CHAPTER - 4

INTRODUCTION TO MICROBIOLOGY AND COMMON MICROORGANISMS

Points to be covered in this topic

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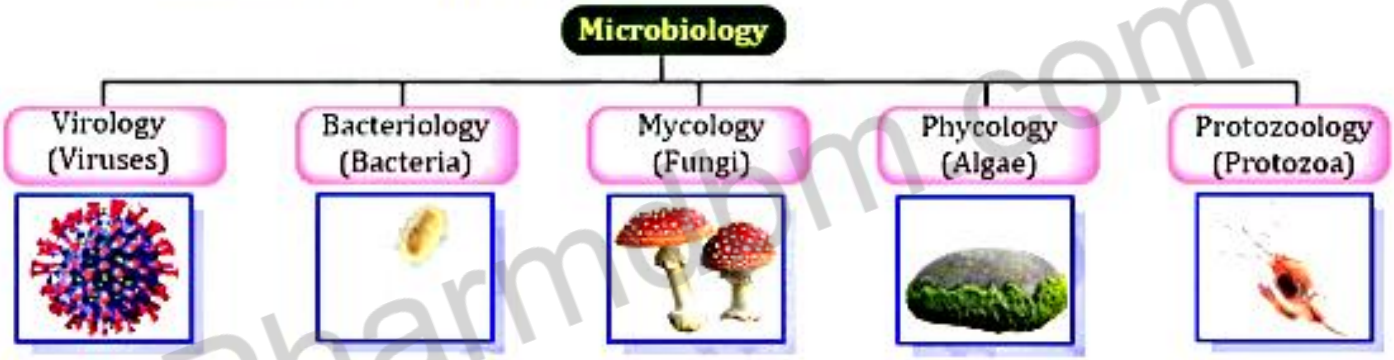
4.1 INTRODUCTION

Providing an overview of the basic ideas and common microorganisms that influence our comprehension of this tiny world, this chapter acts as a doorway into the fascinating field of microbiology. Readers will travel to discover the variety, importance, and effects of these minuscule life forms, from the common bacteria to the mysterious viruses

4.1.1 INTRODUCTION TO MICROBIOLOGY

Microbiology is the study of microorganisms that is the organism which are of microscopic dimensions. These organisms are too small to be clearly perceived by the unaided human eye. Microorganisms are living organisms that are usually too small to be seen clearly with the naked eye. An organism with a diameter of 1 mm or less are microorganisms and fall into the broad domain of microbiology.



The major groups of microorganisms-namely **bacteria, archaea, fungi (yeasts and molds), algae, protozoa,** and **viruses** are summarized below.

❖ Bacteria

- Bacteria are microbes with a cell structure simpler than that of many other organisms. "Their control centre, containing the genetic information, is contained in a single loop of DNA".
- Bacteria are classified into five groups according to their basic shapes: spherical (cocci), rod (bacilli), spiral (spirilla), comma (vibrio's) or corkscrew.

❖ Archaea

- "Archaea are very similar to bacteria (in size, shape, absence of membrane bound organelles)".

- Archaea are important in technology; methanogens are used to produce biogas and as part of sewage treatment, and enzymes from extremophile archaea that can resist high temperatures and organic solvents are exploited in biotechnology.

❖ Fungi

- In addition, most vascular plants could not grow without the symbiotic fungi, or mycorrhizae, that inhabit their roots and supply essential nutrients. Other fungi provide numerous drugs, foods like mushrooms, truffles and morels, and the bubbles in bread, champagne, and beer.

❖ Protozoa

- Protozoa are single celled organisms. They come in many different shapes and sizes ranging from an Amoeba which can change its shape to *Paramecium* with its fixed shape and complex structure.

❖ Algae

- Algae can exist as single cells, an example of which is *Chlamydomonas*, or joined together in chains like *Spirogyra* or made up of many cells, for instance *Rhodymenia* (red seaweed).
- Most algae live in fresh or sea water where they can either be free-floating (planktonic) or attached to the bottom. Some algae can grow on rocks, soil or vegetation as long as there is enough moisture.

❖ Viruses

- A virus is an infectious microbe consisting of a segment of nucleic acid (either DNA or RNA) surrounded by a protein coat. A virus cannot replicate alone; instead, it must infect cells and use components of the host cell to make

Branch of Microbiology

1. **Bacteriology:** Study of bacteria.
2. **Mycology:** Study of fungi
3. **Protozoology:** Study of protozoans.
4. **Virology:** Study of viruses and viral diseases.
5. **Algology or Phycology:** Study of algae.
6. **Parasitology:** Study of parasitism and parasites

4.2 EPIDEMIOLOGY

Epidemiology is the study of determinants, distribution and frequency of disease indicating who gets the disease and why.

