HUMAN DISEASES

LIFE SCIENCE		
Human Diseases		
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HUMAN DISEASES

12th Zoology

Unit 7 – Human Health and Diseases

Common diseases in human beings

- Disease can be defined as a disorder or malfunction of the mind or body. It involves morphological, physiological and psychological disturbances which may be due to environmental factors or pathogens or genetic anomalies or life style changes. Diseases can be broadly grouped into infectious and non infectious types. Diseases which are transmitted from one person to another are called infectious diseases or communicable diseases. Such disease causing organisms are called pathogens and are transmitted through air, water, food, physical contact and vectors. The disease causing pathogen may be virus, bacteria, fungi, protozoan parasites, helminthic parasites, etc., Infectious diseases are common and everyone suffers from such diseases at some time or the other. Most of the bacterial diseases are curable but all viral diseases are not. Some infectious disease like AIDS may be fatal.

- Non-infectious diseases are not transmitted from an infected person to a healthy person. In origin they may be genetic (cystic fibrosis), nutritional (vitamin deficiency diseases) and degenerative (arthritis, heart attack, stroke). Among non - infectious diseases, cancer is one of the major causes of death.

Bacterial and viral diseases Bacterial diseases

- Though the number of bacterial species is very high, only a few bacteria are associated with human diseases and are called pathogenic bacteria. Such pathogens may emit toxins and affected the body.

- Bacteria spread through air, water or by inhaling the droplets/aerosols or even by sharing utensils, dresses with an infected person. Typhoid fever can be confirmed by Widal test

Viral diseases

- Viruses are the smallest intracellular obligate parasites, which multiply within living cells. Outside the living cells they cannot carry out the characteristics of a living organism. Viruses invade living cells, forcing the cells to create new viruses. The new viruses break out of the cell, killing it and invade other cells in the body, causing diseases in human beings. Rhino viruses cause one of the most infectious human ailment called the "Common cold".

- Viral diseases are generally grouped into four types on the basis of the symptoms produced in the body organs.

- Pneumotropic diseases (respiratory tract infected by influenza)

- Dermotropic diseases (skin and subcutaneous tissues affected by chicken pox and measles)

- Viscerotropic diseases (blood and visceral organs affected by yellow fever and dengue fever)

- Neurotropic diseases (central nervous system affected by rabies and polio).

Bacterial resistance

If an antibiotic is used too often to fight a specific bacterial infection, the bacteria may become resistant to the specific antibiotic. Hence the specific antibiotic can no longer be used to treat the bacterial infection. Some bacteria have developed resistance to many antibiotics. Therefore, infections caused by these bacteria are difficult to be cured.

Risk of bacterial resistance can be reduced by observing the following steps

- Avoid using antibiotics to treat minor infections that can be taken care by our immune system.
- Do not use an antibiotic to treat viral infections such as common cold or flu.
- Always follow the prescription. Skipping doses or failing to complete the prescription may allow antibiotic resistance to develop.

Nipah virus is a zoonotic virus (transmitted from animals to humans) and also transmitted through contaminated food. In infected people, it causes a range of illness from asymptomatic infection to acute respiratory illness and fatal encephalitis.

Swine flu was first recognised in the 1919 pandemic and still circulates as a seasonal flu virus. Swine flu is caused by the H1N1 virus strain. Symptoms include fever, cough, sore throat, chills, weakness and body aches. Children, pregnant women and the elderly are at risk from severe infection

Bacterial diseases in human beings

S.No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1	Shigellosis (Bacillary dysentery)	Shigella sp.	Intestine	Food and Water contaminated by faeces/ faecal oral route	Abdominal pain, dehydration, blood and mucus in the stools
2	Bubonic plague (Black death)	Yersinia pestis	Lymph nodes	Rat flea vector – Xenopsyllacheopis	Fever, headache, and swollen lymph nodes.
3	Diphtheria	Corynebacterium diphtheriae	Larynx, skin, nasal and genital passage	Droplet infection	Fever, Sore throat, hoarseness and difficulty in breathing
4	Cholera	Vibrio cholerae	Intestine	Contaminated food and water/ faecal oral route	Severe diarrhoea and dehydration.
5	Tetanus (Lock Jaw)	Clostridium tetani	Spasm of muscles	Through wound infection	Rigidity of jaw muscle, increased heart beat rate and spasm of the muscles of the jaw and face.
6	Typhoid(Enteric fever)	Salmonella typhi	Intestine	Through contaminated food and water	Headache, abdominal discomfort, fever and diarrhoea.
7	Pneumonia	Streptococcus pneumoniae	Lungs	Droplet infection	Fever, cough, Painful breathing and brown sputum
8	Tuberculosis	Mycobacterium tuberculosis	Lungs	Droplet infection	Thick mucopurulant nasal discharge.

Viral diseases in human beings

S.No	Diseases	Causative Agent	Site of infection	Mode of transmission	Symptoms
1	Common Cold	Rhino Viruses	Respiratory tract	Droplet infection	Nasal congestion and discharge, sore throat, cough and headache.
2	Mumps	Mumps virus (RNA virus) Paramyxo virus	Salivary glands	Saliva and droplet infection	Enlargement of the parotid glands.
3	Measles	Rubella virus (RNA virus), Paramyxo virus	Skin and respiratory	Droplet infection	Sore throat, running nose, cough and fever. Reddish rashes on the skin, neck and ears.
4	Viral hepatitis	Hepatitis – B Virus	Liver	Parenterak route, blood transfusion	Liver damage, jaundice, nausea, Yellowish eyes, fever and pain in the abdomen
5	Chicken pox	Varicella Zoster virus (DNA Virus)	Respiratory tract, skin and nervous system	Droplet infection and direct contact	Mild fever with itchy skin, rash and blisters
6	Poliomyelitis	Polio virus (RNA virus)	Intestine, brain, spinal cord	Droplet infection through faecal oral route	Fever, muscular stiffness and weakness, paralysis and respiratory failure
7	Dengue fever (Break bone fever)	Dengue virus or flavi virus (DENV 1-4 virus)	Skin and blood	Mosquito vector Aedesaegypti	Severe flu like illness with a sudden onset of fever and painful headache, muscle and joint pain.
8	Chikungunya	Alpha virus (Toga virus)	Nervous system	Mosquito vector Aedesaegypti	Fever and joint pain, headache and joint swelling

Protozoan diseases

- About 15 genera of protozoans live as parasites within the human body and cause diseases. Amoebiasis also called amoebic dysentery or amoebic colitis is caused by Entamoebahistolytica, which lives in the human large intestine and feeds on food particles and bacteria. Infective stage of this parasite is the trophozoite, which penetrates the walls of the host intestine (colon) and secretes histolytic enzymes causing ulceration, bleeding, abdominal pain and stools with excess mucus. Symptoms of amoebiasis can range from diarrhoea to dysentery with blood and mucus in the stool. House flies (Muscadomestica) acts as a carrier for transmitting the parasite from contaminated faeces and water.

- African sleeping sickness is caused by Trypanosoma species. Trypanosoma is generally transmitted by the blood sucking Tsetse flies. Three species of Trypanosoma cause sleeping sickness in man.

  - T. gambiense is transmitted by Glossinapalpalis (Tsetse fly) and causes Gambian or Central African sleeping sickness.

  - T. rhodesiense is transmitted by Glossinamorsitans causing Rhodesian or East African sleeping sickness.

  - T. cruzi is transmitted by a bug called Triatomamegista and causes Chagas disease or American trypanosomiasis.

