.5.3 Food Safety Regulatory Measures in India

Government of India is also committed to ensuring food safety. There has been relevant policies/programmes and projects incorporating the issues of food safety. Several acts and regulations were also in place since long. Currently the entire issue of food safety is being re-emphasised and strengthened. There are some
aspects needs to be considered while monitoring the food safety measures as shown in Fig 5.2 and Fig. 5.3.

**Monitoring aspects of food safety**

- **Food handler**
  - Physical appearance
    - Hair
    - Nails
    - Skin
    - Shoes
    - Cap
    - Apron
  - Behaviour
    - Hand washing
    - Handling ready to eat items
    - Reporting illness
    - Vaccination
  - Procurement/Storage
  - Raw/Cooked/ready to eat

- **Material**
  - Food items
    - Soap
    - Mop
    - Cap
    - Aprons
    - Cleaning material
    - Garbage bin

- **Equipment**
  - Related to food processing
    - Utensils
    - Mixer/Grinder
    - Knives
    - Refrigerator
    - Deep freezer
    - Chapati maker
  - Related to low budget maintenance
    - Pest control
    - Drains
    - Taps
    - Lights
    - Fans
    - Screens of windows

- **Premises**
  - Other equipment
    - Chimney
    - Wash basin
    - Insect catcher
    - Exhaust fan
  - Heavy budget maintenance
    - Wall paint
    - Floor tiles
    - Ceiling

**Fig. 5.2: Monitoring aspects of food safety (What to monitor)**

**Monitoring Mechanism (How to monitor -2 examples) can be done every Six month**

**Food handler (Nails)**

- Examination of Nails by Head Cook
  - Trimmed/pared
    - First time: verbal warning
    - Second time: report to FBO
  - Long and dirty
    - Advice to cut nails
  - Availability of nail cutter
    - Ensure cutting of nails
    - Do not allow to handle food
  - Allow to handle food

**Fig. 5.3: Monitoring Mechanism**
At present, Food Safety and Standards Authority of India (FSSAI), of Ministry of Health and Family Welfare, established under the Food Safety and Standards Act, 2006, is the regulating body related to food safety. FSSAI is responsible for setting standards for food. e.g.

- Framing of regulations to lay down food safety standards
- Laying down guidelines for accreditation of laboratories for food testing
- Providing scientific advice and technical support to the Central Government
- Collecting data about food consumption, contamination, emerging risks etc
- Disseminating information and promoting awareness about food safety.

Consumers can connect to FSSAI through various channels. Recently an online platform called ‘Food Safety Voice’ has been launched which helps consumers to register their complaints and feedbacks about food safety issues related to adulterated food, unsafe food, substandard food, labelling defects in food and misleading claims and advertisements related to various food products.

5.5.4 Five Keys to Safer Food

i) Keep Clean

- Wash your hands before handling food and often during food preparation
- Wash your hands after going to the toilet
- Wash and sanitise all surfaces and equipment used for food preparation
- Protect kitchen areas and food from insects, pests and other animals

**Hand washing is important:**

Dangerous microorganisms are widely found in soil, water, animals and people and these microorganisms are carried on hands, wiping cloths and utensils. Hands frequently transport microorganisms from one place to another, hand washing is thus very important.

Hands should be washed before handling food and often during food preparation; before eating; after going to the toilet; after handling raw meat and poultry; after changing baby’s nappy, after blowing nose; after handling rubbish and also chemicals; after playing with pet animals; after smoking etc.

**Hand washing method:** Wet hands under running water; rub hands together for 20 seconds with soap; rinse hands under running water; dry hands thoroughly with dry clean towel. While washing hands pay attention to finger tips / nails, thumbs, wrists, and in between fingers. Fig. 5.4

ii) Separate raw and cooked food

- Separate raw meat, poultry and seafood from other foods
- Use separate utensils, knives and cutting boards for handling raw foods
- Store food in containers to avoid contact between raw and prepared foods
Food Borne Diseases and Food Safety

iii) **Cook thoroughly**
- Cook food thoroughly, especially meat, poultry, eggs and seafood
- Bring foods like soups / stews to boiling to make sure 70°C temperature
- Reheat cooked food thoroughly

iv) **Keep food at safe temperatures**

![Hand Washing Steps](image)