It has the following features:

- Epidemiologists study sick people.
- Epidemiologists study healthy people.
- They determine the crucial difference between those who get the disease and those who are spared.
- Epidemiologists study exposed people.
- Epidemiologists study non-exposed people.

4.2.1. APPLICATION OF EPIDEMIOLOGY

- Study the cause or etiology of diseases, or conditions, disorders, disabilities, etc.
- Determine the primary agent responsible for or ascertain causative factors.
- Determine the characteristics of the agent or causative factors.
- Determine the mode of transmission.
- Determine contributory factors.
- Identify and determine geographic factors.

4.2.2. DEFINITIONS

1. **Epidemic:** An epidemic is the rapid spread of disease to a large number of hosts in a given population within a short period of time.
2. **Endemic:** Endemic in a specific population or populated place when that infection is constantly present, or maintained at a baseline level, without extra infections being brought into the group as a result of travel or similar means.
3. **Pandemic:** A pandemic is an epidemic of an infectious illness with a high prevalence that spreads over a large geographic area. Typically, over the course of several months, a pandemic impacts a sizeable section of the global population.
4. **Mode of transmission:** The term modes of transmission refer to how an infectious agent, also called a pathogen, can be transferred from one person, object, or animal, to another.

5. **Outbreak:** An outbreak is a sudden rise in the number of cases of a disease. An outbreak may occur in a community or geographical area, or may affect several countries.
6. **Quarantine**: Quarantine separates and restricts the movement of people who were exposed to a contagious disease to see if they become sick.
7. **Isolation:** Isolation separates sick people with a contagious disease from people who are not sick.
8. **Incubation period:** The incubation period is the period of time between exposure to a pathogenic organism, a chemical, or radiation and the onset of the first symptoms and indicators.
9. **Contact tracing:** Contact tracing in public health is the process of identifying people who may have been exposed to an infected person (referred to as "contacts") and then gathering additional data to determine transmission.
10. **Morbidity:** Morbidity refers to the state of being unhealthy. It applies to all the people affected by a disease in a particular region. The morbidity rate refers to the number of people affected by a particular disease.
11. **Mortality:** Mortality shows the number of deaths in a particular population. It is expressed as the number of deaths per 100,000 people per year.

4.3 TYPES OF DISEASES

The term "disease" encompasses a broad range of health conditions characterized by abnormal functioning of the body's systems. The following are major categories of diseases:

1. **Infectious Diseases:** Caused by pathogenic microorganisms such as bacteria, viruses, fungi, and parasites. Examples include influenza, tuberculosis, and malaria.
2. **Non-Infectious Diseases:** Result from internal factors (e.g., genetics, hormonal imbalances) or external factors (e.g., environmental exposures, lifestyle choices). Examples include cardiovascular diseases, diabetes, and autoimmune disorders.
3. **Communicable Diseases:** Transmitted from person to person, often through direct or indirect contact with infectious agents. Examples include COVID-19, HIV/AIDS, and sexually transmitted infections.

4. **Non-Communicable Diseases (NCDs):** Not transmitted between individuals and typically have a chronic and long-lasting course. Common NCDs include heart disease, diabetes, cancer, and respiratory diseases.
5. **Genetic Diseases:** Result from abnormalities or mutations in an individual's genetic material. Examples include cystic fibrosis, sickle cell anemia, and Huntington's disease.
6. **Congenital Diseases:** Present at birth and may result from genetic factors, environmental exposures during pregnancy, or a combination of both. Examples include congenital heart defects and neural tube defects.

4.3.1 RESPIRATORY INFECTIONS

1. Chicken pox

Viruses have the ability to infect a wide range of organisms, including humans, animals, birds, and insects. The family Poxviridae, based on genetic, antigenic, and ecological criteria, is divided into two sub-families: Chordopoxvirinae and Entomopoxvirinae. Chordopoxvirinae primarily infect vertebrates, while Entomopoxvirinae target insects without affecting vertebrates.

Causative agent: Highly contagious disease caused by the ***varicella-zoster*** **virus (VZV).**

Epidemiology: More than 90% of cases occurring in children younger than 10 years. The disease is benign in the healthy child, and increased morbidity occurs in adults and immunocompromised patients.

Clinical presentation: The rash may first show up on the chest, back, and face, and then spread over the entire body, including inside the mouth, eyelids, or genital area.