- Kala – azar or visceral leishmaniasis is caused by Leishmaniadonovani, which is transmitted by the vector Phlebotomus (sand fly). Infection may occur in the endothelial cells, bone marrow, liver, lymph glands and blood vessels of the spleen. Symptoms of Kala azar are weight loss, anaemia, fever, enlargement of spleen and liver.

- Malaria is caused by different types of Plasmodium species such as P. vivax, P. ovale, P. malariae and P. falciparum . Plasmodium lives in the RBC of human in its mature condition it is called as trophozoite. It is transmited from one person to another by the bite of the infected female Anopheles mosquito.

Types of malaria

S.No	Types of Malaria	Causative agent	Duration of Erythrocytic Cycle.
1	Tertian, benign tertian or vivax malaria	P. Vivax	48 hours
2	Quartan malaria	P. malariae	72 hours
3	Mild tertian malaria	P. ovale	48 hours

4	Malignant tertian or quotidian malaria	P. falciparum	36-48 hours

Fungal diseases

- Fungi was recognized as a causative agent of human diseases much earlier than bacteria. Dermatomycosis is a cutaneous infection caused by fungi belonging to the genera Trichophyton, Microsporum and Epidermophyton.

- Ringworm is one of the most common fungal disease in humans. Appearance of dry, scaly lesions on the skin, nails and scalp are the main symptoms of the disease. Heat and moisture help these fungito grow and makes them to thrive in skin folds such as those in the groin or between the toes. Ringworms of the feet is known as Athlete's foot caused by Tineapedis. Ringworms are generally acquired from soil or by using clothes, towels and comb used by infected persons.

Helminthic diseases

- Helminthes are mostly endoparasitic in the gut and blood of human beings and cause diseases called helminthiasis. The two most prevalent helminthic diseases are Ascariasis and Filariasis.

- Ascaris is a monogenic parasite and exhibits sexual dimorphism. Ascariasis is a disease caused by the intestinal endoparasiteAscarislumbricoides commonly called the round worms. It is transmitted through ingestion of embryonated eggs through contaminated food and water. Children playing in contaminated soils are also prone to have a chance of transfer of eggs from hand to mouth. The symptoms of the disease are abdominal pain, vomiting, headache, anaemia, irritability and diarrhoea. A heavy infection can cause nutritional deficiency and severe abdominal pain and causes stunted growth in children. It may also cause enteritis, hepatitis and bronchitis.

- Filariasis is caused by Wuchereriabancrofti, commonly called filarial worm. It is found in the lymph vessels and lymph nodes of man. Wuchereriabancrofti is sexually dimorphic, viviparous and digenic. The life cycle is completed in two hosts, man and the female Culexmosquito The female filarial worm gives rise to juveniles called microfilariae larvae. In the lymph glands, the juveniles develop into adults. The accumulation of the worms block the lymphatic system resulting in inflammation of the lymph nodes.

- In some cases, the obstruction of lymph vessels causes elephantiasis or fi lariasis of the limbs, scrotum and mammary glands

Maintenance of personal and public hygiene

- Hygiene is a set of practices performed to conserve good health. According to the World Health Organization (WHO), hygiene refers to "conditions and practices that help to maintain health and prevent the spread of diseases." Personal hygiene refers to maintaining one's body clean by bathing, washing hands, trimming fingernails, wearing clean clothes and also includes attention to keeping surfaces in the home and workplace, including toilets, bathroom facilities, clean and pathogen-free.

- Our public places teem with infection, contamination and germs. It seems that every surface we touch and the air we breathe are with pollutants and microbes. It's not just the public places that are unclean, but we might be amazed at the number of people who do not wash their hands before taking food, after visiting the restroom, or who sneeze without covering their faces. Many infectious diseases such as typhoid, amoebiasis and ascariasis are transmitted through contaminated food and water.

- Advancement in science and technology provide effective controlling measures for many infectious and non-infectious diseases. The use of vaccines and adopted immunization programmes have helped to eradicate small pox in India. Moreover a large number of infectious diseases like polio, diphtheria, pneumonia and tetanus have been controlled by the use of vaccines and by creating awareness among the people.

Adolescence – drug and alcohol abuse

- Adolescence begins with a period of rapid physical and sexual development called puberty to maturity at 12 to 19 years of age. Adolescence is also a highly dynamic period of psychologicaland social changes in individuals. Adolescents are vulnerable to group (peer) pressure and many youngsters are pushed into experimenting with drugs and alcohol. Proper education and guidance would enable youth to say no to drugs and alcohol and to follow a healthy life style.

- Alcohol is a psychoactive drug, which acts on the brain, affecting a person's mind and behaviour. It is a depressant, which slows down the activity of the nervous system. The intake of certain drugs for a purpose other than their normal clinical use in an amount and frequency that impair one's physical, physiological and psychological functions is called drug abuse.

- The drugs which are commonly abused include opioids, cannabinoids, coca-alkaloids, barbiturates, amphetamines and LSD.

- Opioids are drugs which bind to specific opioid receptors present in the central nervous system and intestinal tract. Heroin (smack) is chemically diacetyl morphine, which is white, odourless and bitter crystallinecompound. It is

obtained by acetylation of morphine, which is extracted from flowers of the poppy plant. Morphine is one of the strongest pain killer and is used during surgery. It is the most widely abused narcotic drug which acts as a depressant and slows down body functions.

- Cannobinoids are a group of chemicals obtained from Cannabis sativa, the Indian hemp plant. Natural cannabinoids are the main source of marijuana, ganja, hashish and charas. It interferes in the transport of the neurotransmitter, dopamine and has a potent stimulating action on the CNS, producing increased energy and a sense of euphoria.

- Cocaine is a white powder that is obtained from the leaves of the coca plant, Erythroxylum coca. It is commonly called coke or crack. Cocaine causes serious physical and psychological problems including hallucinations and paranoia. The other plants with hallucinogenic properties are Atropa belladonna and Datura.

Classification of drugs

Group	Drugs	Effects
Stimulants	Amphetamines, cocaine, nicotine and tobacco	Accelerates the activity of the brain
Depressants	Alcohol, Barbiturates, Tranquilizers	Slows down the activity of the brain
Narcotic/ Analgesics	Opium, Morphine	Act as depressants on the Central Nervous System
Cannabis	Bhang (Marijuana), Ganja, Charas	Affects the cardiovascular system
Hallucinogens	Lysergic acid diethylamide (LSD), Phencyclidine	Distorts the way one sees, hears and feels.

- Drugs like methamphetamine, amphetamines, barbiturates, tranquilizers, Lysergic acid diethylamide (LSD) are normally used as medicine to treat patients with mental illness like depression and insomnia and are often abused.

- Tobacco is smoked, chewed and used as snuff. It increases the carbon monoxide content of blood and reduces the concentration of haem bound oxygen, thus causing oxygen deficiency in the body. Tobacco contains nicotine, carbon monoxide and tars, which cause problems in the heart, lung and nervous system. Adrenal glands are stimulated by nicotine to release adrenaline and nor adrenaline which increases blood pressure and heart beat.

Addiction and dependence

- Addiction is a physical or psychological need to do or take or use certain substance such as alcohol, to the point where it could be harmful to the

individual. This addictive behaviour can be personally destructive to a person. Overtime addicts start to lose not only their jobs, homes and money, but also friendship, family relationships and contact with the normal world. Addiction to drugs and alcohol can lead to a psychological attachment to certain effects such as euphoria and temporary feeling of well being.