**Fig. 5.4: Method of hand washing**

- Do not leave cooked food at room temperature for more than 2 hours
- Refrigerate promptly all cooked and perishable food (preferably below 5°C)
- Keep cooked food piping hot (more than 60°C) prior to serving
- Do not store food too long even in the refrigerator
- Do not thaw frozen food at room temperature

<table>
<thead>
<tr>
<th>What are safe temperatures for food?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microorganisms cannot multiply if it is too hot or too cold. Cooling or freezing does not kill microorganisms, rather limits growth. The “danger zone” is temperature range of 5°C to 60°C in which microorganisms multiply very fast. Storing food below or above the “danger zone” can effectively limit the production of toxins.</td>
</tr>
</tbody>
</table>

v) **Use safe water and raw materials**
- Use safe water or treat it to make it safe
- Select fresh and wholesome foods
- Choose foods processed for safety, such as pasteurized milk
Nutrition

- Wash fruits and vegetables, especially if eaten raw
- Do not use food beyond its expiry date

5.6 FOOD STORAGE, FOOD HANDLING AND COOKING

Food born diseases are mainly caused due to unhygienic practices while cooking, handling and storing the food items. Let’s now discuss about the general principles of safe storage of food items, role of the food handlers in keeping the food safe and wholesome and the essentials steps to be followed in safe cooking practices.

5.6.1 General Principles of Safe Storage of Food Items

- Chemicals and cleaning supplies like detergents, soap bars, repellents are stored away from food.
- Non-vegetarian and vegetarian products are kept physically separated or stored in different containers / racks / compartments.
- Raw materials are kept separately with proper labelling from semi processed and processed (cooked) foods.
- All foods are stored off the floor and away from the walls (atleast 6 inches).

Management of stored items

The principles of FIFO (first in first out) and FEFO (first expiry first out) should be applied in management of stored food items. For items without a label containing date of expiry or best before date, the rule of FIFO is followed. This ensures that the food that has been in store the longest is used first. As food is used, new food is added to the store to replace it; the essential of good storage is to use the oldest food as soon as possible so that nothing is in store too long lest it becomes unsafe to eat. Every storage area should have such a stock rotation policy. For example, when two kgs onions are lying in the storage area, if another five kgs are received then, put the recently received ones behind the onions already in store. Ensure to use the previous ones first. For products having a label containing date of expiry or best before date follow the principle of FEFO. Items with closest expiry date should be used first even if they are delivered later. Remove and return /destroy from store all products whose shelf life has expired.

5.6.2 Role of Food Handlers in Food Borne Diseases

Most of us equate cooks as food handlers. However, the term food handler includes all those involved in various stages / activities related to preparation, processing, cleaning and chopping raw food material / vegetables, processing (peeling, de skinning, cutting, soaking, marinating), kneading of flour, chapati making, boiling/frying/sauté, washing of dirty utensils cooking and serving of food, e.g. waiter staff/service staff, chefs, head cooks, dishwashers, receiving and store room staff, bartenders, host/hostesses who handle food, street vendors who sell food items, house maids. Food handlers can cause as well as prevent food borne diseases. (Fig. 5.5)
Fig. 5.5: Conceptual framework in food safety: Role of food handlers

It is the prime duty of a food handler to follow hygienic practices and keep the food safe. They are a crucial link in the food safety. Their responsibility is of maintaining food safety during various processes they are involved in while preparing the food. This requires that they maintain good health. If the food handler is not aware about the safety aspects of food, he/she can do more harm than good. Food handlers who suffer from some infectious disease can spread it to people. For example, if they have diarrhoea, their faeces carry pathogens. If they do not wash hands properly after defecating, the germs can reach the victim’s gut through the food materials handled with their dirty hands. So, the consumers may eventually develop diarrhoea.