Role of pharmacist in educating the public and prevention: By vaccination, chicken pox can be avoided as much as possible. Apart from immunization, maintaining proper cleanliness and frequent hand washing can also help stop the spread of chickenpox.

2. Measles

Measles is a highly contagious viral infection caused by the measles virus (MeV), a member of the paramyxoviridae family. The disease is characterized by a distinctive set of symptoms, including a high fever, cough, runny nose, red and watery eyes, and a characteristic rash.

Causative agent: *Measles morbillivirus* (MeV), also called measles virus (MV), is a single-stranded, negative-sense, enveloped, non-segmented RNA virus of the genus morbillivirus within the family Paramyxoviridae. It is the cause of measles.

Epidemiology: Worldwide, 36 cases of measles per 1 million persons are reported each year; about 134,200 die. For every 1,000 children who get measles, one or two will die from it.

Clinical presentation: Measles symptoms often start with a high fever, followed by the appearance of a characteristic rash. Other early symptoms may include cough, runny nose, and red, watery eyes.

Role of pharmacist in educating the public and prevention: Pharmacists play a crucial role in educating the public and contributing to the prevention of measles. Their accessibility, knowledge, and frequent interaction with the community position them as valuable resources for disseminating information and promoting vaccination.

3. Rubella

Rubella, also known as German measles, is a viral infection caused by the rubella virus. It is a contagious illness that primarily affects children, but it can also occur in adults. Rubella is characterized by a mild, pink-red rash and is generally a self-limiting disease.

Causative agent: Rubella is caused by the rubella virus, which is a single-stranded RNA virus belonging to the togaviridae family.

Epidemiology: During 2017–2021, annual measles incidence decreased 62%, from 10.4 to 4.0 cases per 1 million populations, and rubella incidence decreased 48%, from 2.3 to 1.2 cases per 1 million populations.

Clinical presentation: The incubation period for rubella is typically 14 to 21 days from exposure to the virus to the onset of symptoms. The initial symptoms may include a low-grade fever, malaise, and a mild upper respiratory infection with symptoms like a runny or stuffy nose.

Role of pharmacist in educating the public and prevention: The combined Measles, Mumps, and Rubella (MMR) vaccine is available as a preventive measure against rubella. Pharmacists play a crucial role in emphasizing the importance of vaccination, particularly to pregnant mothers, highlighting the potential risks of congenital malformations if they contract rubella.

4. Mumps

Mumps is a contagious viral infection caused by the mumps virus, which belongs to the paramyxoviridae family. This disease primarily affects the salivary glands, leading to characteristic swelling and pain. While mumps is generally a mild illness, it can sometimes result in complications, particularly in adult males.

Causative agent: The mumps virus (MuV) is the virus that causes mumps. MuV contains a single-stranded, negative-sense genome made of ribonucleic acid (RNA).

Epidemiology: From 1999–2019, on average, about 500,000 mumps cases were reported to the World Health Organization annually.

Clinical presentation: The classic symptom of mumps is the swelling of one or more of the salivary glands, especially the parotid glands located on the sides of the face. Other symptoms may include fever, headache, muscle aches, fatigue, and loss of appetite.

Role of pharmacist in educating the public and prevention: A highly effective live attenuated vaccine is available for prevention of mumps. The vaccine is recommended for children over one year of age. The vaccine should not be administered to pregnant women, patients receiving immunosuppressive therapy or those who are severely ill. The disease is highly infectious. The long and variable incubation period and the occurrence of sub-clinical cases make the control difficult. Cases should be isolated till the clinical manifestations subside. Steps should be taken to disinfect the articles used by the patient..

6. Influenza (H_1N_1)

Influenza A (H_1N_1), commonly known as H_1N_1 flu or swine flu, is a subtype of influenza A virus that caused a global pandemic in 2009. It is characterized by a combination of genetic material from human, avian, and swine influenza viruses. The H_1N_1 virus spreads from person to person through respiratory droplets, similar to the seasonal flu.

Causative agent: Influenza A (H_1N_1) is caused by a subtype of the influenza A virus. The causative agent is an influenza A virus with a specific combination of hemagglutinin (H) and neuraminidase (N) proteins on its surface.

Epidemiology: Annual epidemics are estimated to result in about 3 to 5 million cases of severe illness, and about 290000 to 650000 respiratory deaths.

Clinical presentation: Nasal secretions, chills, fever, decreased appetite, and in some cases, lower respiratory tract disease.