- Repeated use of drugs and alcohol may affect the tolerance level of the receptors present in the body. These receptors then respond only to highest doses of drugs and alcohol leading to greater intake and addiction. Excessive use of drug and alcohol leads to physical and psychological dependence. When psychological dependence develops, the drug user gets mentally 'hooked on' to the drug. The drug user constantly thinks only about the drug and has continuous uncontrollable craving for it. This state called "euphoria" is characterized by mental and emotional preoccupation with the drug.

- Physical dependence is a state in which the user's body requires a continuous presence of the drug. If the intake of the drug or alcohol is abruptly stopped, he or she would develop withdrawal symptoms. In a sense, the body becomes confused and protests against the absence of the drug. The withdrawal symptoms may range from mild tremors to convulsions, severe agitation and fits, depressed mood, anxiety, nervousness, restlessness, irritability, insomnia, dryness of throat, etc, depending on the type of drug abuse.

Effects of drugs and alcohol

- Short-term effect appears only for a few minutes after the intake of drugs and alcohol. The abuser feels a false sense of well being and a pleasant drowsiness. Some short term effects are euphoria, pain, dullness of senses, alteration in behaviour, blood pressure, narcosis (deep sleep), nausea and vomiting.

- Drugs and alcohol have long-term effect that lead to serious damages, because of the constant and excessive use. The physical and mental disturbance makes the life of the user unbearable and torturous. For example heavy drinking permanently damages the liver and brain.

- The use of alcohol during adolescence may have long-term effects. Alcohol interferes with the ability of the liver to break down fat. Over time fat accumulation and high levels of alcohol destroy the liver cells and a scar tissue grows in the place of dead cells. This scarring of the liver is called "Liver cirrhosis". Alcohol irritates the stomach lining due to the production of excess acid leading to ulcers. Excessive alcohol use weakens the heart muscle, causing scar tissue to build up in the cardiac muscle fibers. As a result, heavy drinkers have an increased risk of high blood pressure, stroke, coronary artery disease and heart attack. Korsakoff syndrome, a chronic memory disorder is most commonly caused by alcohol misuse.

Alcoholism is the inability to control drinking due to physical and emotional dependence on alcohol. Treatment involves counseling by a healthcare professional. Detoxification programme in a hospital or medical facility is an option for those who need additional assistance. Medications are available to reduce the desire to drink and smoke.

Prevention and control

- It is practically possible to prevent some one from using drugs and alcohol. Here are some ways that help to prevent drug and alcohol abuse.

- **Effectively dealing with peer pressure**

  The biggest reason for teens to start on drugs is due to their friends / peer groups imposing pressure on them. Hence, it is important to have a better group of friends to avoid such harmful drugs and alcohol.

- **Seeking help from parents and peers**

  Help from parents and peer group should be sought immediately so that they can be guided appropriately. Help may even be sought from close and trusted friends. Getting proper advice to sort out their problems would help the young to vent their feelings of anxiety and guilt.

- **Education and counselling**

  Education and counselling create positive attitude to deal with many problems and to accept disappointments in life.

- **Looking for danger signs**

  Teachers and parents need to look for sign that indicate tendency to go in for addiction.

- **Seeking professional and medical assistance**

  Assistance is available in the form of highly qualified psychologists, psychiatrists and de-addiction and rehabilitation programmes to help individuals to overcome their problems.

Mental health – Depression

- Mental health is a state of well being of the mind, with self esteem. Self esteem means liking yourself and being able to stand up for what you believe is right. Positive mental health is an important part of wellness. A mentally healthy person reflects a good personality. Activities of mentally healthy people are always appreciated and rewarded by the society as these persons are creative as well as cooperative with others. Mental health improves the quality of life.

- Depression is a common mental disorder that causes people to experience depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep poor appetite, low energy and poor concentration.

Alcoholic Anonymous
Alcoholic anonymous was started in 1935 by a businessman and a doctor who had been a "hopeless drunk" for many years. After the men helped each other to stop drinking and to stay sober, they then founded the alcoholic anonymous to help other alcoholics. Since that time alcoholic anonymous has spread throughout the world.

Signs and symptoms of mental depression

- Loss of self confidence and self esteem
- Anxiety
- Not being able to enjoy things that are usually pleasurable or interesting.

- Lifestyle changes like exercise, meditation, yoga and healthy food habits can help to be relieved from depression. Exercise stimulates the body to produce serotonin and endorphins, which are neurotransmitters that suppress depression. Practicing exercise in daily life creates a positive attitude .

Participating in an exercise programme can:

- Increase self-esteem
- Boost self-confidence
- Create a sense of empowerment
- Enhance social connections and relationships

- Brain is one of the most metabolically active part of the body and needs a steady stream of nutrients to function. A poor diet may not provide the nutrients for a healthy body and may provoke symptoms of anxiety and depression.

Lifestyle disorders in human beings

- The old saying that "health is wealth" is truly applicable to human beings. With the changes in life style, there are many emerging medical conditions and diseases that are reducing human longevity. Life style disorder result due to activities involving smoking, alcohol and drug abuse, consuming high fat diet, lack of exercise or living a latent life.

- The World Health Organization (WHO) in its report cautions a slow moving public health disaster due to life style disorders in the form of non-communicable diseases like diabetes, cardiovascular and lung diseases. WHO believes that not thousands but millions of people die every year within the age groupof thirty to sixty due to life style related disorders.

- The following facts will help in better understanding of life style disorders.

- Life style disorder causes cardiovascular diseases resulting in 31 percent of global deaths.

- The sedentary life style also causes deficiency of vitamins such as vitamin D resulting in fatigue, tiredness, back pain, depression, bone loss, muscle pain, etc,

- Life style disorder also includes social isolation resulting in age related problems.

- Eating junk foods that have high caloric values, rich in carbohydrates and fat can lead to obesity and early health issues.

- Consumption of processed and packaged food, which lacks in fiber may result in constipation.

- Several people today complain of irritable bowel syndrome with stomach discomfort or pain and trouble with bowel movements, causing diarrhoea. The main cause of irritable bowel syndrome is stress and other illnesses.

Life style modifications

- Avoid eating junk food and foods that have preservatives and colouring agents.

- Physical exercises such as brisk walking and yoga can be done regularly.

- Following medical advice, if any health problems in addition to life style disorders.

- To avoid smoking drugs and drinking alcohol.

- To follow a healthy balanced diet rich in vitamins and proteins.

- 7 – 8 hours of sleep every day is required.

Chapter 8 – Immunology

Innate immunity

- Innate immunity is the natural phenomenon of resistance to infection which an individual possesses right from the birth. The innate defense mechanisms are non-specific in the sense that they are effective against a wide range of potentially infectious agents. It is otherwise known as non-specific immunity or natural immunity. A number of innate defense mechanisms are operative non-specifically against a large number of microorganisms as shown in the Table 8.1 and Fig. 8.2.

Type of innate Immunity	Mechanism
1. Anatomical barriers • **Skin** • **Mucus Membrane**	• Prevents the entry of microbes. Its acidic environment (pH 3-5) retards the growth of microbes. • Mucus entraps foreign microorganisms and competes with microbes for attachment.
2. Physiological barriers • **Temperature** • **Low pH** • **Chemical mediators**	• Normal body temperature inhibits the growth of pathogens. Fever also inhibits the growth of pathogens. • Acidity of gastric secretions (HCl) kills most ingested microbes. • Lysozyme acts as antibacterial agent and cleaves the bacterial cell wall. Interferon's induce antiviral state in the uninfected cells. Complementary substances produced from leucocytes lyse the pathogenic microbes or facilitate phagocytosis.
3. Phagocytic bazrriers	Specialized cells (Monocytes, neutrophils, tissue macrophages) phagocytose, and digest whole micro -organisms.
4. Inflammatory barriers	Tissue damage and infection induce leakage of vascular fluid, containing chemotactic signals like serotonin, histamine and prostaglandins. They influx the phagocytic cells into the affected area. This phenomenon is called diapedesis.