Similarly, if food handlers have eye/ear/skin infection, cough or running nose the related germs will infect the consumers. This spreads through their hands through eye/ear/skin discharges, urine, sputum etc. A cook with diseases like jaundice or typhoid may continue to spread these for a long time.

**Food handler and good hygienic practices**

Food handlers should be aware of their role in food safety. Following basic food hygiene practices need to be observed by every food handler.

- Not to sit on kitchen shelf.
- Not to leave personal items on the kitchen shelf/cooking area.
- Not to work in kitchen with open sores.
- Not to blow into a bag to open it to put in food.
- Not to blow on food for any reason.
Nutrition

- Not to spit, smoke or use tobacco in kitchen.
- Not to eat in kitchen
- Not to touch food with bare hands.
- Not to use fingers for tasting food
- Not to reuse a spoon without washing after tasting food
- Not to touch hair or other body parts, viz., noses, eyes or ears while cooking.

They should wash and dry their hands whenever they touch any contaminated area. When sneezing or coughing in kitchen is unavoidable, they should turn away from food and cover their noses and mouths with tissue paper or handkerchiefs. Hands should then be thoroughly cleaned at once. Food handlers must tell seniors if they have breached any food safety aspect, e.g., if something has fallen into food or a glass item has broken near exposed food.

Food handlers’ health

A food handler suffering from any infectious disease is a potential danger to food safety. He may transmit germs from his body to food (through clothing, hands, coughing, sneezing, boils/cuts or discharge from eye /nose). A food handler should not handle food if he is suffering from – diarrhoea, vomiting, fever, cough, skin lesions (including boils/cuts), eye discharge or nose discharge. Such a person must report his illness to his senior. An infected sore can be covered by bandage, preferably a waterproof one. In case of cold a disposable tissue or a handkerchief must be used to handle the secretions.

Safe cooking practices that ensure food safety

Observing good hygiene during food preparation (washing, chopping, slicing, and thawing cooking and cooling) is important for ensuring food safety. Any hygiene lapse in kitchen may cause FBD, e.g., cross contamination to cooked food from raw food while chopping it in kitchen. Before starting cooking raw food material need to be inspected. We should discard it if it looks suspect, e.g. a cracked egg may be already contaminated by salmonella bacteria. Potential sources of food contamination include – unclean cooking shelves, chopping boards, knives, utensils / equipment, sinks, clothing, hands or waste bins. Cockroaches and rats can also contaminate the food. (Fig. 5.6)
5.6.3 Essentials Steps in Safe Cooking Practices

I) Clean

The first step in hygienic cooking is that all food handlers should wash hands thoroughly with soap and water before entering the kitchen. Fruits and vegetables can have contaminants like pesticides, chemicals, and bacteria on them. So, these need to be properly cleaned / washed. Basins for this purpose should not be used for washing hands. Water used for cleaning should be potable. Unclean water can contaminate raw items. (Fig 5.7)

Chopping/cutting boards, dishes, utensils and countertops should be made of food grade material. These can be cleaned with hot soapy water followed by use of bleach. The knives should preferably be of different colours making identification easier for vegetarian and non-vegetarian food items. Use separate and different colored cutting boards and knives for meat, fish, poultry and cooked products. We need to wash, rinse and sanitise cutting boards, knives and other utensils between uses.

II) Cleaning of utensils

To ensure food safety it is important that everything in the kitchen is clean. This applies to utensils, cutlery and crockery also. If utensils are not cleaned properly, chance of food borne infections increase. First thing here is that in the beginning it should be ensured that these shall be made of food grade material. When we buy utensils etc. care must be taken about their design. Too much of grooves / raised parts / curved portions in the design will invite dirt /grime/ grease accumulation. If the utensil is cracked/ broken/ chipped/ dented same problem may arise.

In India, utensils are mostly washed manually. A sink of adequate size and running water supply in the kitchen is the first requirement for this. Hot water supply is an additional need especially in winters.