Role of pharmacist in educating the public and prevention: Good ventilation in public buildings. Avoiding crowded places during epidemics.

7. SARS (Severe acute respiratory syndrome)

Severe Acute Respiratory Syndrome (SARS) is a viral respiratory illness caused by the SARS coronavirus (SARS-CoV). The disease first emerged in 2002-2003, leading to a global outbreak with significant public health implications.

Causative agent: SARS is caused by the SARS coronavirus, a novel coronavirus named SARS-CoV.

Epidemiology: Epidemiology 0.73% of adults (>18 years) in India were exposed to SARS-CoV-2 infection, amounting for 6.4 million cases in total by early May 2020.

Clinical presentation: SARS presented as a severe respiratory illness with symptoms such as fever, cough, shortness of breath, and pneumonia.

Role of pharmacist in educating the public and prevention: Hand-washing with soap and water, or use of alcohol-based hand sanitizer. Disinfection of surfaces of fomites to remove viruses. Avoiding contact with body fluids.

8. MERS (Middle east respiratory syndrome)

Middle East Respiratory Syndrome (MERS) is a viral respiratory illness caused by the Middle East Respiratory Syndrome Coronavirus (MERS-CoV).

Causative agent: MERS is caused by the MERS-CoV, a novel coronavirus belonging to the coronaviridae family.

Epidemiology: The median age was 53 years old, and 69.4% of cases were The median time from disease onset to diagnosis was 5 days.

Clinical presentation: MERS presents with symptoms such as fever, cough, and shortness of breath. Severe respiratory illness can develop, leading to pneumonia and, in some cases, acute respiratory distress syndrome (ARDS).

Role of pharmacist in educating the public and prevention: Use a medical mask, eye protection (such as goggles or a face shield), and a clean, non-sterile, long-sleeved gown along with gloves.

9. COVID-19

COVID-19, short for "coronavirus disease 2019," is a respiratory illness caused by the severe acute respiratory syndrome coronavirus 2. The disease was first identified in December 2019 in the city of Wuhan, Hubei province, China, and it quickly evolved into a global pandemic.

Causative agent: COVID-19 is caused by the SARS-CoV-2 virus, a novel coronavirus belonging to the coronaviridae family.

Epidemiology: In the last 28-day period (31 July to 27 August 2023), over 1.4 million new COVID-19 cases and over 1800 deaths were reported to WHO, an increase of 38% and a decrease of 50%, respectively, compared to the previous 28 days.

Clinical presentation: Common symptoms include fever, cough, shortness of breath, fatigue, and loss of taste or smell.

Role of pharmacist in educating the public and prevention: Avoid close contact with people who are sick. Avoid touching your eyes, nose and mouth with unwashed hands. Wash your hands often with soap and water at least for 20 seconds. Use an alcohol based sanitizer that contains at least 60% alcohol if soap and water are not available.

10. Diphtheria

Diphtheria is a bacterial infection caused by *Corynebacterium diphtheriae*, which produces a toxin affecting the respiratory system. The disease is characterized by the formation of a thick, grayish membrane in the throat and nose, leading to breathing difficulties and potential complications.

Causative agent: Diphtheria is caused by the bacterium *corynebacterium diphtheriae*. There are different strains of the bacterium, and it primarily infects the respiratory system.

Epidemiology: In 2017, a total of 8,819 cases of diphtheria were reported worldwide, the most since 2004.

Clinical presentation: Diphtheria commonly presents with symptoms such as a sore throat, fever, and swollen lymph nodes. The hallmark sign is the development of a thick, grayish membrane in the throat and nose, which can lead to airway obstruction.

Role of pharmacist in educating the public and prevention: Active immunization with diphtheria toxoid is the primary and effective means of controlling diphtheria in infants. It is recommended to administer the DPT vaccine to infants at the earliest possible age.

11. Whooping Cough

Whooping cough, also known as pertussis, is a highly contagious respiratory infection caused by the bacterium *bordetella pertussis*. It is characterized by severe and prolonged coughing fits, often accompanied by a characteristic "whooping" sound when the person inhales.

Causative agent: *Bordetella pertussis* is the bacterium responsible for causing whooping cough. It is transmitted from person to person through respiratory droplets.

Epidemiology: This translated to an annual incidence of 85 cases per 1000 children aged below 10 years, and 115 cases per 1000 children below 5 years. The median age for pertussis infection was 2.4 years, and by 10 years of age, nearly 60% of the children had suffered from pertussis.

Clinical presentation: The illness typically begins with symptoms similar to those of a common cold, such as a runny nose, sneezing, and mild cough.