Acquired immunity

- The immunity that an individual acquires after birth is known as acquired immunity. It is the body's resistance to a specific pathogen.

- The unique features of acquired immunity are antigenic specificity, diversity, recognition of self and non-self and immunological memory.

Components of acquired immunity

- Acquired immunity has two components – cell mediated immunity (CMI) and antibody mediated immunity or humeral immunity.

1. Cell mediated immunity

- When pathogens are destroyed by cells without producing antibodies, then it is knownas cell mediated immune response or cell mediated immunity. This is brought about by T cells, macrophages and natural killer cells.

2. Antibody mediated immunity or humoral immunity

- When pathogens are destroyed by the production of antibodies, then it is known as antibody mediated or humoral immunity. This is brought about by B cells with the help of antigen presenting cells and T helper cells. Antibody production is the characteristic feature of vertebrates only.

Types of acquired immunity

- Acquired immunity may be active immunity or passive immunity. The immunological resistance developed by the organisms through the production of antibodies in their body is called active immunity. Active immunity is acquired through the use of a person's immune responses, which lead to the development of memory cells. Active immunity results from an infection or an immunization. Passive immunity does not require the body to produce antibodies to antigens. The antibodies are introduced from outside into the organism. Thus, passive immunity is acquired without the activation of a person's immune response, and therefore there is no memory.

The process of production of blood cells in the bone marrow is called haematopoiesis.

S. No	Active Immunity	Passive immunity
1.	Active immunity is produced actively by host's immune system.	Passive Immunity is received passively and there is no active host participation.
2.	It is produced due to contact with pathogen or bu its antigen.	It is produced due to antibodies obtained from outside.
3.	It is durable and effective in protection	It is transient and les effective.
4.	Immunological memory is present.	No memory.
5.	Booster effect on subsequent does is possible.	Subsequent dose is less effective.
1.	Immunity is effective only after a short period.	Immunity develops immediately

Cells of the immune system

- The immune system is composed of many interdependent cells that protect the body from microbial infections and the growth of tumour cells. The cellular composition of adult human blood is given in Table8. 4.

Cell type	Number of cells per μ l	Approximate percentage
Red blood	4200,000- 6500,000	-
White blood cells		
i **Agranulocytes**		
• Lymphocytes	1500 - 4000	20 – 30
• Monocytes	200 - 950	2 – 7
ii **Granulocytes**		
• Neutrophils	2000 – 7000	50- 70
• Basophils	50 - 100	<1
• Eosinophils	40 - 500	2 – 5
• Platelets	150,000 – 500,000	

- All these cells are derived from pluripotent haematopoetic stem cells. Each stem cell had the capacity to produce RBC, WBC and platelets. The only cells capable of specifically recognising and producing an immune response are the lymphocytes. The other types of white blood cells play an important role in non-specific immune response, antigen presentation and cytokine production.

Lymphocytes

- About 20-30% of the white blood cells are lymphocytes. They have a large nucleus filling most of the cell, surrounded by a little cytoplasm. The two main types of lymphocytes are B and T lymphocytes. Both these are produced in the bone marrow. B lymphocytes (B cells) stay in the bone marrow until they are mature. Then they circulate around the body. Some remain in the blood, while others accumulate in the lymph nodes and spleen. T lymphocytes leave the bone marrow and mature in the thymus gland. Once mature, T cells also accumulate in the same areas of the body as B cells. Lymphocytes have receptor proteins on their surface. When receptors on a B cell bind with an antigen, the B cell becomes activated and divides rapidly to produce plasma cells. The plasma cells produce antibodies. SomeB cells do not produce antibodies but become memory cells. These cells are responsible for secondary immune response. T lymphocytes do not produce antibodies. They recognize antigen-presenting cells and destroy them. The two important types of T cells are Helper T cells and Killer T cells. Helper T cells release a chemical called cytokine which activates B cells. Killer cells move around the body and destroy cells which are damaged or infected (Fig. 8.6).

- Apart from these cells neutrophils and monocytes destroy foreign cells by phagocytosis. Monocytes when they mature into large cells, they are called macrophages which perform phagocytosis on any foreign organism.

Dendritic cells are called so because it's covered with long, thin membrane extensions that resemble dendrites of nerve cells. These cells present the antigen to T-helper cells. Four types of dendritic cells are known. They are Langerhans, interstitial cells, myeloid and lymphoid cells.

Antigens

- The term antigen (Ag) is used in two senses, the first to describe a molecule which generates an immune response and the second, a molecule which reacts with antibodies. In general antigens are large, complex molecular substances that can induce a detectable immune response. Thus an antigen is a substance that is specific to an antibody or a T-cell receptor and is often used as a synonym for immunogen.

The histocompatibility antigens are cell surface antigens that induce an immune response leading to rejection of allografts.

- An immunogen is a substance capable of initiating an immune response. Haptens are substance that are non-immunogenic but can react with the products of a specific immune response. Substances that can enhance the immune response to an antigen are called adjuvants. Epitope is an antigenic determinant and is the active part of an antigen. A paratope is the antigen – binding site and is a part of an antibody which recognizes and binds to an antigen.

Antigenicity is the property of a substance (antigen) that allows it to react with the products of the specific immune response.

Types of antigens

- On the basis of origin, antigens are classified into exogenous antigens and endogenous antigens. The antigens which enter the host from the outside in the form of microorganisms, pollens, drugs, or pollutants are called exogenous antigens. The antigens which are formed within the individual are endogenous antigens. The best examples are blood group antigens.

Antibodies

- Antibodies are immunoglobulin (Ig) protein molecules synthesized on exposure to antigen that can combine specifically with the antigen. Whenever pathogens enter our body, the B-lymphocytes produce an army of proteins called antibodies to fight with them. Thus, they are secreted in response to an antigen (Ag) by the effect of B cells called plasma cells. The antibodies are classified into five major categories, based on their physiological and biochemical properties. They are IgG (gamma), IgM (mu), IgA (alpha), IgD (delta) and IgE (epsilon).

- In the 1950s, experiments by Porter and Edelman revealed the basic structure of the immunoglobulin. An antibody molecule is Y shaped structure that comprises of four polypeptide chains, two identical light chains (L) of molecular weight 25,000 Da (approximately 214 amino acids) and two identical heavy chains (H) of molecular weight 50,000 Da (approximately 450 amino acids). The polypeptide chains are linked together by di-sulphide (S-S) bonds. One light chain is attached to each heavy chain and two heavy chains are attached to each other to form a Y shapedstructure. Hence, an antibody is represented by H2 L2. The heavy chains have a flexible hinge region at their approximate middles.

- Each chain (L and H) has two terminals. They are C - terminal (Carboxyl) and amino or N-terminal. Each chain (L and H) has two regions. They have variable (V) region at one end and a much larger constant (C) region at the other end. Antibodies responding to different antigens have very different (V) regions but their (C) regions are the same in all antibodies. In each arm of the monomer antibody, the (V) regions of the heavy and light chains combines to form an antigen – binding site shaped to 'fit' a specific antigenic determinant. Consequently each antibody monomer has two such antigen – binding regions. The (C) regions that forms the stem of the antibody monomer determine the antibody class and serve common functions in all antibodies. The functions of immunoglobulin are agglutination, precipitation, opsonisation, neutralization etc.,

Antigen and antibody interaction

- The reaction between an antigen and antibody is the basis for humoral immunity or antibody mediated immunity. The reaction between antigen and antibody occurs in three stages. During the first stage, the reaction involves the formation of antigen - antibody complex. The next stage leads to visible events like precipitation, agglutination, etc,.The final stage includes destruction of antigen or its neutralization (Fig. 8.8).