1) Steps involved in washing utensils will vary as per the availability of a double/single sink in the kitchen. As a first step before the actual washing process actually begins, any leftover food need to be scraped off from the utensils in garbage bin. It should not be thrown in the sink. Another basic rule is not to allow used utensils to dry. After scraping utensils may be put in the sink and some tap water may be run over these. This will avoid drying off of the leftover food on the utensils, e.g., pressure cookers and kadhai/pen, may be filled with hot water and let these be so for 10–15 min. (Fig. 5.8)
2) Fill the sink up to about half full with hot water. Else a large bowl can be filled with water instead of the sink itself. This will make it a little easier, in case water needs to be changed.

3) Now soap may be added in the sink water and stirred with hands to foam it.

4) First glassware may be washed. Immerse the utensils in the water and scrub any grease etc off by using a kitchen brush or sponge. Steel wool can be abrasive. Replace the water and add more soap as per the need. (Fig. 5.9)

5) After scrubbing the dishes, rinse these under the tap water, or in the second sink filled with lukewarm water. Replace the water as per the need. (Fig. 5.10)

6) After this there is a need to check for any remaining dirt / food. Repeat steps 4–5 as per the need. Try soaking it longer or use a stronger cleaning solution, if still not clean.

7) In the end, dry the utensils in a drying rack. Don’t use a dirty cloth or hand towel to wipe them. Putting bowls and glasses in the rack upside down to drain off water is a good practice. Access to sunlight for drying is an added advantage. (Fig. 5.11)
8) Store the utensils away in the cupboard after drying to protect from dust. After rinsing utensils may be sanitised by using Chlorine (bleach) or Iodine.

### Check Your Progress 3

1) What is unsafe food?

2) What are the WHO Five Keys to Safer Food?

3) Food safety standards are laid down by which agency in India?

4) What is the ‘danger zone’ of temperature for refrigeration of food?

5) For effective hand washing, how long hands should be rubbed with soap and water.

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### 5.7 LET US SUM UP

Food borne diseases are a worldwide public health problem including India and a significant cause of morbidity and mortality. More than 200 food borne diseases occur annually – ranging from diarrhoea to cancer.

Food borne diseases resulting from contaminated food include food-borne infections and food-borne intoxications including food poisoning. These diseases are typically caused by microorganisms (bacteria, virus, and parasites) and/or chemicals/toxic substances. Contamination of food may occur during food production and processing or during preparation, handling and consumption. Personal and food hygienic measures including environmental sanitary conditions are the major contributory factors.

Most diseases occur sporadically, outbreaks of food poisoning are also reported frequently. Most often manifests with gastro-intestinal symptoms, which vary in severity and duration. Majority cases/outbreaks can be diagnosed by easily...
identifiable clinico-epidemiological characteristics. Immediate public health responses include – early detection and assessment for severity; management, referral and notification. All outbreaks should also be investigated.

Food safety is the present-day priority concern. Besides implementation and monitoring of legislative and regulatory mechanisms at various levels, food safety education is a critical pre-requisite. Food handlers at all levels and the community should be made aware about practising five keys to safer food – Keep clean; Separate raw and cooked food; Cook thoroughly; Keep food at safe temperatures; and Use safe water and raw materials. Primary and mid-level health workers at the field can really make a difference in this regard.

5.8 MODEL ANSWERS

Check Your Progress 1
1) 40%
2) Food-borne infections and food-borne intoxications
3) Bacteria, Virus, Parasites, Toxins and Chemicals,
4) Abdominal cramps, diarrhoea (which may be bloody), nausea, vomiting, fever, headache, fatigue, and body aches.

Check Your Progress 2
1) C) - Secondary cases are common
2) Mustard oil contamination with argemone oil
3) Lathyrism
4) C) – Botulism
5) Diarrhoea, Nausea / Vomiting, Abdominal cramps, Fever
6) Food production and processing, food preparation and handling, improper storage of food.

Check Your Progress 3
1) ‘Article of food whose nature, substance or quality is so affected as to render it injurious to health’
3) Food Safety and Standards Authority of India (FSSAI)
4) Temperature range of 5°C to 60°C
5) At least 20 seconds

5.9 REFERENCES


4) Food Safety Standards Authority of India. Key aspects to ensure food safety. Available from: http://www.fssai.gov.in/TRAINING MANUAL.aspx