Role of pharmacist in educating the public and prevention: If pertussis is prevalent in the community, immunization can be started at the age of one month. The contraindications to pertussis vaccination are a strong family history of epilepsy, convulsions or similar CNS disorders.

12. Meningococcal Meningitis

Meningococcal meningitis is a severe and potentially life-threatening infection of the meninges the protective membranes surrounding the brain and spinal cord. The disease is primarily caused by the bacterium *Neisseria meningitidis*, and it can lead to rapid onset of symptoms, including high fever, severe headache, and neck stiffness.

Causative agent: Caused by the bacteria *Neisseria meningitidis* (also known as meningococcus).

Epidemiology: The annual number of invasive disease cases worldwide is estimated to be at least 1.2 million, with 135,000 deaths related to invasive meningococcal disease (IMD).

Clinical presentation: Meningococcal meningitis often presents with sudden onset of symptoms, including high fever, severe headache, neck stiffness, and sensitivity to light.

Role of pharmacist in educating the public and prevention: The long-term strategies to stop the illness are better housing and avoiding overcrowding. Although penicillin is the preferred medication, carrier states are not eliminated by it.

13. Acute Respiratory Infections (ARIs)

Acute Respiratory Infections (ARIs) represent a broad category of respiratory illnesses characterized by the sudden onset of symptoms affecting the respiratory system.

Causative agent: Most commonly associated ARI-causing bacterial organisms are *Streptococcus pneumoniae, Haemophilus influenzae, Staphylococcus aureus* etc.

Epidemiology: According to the World Health Organization (WHO), respiratory infections account for 6% of the total global disease burden.

Clinical presentation: Symptoms of ARIs can vary widely but often include cough, sneezing, sore throat, nasal congestion, fever, and difficulty breathing in more severe cases.

Role of pharmacist in educating the public and prevention: Preventive measures encompass enhancements in living conditions, improved nutrition, and the reduction of household smoke. Emphasizing the significance of good ventilation is crucial for pharmacists.

14. Tuberculosis

Tuberculosis (TB) is a contagious infectious disease primarily caused by the bacterium *Mycobacterium tuberculosis.*

Causative agent: *Mycobacterium tuberculosis* is the main bacterium responsible for tuberculosis.

Epidemiology: Every year, about 10 million people develop TB disease and 1.6 million people die of it. In fact, TB disease is the leading cause of death due to infectious disease in the world.

Clinical presentation: TB can present as latent infection or active disease. In latent TB, the bacteria are dormant, and the person does not exhibit symptoms.

Role of pharmacist in educating the public and prevention: Tuberculosis is a complex ailment with both medical and social dimensions. The occurrence of the disease is correlated with social well-being in an inverse manner.

15. Ebola

Ebola virus disease (EVD), commonly known as Ebola, is a severe and often fatal illness caused by the Ebola virus.

Causative agent: Ebola virus is a member of the filoviridae family, which includes several species.

Epidemiology: The experience of the 2014 to 2016 West African epidemic demonstrated that the mortality associated with Ebola virus disease may be reduced through adequate supportive care.

Clinical presentation: Ebola virus disease is characterized by the sudden onset of fever, intense weakness, muscle pain, headache, and sore throat.

Role of pharmacist in educating the public and prevention: All drugs prescribed under DOTS therapy are provided free of charge by the Government of India to patients.

4.3.2 INTESTINAL INFECTIONS

1. Poliomyelitis

Poliomyelitis is a disease that only affects humans, and the virus that causes it only comes from humans either the patient or, more frequently, the asymptomatic carriers.

Causative agent: Poliomyelitis is caused by three types of poliovirus: type 1, type 2, and type 3. These viruses belong to the picornaviridae family and enter the body through the mouth

Epidemiology: Wild poliovirus cases have decreased by over 99% since 1988, from an estimated 350000 cases in more than 125 endemic countries to 6 reported cases in 2021.

Clinical presentation: A child's fever, lethargy, headache, stiff neck, back, and slightly elevated spinal fluid cells and proteins are the hallmarks of an acute sickness.

Role of pharmacist in educating the public and prevention: They play a vital role in educating the public about the importance of vaccination, ensuring appropriate vaccine storage, and facilitating access to immunization services.

2. Viral hepatitis

Viral hepatitis refers to inflammation of the liver caused by viral infections. There are several types of hepatitis viruses, classified as hepatitis A, B, C, D, and E.

Causative agent: The causative agents of viral hepatitis are viruses, and each type of hepatitis is associated with a specific virus.