Binding force of antigen - antibody reaction

- The binding force between antigen and antibody is due to three factors. They are closeness between antigen and antibody, non-covalent bonds or intermolecular forces and affinity of antibody.When antigen and antibody are closely fitted, the strength of binding is great. When they are apart binding strength is low.The bonds that hold the antigen to the antibody combining site are all non-covalent in nature. These include hydrogen bonds, electrostatic bonds, Van der Waals forces and hydrophobic bonds. Antibody affinity is the strength of the reaction between a single antigenic determinant and a single combining site on the antibody.

- The chief application of antigen - antibody reactions are to determine blood groups for transfusion, to study serological ascertainment of exposure to infectious agents, to develop immunoassays for the quantification of various substances, to detect the presence or absence of protein in serum and to determine the characteristics of certain immunodeficiency diseases.

Different types of antigen and antibody reactions

- The reaction between soluble antigen and antibody leads to visible precipitate formation, which is called precipitin reaction. Antibodies that bring about precipitate formation on reacting with antigens are called as precipitins.
- Whenever a particulate antigen interacts with its antibody, it would result in clumping or agglutination of the particulate antigen, which is called agglutination reaction. The antibody involved in bringing about agglutination reaction is called agglutinin.

- Opsonisation or enhanced attachment is the process by which a pathogen is marked of ingestion and destruction by a phagocyte. Opsonisation involves the binding of an opsonin i.e., antibody, to a receptor on the pathogen's cell membrane. After opsonin binds to the membrane, phagocytes are attracted to the pathogen. So, opsonisation is a process in which pathogens are coated witha substance called an opsonin, marking the pathogen out for destruction by the immune system. This results in a much more efficient phagocytosis.

- The neutralization reactions are the reactions of antigen-antibody that involve the elimination of harmful effects of bacterial exotoxins or a virus by specific

antibodies. These neutralizing substances i.e., antibodiesare known as antitoxins. This specific antibody is produced by a host cell in response to a bacterial exotoxin or corresponding toxoid (inactivated toxin).

Vaccines

- A vaccine is a biological preparation that provides active acquired immunity to a particular disease and resembles a microorganism and is often made from weakened of attenuated or killed forms of the microbes, their toxins, or one of its surface proteins. Vaccines "teach "our body how to defend itself when viruses or bacteria, invade it/ Vaccines deliver only very little amounts of inactivated or weakened viruses or bacteria, or parts of them. This allows the immune system to recognize the organism without actually experiencing the diseases. Some vaccines need to be given more than once (i.e., a 'booster' vaccination) to make sure the immune system can overcome a real infection in the future.

- First generation vaccine is further subdivided into live attenuated vaccine, killed vaccine and toxoids (Fig. 8.9). Live attenuated vaccines use the weakened (attenuated), aged, less virulent form of the virus. E.g. Measles, mumps and rubella (MMR) vaccine and the Varicella (chickenpox) vaccine, Killed (inactivated) vaccines are killed or inactivated by heat and other methods. E.g. Salk's polio vaccine. Toxoid vaccines contain a toxin or chemical secreted by the bacteria or virus. They make us immune to the harmful effects of the infection, instead of to the infection itself. E.g. DPT vaccine (Diphtheria, Pertussis and Tetanus).

- Second generation vaccine contains the pure surface antigen of the pathogen. E.g.Hepatitis-B vaccine. Third generation vaccine contains the purest and the highest potency vaccines which are synthetic in generation. The latest revolution in vaccine is DNA vaccine or recombinant vaccine (Refer Chapter- 10 for details).

Vaccino therapy is the method of use of vaccine from treatment of disease. Dr. Edward Jenner prepared first vaccine for small pox in 1796. Polio vaccine was developed by Dr. Jonas Salk (vaccine consists of inactivated microorganism) and Dr. Albert Sabin (live attenuated oral poliacaccine). Louis Pasteur (1885) discovered vaccine against rabies, anthrax and cholera. BCG vaccine was developed by Calmette and Guerin against tuberculosis in France in the Year 1908.

Vaccination and immunization

- "Vaccination is the process of administrating a vaccine into the body or the act of introducing a vaccine into the body to produce immunity to a specific disease." Immunization is the process of the body building up immunity to a particular disease. Immunization describes the actual changes in the body after receiving a vaccine. Vaccines work by fighting the pathogen and then recording it in their memory system to ensure that the next time this pathogen enters the body, it is

eliminated far quickly. Once, the body is able to fight against the disease, it is believed to have built the immunity for it, also known as the body being immunized against the disease.

11th Zoology

Chapter 5 – Digestion and Absorption

Nutrients, Vitamins and Minerals

- Food comprises of macronutrients and micronutrients. The nutrients required inlarger quantities are called macronutrients, whereas those required in small quantities are called micronutrients. Essential nutrients cannot be synthesized by the body; they have to be included in the diet. Macronutrients are lipids, carbohydrates, proteins and the micronutrients are vitamins and minerals. Water plays an important role in the metabolic processes and prevents dehydration of the body.

- Intake of too much of food or lesser amount of food than the basic requirement is called malnutrition. A diet which can provide all the metabolic requirements ofthe body in a right proportion is called balanced diet. That means it shouldcontain carbohydrates and fats for energy yielding, proteins for growth and replacement; and vitamins, minerals and water for physiological regulation.

Vitamins:

- Vitamins are naturally occurring organic substances regularly needed in minutequantities for maintaining normal health as metabolic regulators. The identified vitamins are classified as fat soluble (A,D,E and K) and vitamin B and vitamin C are water soluble. Vitamin A, D, E and K, if consumed beyond required level may cause defects, commonly referred to as hypervitaminosis.

Minerals:

- These are the inorganic chemical elements, i.e., Ca, Fe, I, K, Mg, Na, P, S, etc needed for regulation of various physiological functions. These can be classified into major minerals (Na, P, K, Ca, Mg, S, Cl) and others are trace minerals such as Fe,Cu, Zn, Co, Mn, I, and fluorine. Sodium ions are more abundant than any other cation in the body fluids.

N.I. Lunin discovered vitamins but the name vitamin was given by Dr. Funk (1912).The first vitamin isolated was B1 by Dr.Funk. The first vitamin produced by fermentation process using, Acetobacter bacteria is Vitamin C.

Fat soluble vitamins		
Vitamins	**Functions**	**Symptoms of Deficiency**
A (Retinol)/ Antixerophthalmic vitamin	Plays a vital role in visual perception. Maintenance and growth of epithelial	Night blindness (Nyctalopia), Xerophthalmia

	tissue.	(drying of eyeballs), Bitot's spot in the cornea, Dermatosis(dry and scaly skin) and Keratomalacia Atrophy of lacrymal glands and reduction in tear secretion
D (Calciferol)/ Antirachiticvitamin	Promotes intestinal absorption of calcium and phosphorus. Formation of teeth and bones	Rickets in children (softness and deformities of bones and bow legs and pigeon chest) and Osteomalacia in adults (weak and fragile bones, bent, deformed pelvis).
E (Tocopherol) / Antisterility vitamin	Antioxidant It keeps the skin healthy by reduces the process of ageing	Sterility in animals, Ruptured red blood cells
K Anti haemorrahagic vitamin.	1. Required for the synthesis of prothrombin in the liver.	Defect in blood clotting called Haemorrhagic manifestations.