Epidemiology: The overall prevalence of HAV ranged from 2.1% to 52.5%. The overall prevalence of HBV ranged from 0.87% to 21.4%. The overall prevalence of HCV ranged from 0.19% to 53.7%.

Clinical presentation: Anorexia, nausea, vomiting, black urine, and weakness accompany non-specific symptoms such fever, chills, headaches, fatigue, aches, and pains.

Role of pharmacist in educating the public and prevention: Pharmacists dispense antiviral medications prescribed by healthcare providers for the treatment of chronic viral hepatitis.

3. Cholera

Cholera is an acute diarrheal infection caused by the ingestion of food or water contaminated with the bacterium *Vibrio cholerae*. The disease can range from mild to severe and is characterized by profuse, watery diarrhea.

Causative agent: Cholera is caused by the bacterium *Vibrio cholerae*.

Epidemiology: During the 19th century, cholera spread across the world from its original reservoir in the Ganges delta in India.

Clinical presentation: Cholera infection can range from asymptomatic to severe. In severe cases, the onset is sudden, and symptoms include profuse, watery diarrhea, vomiting, and muscle cramps.

Role of pharmacist in educating the public and prevention: Pharmacists dispense medications prescribed by healthcare providers, including antibiotics (such as doxycycline or azithromycin) used to reduce the severity and duration of cholera symptoms.

4. Acute Diarrheal Diseases

Acute diarrheal diseases refer to a group of infectious or non-infectious conditions that cause the sudden onset of loose or watery stools. These diseases are a significant global health concern, particularly in developing countries, where they contribute to high rates of morbidity and mortality, especially among children.

Causative agent: Acute diarrheal diseases can be caused by a variety of infectious agents, including viruses, bacteria, and parasites.

Epidemiology: About 15 per cent of older adults in India suffer from diarrhoea (rural-17 % and urban-9 %). The prevalence of diarrhoea among older adults was highest in Mizoram (33.5 per cent), followed by Chhattisgarh (30.7 per cent), Bihar (30.2 per cent), and Rajasthan (30.2 per cent).

Role of pharmacist in educating the public and prevention: Pharmacists assist patients in selecting appropriate over-the-counter (OTC) medications for the symptomatic relief of diarrhea. This may include recommending antidiarrheal agents containing loperamide, which helps reduce stool frequency.

5. Typhoid

Typhoid fever is a bacterial infection caused by the *bacterium Salmonella*. It is a systemic illness characterized by fever, abdominal pain, and gastrointestinal symptoms.

Causative agent: Typhoid fever is caused by the *bacterium Salmonella enterica*.

Epidemiology: As of 2019 estimates, there are 9 million cases of typhoid fever annually, resulting in about 110000 deaths per year. Typhoid risk is higher in populations that lack access to safe water and adequate sanitation, and children are at highest risk.

Clinical Presentation: Symptoms of typhoid fever include a sustained high fever, headache, abdominal pain, and a characteristic rose-colored rash. Gastrointestinal symptoms such as diarrhea or constipation may also occur.

Role of pharmacist in educating the public and prevention: Pharmacists educate patients about the prescribed antibiotics, including proper dosage, administration instructions, potential side effects, and the importance of completing the full course of treatment.

6. Amebiasis

Amebiasis is an infectious disease caused by the protozoan parasite *Entamoeba histolytica*. This parasitic infection primarily affects the intestines, causing symptoms such as diarrhea, abdominal pain, and fatigue. Amebiasis is a significant health concern, particularly in areas with poor sanitation and limited access to clean water.

Causative agent: Amebiasis is caused by the protozoan parasite *Entamoeba histolytica*.

Epidemiology: A recent review on laboratory methods for detection of *Entamoeba spp.* has reported that 15-20% of the Indian population is infected with *E. histolytica*.

Clinical presentation: In more severe cases, symptoms can include dysentery (bloody diarrhea), abdominal pain, weight loss, fatigue, and fever.

Role of pharmacist in educating the public and prevention: Pharmacists dispense medications prescribed by healthcare providers for the treatment of amebiasis.

7. Worm Infestations

Worm infestations, also known as helminth infections, refer to the presence of parasitic worms in the human body. These infections are caused by various types of helminths, including nematodes (roundworms), cestodes (tapeworms), and trematodes (flukes).

Causative agent: Roundworms (Nematodes), Flatworms (Platyhelminthes), Hookworms (Nematodes), Whipworms (Nematodes), Pinworms (Nematodes), Filariasis (Nematodes).