Water Soluble Vitamins

Vitamins	**Functions**	**Symptoms of Deficiency**
B1 (Thiamine)	Involved in carbohydrate metabolism. Act as a coenzyme	**Beriberi:**affects muscular, nervous and cardiovascular system
B2 (Riboflavin)	Acts as coenzyme in oxidation and reduction reactions	Inflammation, soreness and fissures in the corners of the mouth, lips and tongue. Loss of appetite. Skin and eye disorder
B3 (Pantothenic acid)	Acts as coenzyme A and is essential for the metabolism of fats and carbohydrates	Gastrointestinal disorders, anaemia, Burning feet syndrome, etc.
B4 (choline)	Precursor for acetylcholine	Fatty liver
B5 (Niacin / Nicotinic acid)	Derivatives of coenzymes	Pellagra (4D Syndrome) characterized by dermatitis, diarrhoea and dementia (mental deterioration) and death.
B6 (Pyridoxine)	Haemoglobin formation,	Dermatitis, convulsions,

	brain, heart and liver activities	muscular twitching and anaemia
B7(Biotin) / Vit.H	Acts as a coenzyme in synthesis of fat, glycogen and amino acids	Dermatitis
B9 (Folic acid)	It acts as a co-enzyme for synthesis of nucleic acid and essential for growth and formation of RBC	Megaloblastic anaemia (large, immature, nucleated RBC in blood)
B12 (Cobalamine)	Promotes DNA synthesis. Necessary for maturation of RBC and formation of myelin sheath.	Pernicious anaemia (immature nucleated RBC without haemoglobin). Causes nervous disorder
C (Ascorbic acid)	Acts as an antioxidant. Strengthens the immune system. Necessary for healthy gums and teeth.	Scurvy (Sailor's disease) characterized by spongy and bleeding gums, falling of teeth, fragile bones, delayed wound healing etc. - Infantile scurvy)

Food adulterants cause harmful effects in the form of headaches, palpitations, allergies, cancers and in addition reduces the quality of food. Common adulterants are addition of citric acid to lemon juice, papaya seeds to pepper, melamine to milk, vanillin for natural vanillin, red dyes to chillis, lead chromate and lead tetraoxide to turmeric powder, etc.,

Caloric value of carbohydrates, proteins and fats

- We obtain 50% energy from carbohydrates 35% from fats and 15% from proteins. We require about 400 to 500 gm of carbohydrates, 60 to 70 gm of fats and 65 to 75 gm of proteins per day. Balanced diet of each individual will vary according to their age, gender, level of physical activity and others conditions such as pregnancy and lactation.

- Carbohydrates are sugar and starch. These are the major source of cellular fuel which provides energy. The caloric value of carbohydrate is 4.1 calories per gram and its physiological fuel value is 4 Kcal per gram.

- Lipids are fats and derivatives of fats, are also the best reserved food stored in our body which is used for production of energy. Fat has a caloric value of 9.45 Kcaland a physiological fuel value of 9 Kcal per gram.

Many research findings have proven that usage of chemical preservatives and artificial enhancers lead to highly harmful effects. It includes heart ailments, hypertension, infertility, gastrointestinal disorders, early puberty in girls, weakening

of bones, damage in organs like kidney and liver, chronic obstructive pulmonary diseases, headache, allergies, asthma, skin rashes and even cancer. Remember that nothing will beat and overtake the taste and safety of homemade foods. "East or west home preparation is the best."

- Proteins are source of amino acids required for growth and repair of bodycells. They are stored in the body only to a certain extent; large quantities are excreted as nitrogenous waste. The caloric value and physiological fuel value of one gram of protein are 5.65 Kcal and 4 Kcal respectively. According to ICMR (Indian Council of Medical Research and WHO (World Health Organization), the daily requirement of protein for an average Indian is 1gm per 1 kg body weight.

Nutritional and digestive disorders

- Intestinal tract is more prone to bacterial, viral and parasitic worm infections. Thisinfection may cause inflammation of the inner lining of colon called colitis. The most common symptoms of colitis are rectal bleeding, abdominal cramps, and diarrhoea.

10th Full Book

Unit 21 – Health & Disease

Drug, Alcohol and Tobacco Abuse

- The physical and mental dependency on alcohol, smoking and drugs is called addiction. The addictive potential of these substances pulls an individual into a vicious cycle leading to regular abuse and dependency. This is of serious concern because abuse of tobacco, alcohol or drugs produce many harmful effects in an individual, to the family and even to the society. This dangerous behavior pattern among youth can be prevented through proper guidance.

Drug Abuse

- Drugs are normally used for the treatment of disease on advice of a physician and withdrawn after recovery. A person who is habituated to a drug due to its prolonged use is called drug addict. This is called drug addiction or drug abuse.

- A drug that modifies the physical, biological, psychological or social behaviour of a person by stimulating, depressing or disturbing the functions of the body and the mind is called addictive drug. These drugs interact with the central nervous system and affect the individual physically and mentally.

Types of Drugs

- There are certain drugs called psychotropic drugs which acts on the brain and alter the behaviour, consciousness, power of thinking and perception. They are referred as mood altering drugs.

Drug Dependence

- Persons who consume these drugs become fully dependent on them, they cannot live without drugs. This condition is referred as drug dependence.

➢ **Physical and mental dependence**

- Dependence on the drug for normal condition of well being and to maintain physiological state.

➢ **Psychological dependence** is a feel that drugs help them to reduce stress.

➢ International Day against Drug Abuse and Illicit Trafficking - June 26.
➢ Narcotic Drugs and Psychotropic Substances Act was introduced in 1985.

Behavioural Changes of Drug Users

- Adverse effects of drug use among adolescents are

- Drop in academic performance, absence from school or college.
- Lack of interest in personal hygiene, isolation, depression, fatigue and aggressive behaviour.
- Deteriorating relationship with family and friends.
- Change in food and sleeping habits
- Fluctuation in body weight and appetite
- Always looking out for an easy way to get money for obtaining drugs.
- Prone to infections like AIDS and Hepatitis-B.

World Health Organization (WHO) 1984 suggested the use of the term drug dependence in place of drug addiction or drug abuse

Drug De-addiction

- Management of de-addiction is a complicated and difficult task. The path to recovery of drug addicts is long and often slow.
- Family members, friends and society on the whole have a very important role to play.
  - ✓ **Detoxification:** The first phase of treatment is detoxification. The drug is stopped gradually and the addict is helped to overcome the withdrawal symptoms. The addict undergoes severe physical and emotional disturbance. This is taken care by specific medication.
  - ✓ **Psychotherapy:** Individual and group counselling is given by psychologists and counsellors. The treatment includes efforts to reduce the addict's stress, taught new ways to solve everyday's problems, adequate diet, rest and relaxation.
  - ✓ **Counselling to family members:** Social workers counsell family members in order to change the attitude of rejection so that the addict is accepted by the family and the society.
  - ✓ **Rehabilitation:** They are given proper vocational training so that they can lead a healthy life and become useful members of the society.

Tobacco Abuse

- Tobacco is obtained from the tobacco plant Nicotianatobaccum and Nicotianarustica. The dried and cured leaves of its young branches make the commercial tobacco used worldwide. Addiction to tobacco is due to 'nicotine' an alkaloid present in it. Nicotine is a stimulant, highly harmful and poisonous substance.

Tobacco Use

- Tobacco is used for smoking, chewing and snuffing. Inhaling tobacco smoke from cigars, cigarettes, bidis, pipes, hukka is called smoking. Tobacco in powder form is chewed with pan. When powdered tobacco is taken through nose, it is called snuffing.

Smoking Hazards and Effects of Tobacco

- When smoke is inhaled, the chemicals get absorbed by the tissues and cause the following harmful effects

- **Benzopyrene** and **polycyclic hydrocarbons** present in tobacco smoke is carcinogenic causing lung cancer.

- Causes inflammation of throat and bronchi leading to conditions like bronchitis and pulmonary tuberculosis.

- Inflammation of lung alveoli, decrease surface area for gas exchange and cause emphysema.

- Carbon monoxide of tobacco smoke binds to haemoglobin of RBC and decreases its oxygen carrying capacity causing hypoxia in body tissues.

- Increased blood pressure caused by smoking leads to increased risk of heart disease.

- Causes increased gastric secretion which leads to gastric and duodenal ulcers.

- Tobacco chewing causes oral cancer (mouth cancer).

Prevention of Smoking

- Knowing the dangers of smoking and chewing tobacco adolescents and the old people need to avoid these habits. Proper counselling and medical assistance can help an addict to give up the habit of smoking.

Alcohol Abuse

- The consumption of alcohol is a social evil practiced by the wealthier and poorer sections of the society. The dependence of alcohol is called alcoholism and the addict is termed as alcoholic. It is called alcohol abuse. Drinking of alcohol impairs one's physical, physiological and psychological functions.

Harmful Effects of Alcohol to Health

- Prolonged use of alcohol depresses the nervous system, by acting as a sedative and analgesic substance. Some of the harmful effects are

➢ Nerve cell damage resulting in various mental and physical disturbances

➢ Lack of co-ordination of body organs

➢ Blurred or reduced vision, results in road accidents

➢ Dilation of blood vessels which may affect functioning of the heart

➢ Liver damage resulting in fatty liver which leads to cirrhosis and formation of fibrous tissues

➢ Body loses its control and consciousness eventually leading to health complications and ultimately to death.

Rehabilitation Measures for Alcoholics

✓ **Education and counselling:** Education and proper counselling will help the alcoholics to overcome their problems and stress, to accept failures in their life.

✓ **Physical activity:** Individuals undergoing rehabilitation should be channelized into healthy activities like reading, music, sports, yoga and meditation.

✓ **Seeking help from parents and peer groups:** When a problematic situation occurs, the affected individuals should seek help and guidance from parents and peers. This would help them to share their feeling of anxiety, wrong doing and get rid of the habit.

✓ **Medical assistance:** Individual should seek help from psychologists and psychiatrists to get relieved from this condition and to lead a relaxed and peaceful life.

- Alcohol de-addiction and rehabilitation programmes are helpful to the individual so that they could get rid of the problem completely and can lead a normal and healthy life.

Diseases and Disorders due to Lifestyle Modifications

- Diseases are prevalent in our society due to our improper way of living, conditions of stress and strain. These diseases are non-communicable and affect the person who are suffering from particular symptoms. It is an impairment of the body tissue or organ, disturbances in metabolic function which require modification of an individual's normal life.

Diabetes Mellitus

- Diabetes mellitus is a chronic metabolic disorder. In Greek (Diabetes – running through; mellitus- sweet). It is characterised by increased blood glucose level due to insufficient, deficient or failure of insulin secretion. This is the most common pancreatic endocrine disorder. The incidence of Type-1 and Type-2 diabetes is increasing worldwide.

Type-1 Insulin Dependent Diabetes Mellitus (IDDM)

- IDDM accounts for 10 to 20% of the known diabetics. The condition also occurs in children (juvenile onset diabetes) and young adults, the onset is usually sudden and can be life threatening. This is caused by the destruction of β-cells of the pancreas. It is characterized by abnormally elevated blood glucose levels (hyperglycemia) resulting from inadequate insulin secretion.

Causes: Genetic inheritance and environmental factors (infections due to virus, acute stress) are the cause for this condition.

Type-2 Non-Insulin Dependent Diabetes Mellitus (NIDDM)

- This is also called as adult onset diabetes and accounting for 80 to 90% of the diabetic population. It develops slowly, usually milder and more stable. Insulin production by the pancreas is normal but its action is impaired. The target cells do not respond to insulin. It does not allow the movement of glucose into cells.

Causes: The causes are multifactorial which include increasing age (affecting middle aged and older people), obesity, sedentary life style, overeating and physically inactive.

Symptoms: Diabetes mellitus is associated with several metabolic alterations.The most important symptoms are

- Increased blood glucose level (Hyperglycemia)

- Increased urine output (Polyuria) leading to dehydration
- Loss of water leads to thirst (Polydipsia) resulting in increased fluid intake
- Excessive glucose excreted in urine (Glycosuria)
- Excess hunger (Polyphagia) due to loss of glucose in urine.
- Fatigue and loss of weight

According to WHO recommendation, if the fasting blood glucose is greater than 140 mg/dl or the random blood glucose is greater than 200 mg /ml on more than two occasions, diagnosis for confirming diabetes is essential.

Prevention and Control of Diabetes

- Diet, hypoglycemic drugs, insulin injection and exercise are the management options based on the type and severity of the condition. The overall goal of diabetes management is to maintain normal blood glucose level.

Differences between Type-1 and Type-2 Diabetes Mellitus

Factors	**Type-1 Insulin Dependent Diabetes Mellitus (IDDM)**	**Type-2 Non-Insulin Dependent Diabetes Mellitus (NIDDM)**
Prevalence	10-20%	80 – 90%
Age of onset	Juvenile onset (<20 Years)	Maturity onset (>30 Years)
Body Weight	Normal or underweight	obese
Defect	Insulin deficiency due to destruction of β – cells.	Target cells do respond to insulin
Treatment	Insulin administration is necessary	Can be controlled by diet, exercise and medicine

- ✓ **Dietary management:** Low carbohydrate and fibre rich diets are more appropriate. Carbohydrates should be taken in the form of starch and complex sugars. Refined sugars (sucrose and glucose) should be avoided. Diet comprising whole grains, millets (jowar, bajra, ragi), green leafy vegetables, wheat and unpolished rice should be included in diet regularly. Carbohydrates is maintained to about 50- 55% of the total calories. High protein content of 10-15% of the total intake is required to supply essential amino acids. Fat content in the diet should be 15-25% of the total calories. Saturated fat intake should be reduced. Polyunsaturated fatty acid content should be higher.

- ✓ **Management with insulin:** Commercially available insulin preparations (short and long acting) are also used to maintain blood glucose levels.

- ✓ **Physical activity:** Exercise plays an important role in facilitating a good control of diabetes, in addition to strengthening and toning up the muscles.

- ✓ **Education and Awareness:** People with diabetics should be educated on the nature of disease they have and the possibility of complications of the disease, if blood sugar is not kept under control. Instructions regarding diet, exercise and drugs should be explained.

Obesity

- Obesity is the state in which there is an accumulation of excess body fat with an abnormal increase in body weight. Obesity is a complex multifactorial chronic disease developing from influence of social, behavioural, psychological, metabolic and cellular factors.

- Obesity occurs if intake of calories is more than the expenditure of energy. Over weight and obesity are conditions where the body weight is greater than the mean standard weight for age and height of an individual. Body mass index (BMI) is an estimate of body fat and health risk.

$$\textbf{BMI = Weight (kg) / Height (m)}^{2.}$$

Causes and risk factors: Obesity is due to genetic factors, physical inactivity, eating habits (overeating) and endocrine factors. Obesity is a positive risk factor in development of hypertension, diabetes, gall bladder disease, coronary heart disease and arthritis.