Epidemiology: Ascariasis has been a disease that has affected the world population for centuries.

Clinical presentation: Common symptoms include abdominal pain, diarrhea, weight loss, fatigue, and, in some cases, visible worms in stool.

Role of pharmacist in educating the public and prevention: Pharmacists dispense medications prescribed by healthcare providers for the treatment of worm infestations.

8. Food poisoning

Food poisoning, also known as foodborne illness, refers to the ingestion of contaminated food or water that contains harmful microorganisms, toxins, or chemicals.

Causative agent: Food poisoning can be caused by various agents, including bacteria, viruses, parasites, and toxins. Here are some common causative agents associated with food poisoning.

Epidemiology: Every year, an estimated 1 in 6 Americans (or 48 million people) get sick, 128,000 are hospitalized, and 3,000 die from foodborne diseases.

Role of pharmacist in educating the public and prevention: They recommend oral rehydration solutions (ORS) containing electrolytes to replace fluids lost due to illness. Pharmacists collaborate with healthcare providers to optimize treatment plans.

4.3.3 ARTHROPOD-BORNE INFECTIONS

1. Dengue

The disease is caused by the dengue virus, which is t
primarily through the bites of infected Aedes mosquit
aegypti and, to a lesser extent, *Aedes albopictus*.

Causative agent: Dengue fever is caused by the dengue virus, which belongs to the Flavivirus genus.

Epidemiology: Dengue is a vector-borne viral disease caused by the flavivirus dengue virus (DENV). Approximately 400 million cases and 22000 deaths occur due to dengue worldwide each year.

Clinical presentation: Dengue fever typically presents with sudden onset of high fever, severe headaches, pain behind the eyes, joint and muscle pain, rash, and mild bleeding.

Role of pharmacist in educating the public and prevention: The mosquito vector responsible for transmitting dengue fever, breeds in and around households and can be effectively managed through actions taken by individuals and communities.

2. Malaria

Malaria is a life-threatening infectious disease caused by plasm
parasites transmitted to humans through the bites of infected An
mosquitoes.

Causative agent: Malaria is caused by Plasmodium parasites, primarily *Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae.*

Epidemiology: According to the latest World malaria report, there were 247 million cases of malaria in 2021 compared to 245 million.
2020.

Clinical presentation: Symptoms of malaria include high fever, chills, sweats, headache, muscle aches, and fatigue.

Role of pharmacist in educating the public and prevention: Pharmacists can ensure the availability and proper distribution of antimalarial drugs, including over-the-counter medications.

3. Filariasis

Filariasis, also known as lymphatic filariasis, is a tropical and subtropical parasitic disease caused by infection with filarial worms. The primary species responsible for lymphatic filariasis include *Wuchereria bancrofti*, *Brugia malayi*, and Brugia timori.

Causative agent: The main filarial worms causing lymphatic filariasis are *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori*. Each species has a specific geographical distribution.

Epidemiology: About 31 million people are estimated to be the carriers of lymphatic filariasis (LF) and over 23 million suffer from filarial disease manifestations in India.

Clinical presentation: Early symptoms may include fever, lymphangitis, and lymphadenitis. Chronic infection can lead to lymphedema, elephantiasis and hydrocele.

Role of pharmacist in educating the public and prevention: Pharmacists can educate patients on the importance of adhering to prescribed antifilarial medications to ensure effective treatment and reduce the risk of transmission.

4. Chikungunya

Chikungunya is an infectious disease caused by the chikungunya virus, which is primarily transmitted to humans through the bites of infected Aedes mosquitoes, particularly *Aedes aegypti* and *Aedes albopictus*.

Causative agent: Chikungunya is caused by the chikungunya virus, an arthropod-borne virus belonging to the Alphavirus genus.

Epidemiology: In 2019, a total of 81914 cases were clinically suspected for CHIKV, out of which, 12205 (14.9%) laboratory confirmed chikungunya was reported in 21 Indian states and 3 Union territories in this year.

Clinical presentation: Chikungunya is characterized by the sudden onset of high fever, severe joint pain, muscle pain, headache, nausea, fatigue, and rash.

Role of pharmacist in educating the public and prevention: Provide information to the community about the symptoms of chikungunya, emphasizing the sudden onset of fever, severe joint pain, and other associated symptoms.

4.3.4 SURFACE INFECTIONS

1. Trachoma

Trachoma is a contagious bacterial infection of the eyes, primarily caused by the bacterium *Chlamydia trachomatis*. It is a leading cause of preventable blindness and visual impairment in certain parts of the world, particularly in areas with poor sanitation and limited access to healthcare.

Causative agent: Caused by the bacteria *Chlamydia trachomatis*, which is transmitted through contact with eye secretions of infected people, as well by flies that help spread it.

Epidemiology: Worldwide, an estimated 229 million people in 53 countries live in trachoma-endemic areas.

Clinical presentation: The infection leads to inflammation. The inflammation may undergo spontaneous resolution or may progress to conjunctival scarring which can cause inward deviation of eye lashes, termed as trichiasis or of the lid margin termed as entropion.

Role of pharmacist in educating the public and prevention: Chemotherapy is one of the effective intervention. 1% ophthalmic ointment or oily suspension of tetracycline is suggested. Alternatively, Erythromycin and Rifampicin is recommended.

2. Tetanus

Tetanus is a potentially severe and life-threatening disease caused by the bacterium *clostridium tetani*. The spores of this bacterium are commonly found in soil, dust, and animal feces.

Causative agent: Tetanus is caused by the bacterium *clostridium tetani*.

Epidemiology: Tetanus occurs worldwide but is more common in agricultural regions of warmer climates, especially where contact with animal manure is more likely. Neonatal tetanus frequently occurs in developing countries when access to vaccine and maternity care is limited.

Clinical presentation: Tetanus is characterized by muscle stiffness and spasms, often starting in the jaw (trismus or "lockjaw") and neck muscles.

Role of pharmacist in educating the public and prevention: Pharmacists can provide immunization services, including administering tetanus vaccines to individuals based on their immunization history and the need for booster doses.

3. Leprosy (Hansen's Disease)

Leprosy, also known as "Hansen's disease", is a chronic infectious disease caused by the bacterium *mycobacterium leprae*. This slow-growing bacterium primarily affects the skin and peripheral nerves, leading to skin lesions and nerve damage.

Causative agent: Leprosy is caused by *mycobacterium leprae*, an acid-fast, rod-shaped bacterium.

Epidemiology: In 2022, 182 countries, areas and territories shared information on leprosy, accounting for a registered prevalence of 165459 cases and 174087 new cases, of which 67657 (39%) were among females.

Clinical presentation:

Skin Lesions: The disease is often characterized by skin lesions, nodules, and changes in pigmentation. **Nerve Involvement:** Leprosy can cause nerve damage, leading to sensory and motor deficits, as well as muscle weakness.

Role of pharmacist in educating the public and prevention: Provide information to patients and the community about leprosy, its symptoms, and methods of transmission to dispel myths and reduce stigma.

4. Sexually Transmitted Diseases (STDs)

Sexually Transmitted Diseases (STDs), also referred to as Sexually Transmitted Infections (STIs), are infections that are primarily transmitted through sexual contact. These diseases can affect anyone engaging in sexual activity, including vaginal, anal, or oral sex.

Causative agent: Sexually Transmitted Diseases (STDs) are caused by various microorganisms, including bacteria, viruses, parasites, and fungi. Different STDs have different causative agents.

Epidemiology: In general, the prevalence of STDs tends to be higher in urban residents, in unmarried individuals, and in young adults. STDs tend to occur at a younger age in females than in males, related to patterns of sexual activity and to the relative rates of transmission from one sex to the other.

Clinical presentation: Preventive measures to control sexually transmitted diseases are an effective way to deal with them.

Role of pharmacist in educating the public and prevention: Provide comprehensive information to patients about the risks of STDs, modes of transmission, and preventive measures.

4. AIDS (Acquired immune deficiency syndrome)

Acquired Immune Deficiency Syndrome (AIDS) is a severe and advanced stage of infection with the Human Immunodeficiency Virus (HIV). HIV attacks the immune system, specifically the CD_4 cells (T cells), which play a crucial role in the body's defense against infections.

Causative agent: HIV is a retrovirus that infects and gradually destroys the CD_4 cells of the immune system.

Epidemiology: Globally, 39.0 million (33.1–45.7 million) people were living with HIV at the end of 2022.

Clinical presentation: Opportunistic Infections: People with AIDS are vulnerable to a wide range of opportunistic infections, including pneumonia, tuberculosis, and fungal infections.

Role of pharmacist in educating the public and prevention: Safer Sex Practices: Using condoms and practicing safer sex to prevent sexual transmission. Needle Exchange Programs: Providing access to clean needles to reduce the risk of transmission through injecting drug use. Pre-Exposure Prophylaxis (PrEP): Medications taken by individuals at high risk to prevent HIV infection.