Prevention and Control of Obesity

- ➢ **Diet Management:** Low calorie, normal protein, vitamins and mineral, restricted carbohydrate and fat, high fiber diet can prevent overweight. Calorie restriction for weight reduction is safe and most effective.

- ➢ **Physical exercise:** A low calorie diet accompanied by moderate exercise will be effective in causing weight loss. Meditation, yoga and physical activity can also reduce stress related to overeating.

Heart Disease

- Cardiovascular disease (CVD) is associated with diseases of the heart and blood vessels. Coronary heart disease (CHD) is the most common form and is caused by deposition of cholesterol in the blood vessels.

- It usually develops slowly over many years beginning from childhood, they may form a fatty streak to a fibrous complicated plaque. It leads to the narrowing of blood vessels leading to atherosclerosis in the large and medium sized arteries that supply the heart muscle with oxygen. It leads to sudden ischemia (deficient blood supply to heart muscle) and myocardial infarction (death of the heart muscle tissue).

- **Risk factors:** Hypercholesterolemia (High blood cholesterol) and high blood pressure (Hypertension) are the major causes and contributing factors for heart disease and if untreated may cause severe damage to brain, kidney and eventually lead to stroke.

- **Causes:** Heredity (family history), diet rich in saturated fat and cholesterol, obesity, increasing age, cigarette smoking, emotional stress, sedentary lifestyle, excessive alcohol consumption and physical inactivity are some of the causes.

- **Symptoms:** Shortness of breath, headache, tiredness, dizziness, chest pain, swelling of leg, and gastrointestinal disturbances.

HDL (High Density Lipoprotein) or "good" cholesterol lowers risk of heart disease while LDL (Low Density Lipoprotein) or "bad" cholesterol increases risk of heart disease.

Prevention and Control of Heart Disease

- **Diet management:** Reduction in the intake of calories, low saturated fat and cholesterol rich food, low carbohydrates and common salt are some of the dietary modifications. Diet rich in polyunsaturated fatty acids (PUFA) is essential. Increase in the intake of fibre diet, fruits and vegetables, protein, minerals and vitamin are required.

- **Physical activity:** Regular exercise, walking and yoga are essential for body weight maintenance

- **Addictive substance avoidance:** Alcohol consumption and smoking are to be avoided.

Cancer

- Cancer causes about 4 million deaths annually throughout the world. In India more than one million people suffer from cancer. Cancer is derived from Latin word meaning crab. The study of cancer is called Oncology (Oncos- Tumor).

- Cancer is an abnormal and uncontrolled division of cells that invade and destroy surrounding tissue forming a tumor or neoplasm (new growth). It is a heterogenous group of cells that do not respond to the normal cell division.

- The cancerous cells migrate to distant parts of the body and affect new tissues. This process is called metastasis. The frequent sites of metastasis are lungs, bones, liver, skin and brain.

Types of Cancers

- Cancers are classified on the basis of the tissues from which they are formed.

➢ Carcinomas arise from epithelial and glandular tissues. They include cancers of skin, lung, stomach and brain. About 85% of the tumours are carcinomas

➢ Sarcomas are occur in the connective and muscular tissue. They include the cancer of bones, cartilage, tendons, adipose tissue and muscles. These form 1% of all tumours.

➢ Leukaemia are characterized by an increase in the formation of white blood cells in the bone marrow and lymph nodes. Leukaemia are called blood cancers. Most common type of cancer which also affect children below 15 years of age.

Carcinogenic Agents

- Cancer causing agents are called carcinogens. They are physical, chemical agents, ionizing radiations and biological agents.

  ✓ **Physical Irritant:** Heavy smoking causes lung cancer and cancers of oral cavity, pharynx (throat) and larynx. Betel and tobacco chewing causes oral cancer. Excessive exposure to sunlight may cause skin cancer.

  ✓ **Chemical agents:** Nicotine, caffeine, products of combustion of coal and oil, pesticides, asbestos, nickel, certain dyes and artificial sweetners induce cancer

  ✓ **Radiations:** Ionizing radiations like X-rays, gamma- rays, radioactive substances and non-ionising radiations like UV rays cause DNA damage leading to cancer.

  ✓ **Biological agents:** Cancer causing viruses are called oncogenic viruses.

Treatment of Cancer

The treatment of cancer involves the following methods:

➢ **Surgery:** Tumours are removed by surgery to prevent further spread of cancer cells.

- **Radiation therapy:** Tumour cells are irradiated by lethal doses of radiation while protecting the surrounding normal cells.

- **Chemotherapy:** It involves administration of anticancerous drugs which prevent cell division and are used to kill cancer cells.

- **Immunotherapy:** Biological response modifiers like interferons are used to activate the immune system and help in destroying the tumors.

Preventive measures for Cancer

- Cancer control programmes should focus on primary prevention and early detection.

- To prevent lung cancer tobacco smoking is to be avoided and protective measures to be taken against exposure to toxic pollutants of industries. Excessive exposure to radiation is to be avoided to prevent skin cancer.

AIDS (Acquired Immunedeficiency Syndrome)

- AIDS is a severe viral disease and caused by Human Immunodeficiency Virus (HIV). It is a condition in which immune system fails and suppress the body's disease fighting mechanism. They attack the lymphocytes and the affected individual is prone to infectious diseases.

Dr.Suniti Solomon, pioneered HIV research and treatment in India. She set up the first voluntary testing and counselling centre and an AIDS Research group in Chennai during 80's. Her team was the first to document evidence of HIV infection in India in 1985 (First Indian AIDS patient in Chennai).

Transmission of HIV

- AIDS virus has been found in urine, tears, saliva, breast milk and vaginal secretions. The virus is transmitted by an infected patient who comes in contact with blood of a healthy person. HIV/AIDS is not transmitted by touch or any physical contact. It spreads through contact of body fluids or blood.

HIV is transmitted generally by

- Sexual contact with infected person
- Use of contaminated needles or syringes especially in case of intravenous drug abusers
- By transfusion of contaminated / infected blood or blood products
- From infected mother to her child through placenta.

Symptoms and Treatment of AIDS

Symptoms: Infected individuals become immunodeficient. The person becomes more susceptible to viral, bacterial, protozoan and fungal infections. Swelling of lymph nodes, damage to brain, loss of memory, lack of appetite and weight loss, fever, chronic diarrhoea, cough, lethargy, pharyngitis, nausea and headache.

Diagnosis: The presence of HIV virus can be confirmed by Western Blot analysis or Enzyme Linked Immunosorbent Assay (ELISA)

Treatment: Anti-retroviral drugs and immunestimulative therapy can prolong the life of the infected person.

Prevention and Control of AIDS

- The following steps may help in controlling and prevent the spreading of HIV infection

- Screening of blood from blood banks for HIV before transfusion.
- Ensuring the use of disposable needles and syringes in hospitals and clinics.
- Advocating safe sex and advantages of using condoms.
- Creating awareness campaign and educating people on the consequences of AIDS.
- Persons with HIV/AIDS should not be isolated from the family and society.

9th Full Book

Unit 21- Nutrition & Health

Classes of Nutrients

Nutrients are classified into the following major groups as given below.

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals

Carbohydrates

- Carbohydrates are organic compounds composed of carbon, hydrogen and oxygen. Carbohydrate is an essential nutrient which provides the chief source of energy to the body. Glucose, sucrose, lactose, starch, cellulose are examples for carbohydrates.

- Carbohydrates are classified as monosaccharide (Glucose), disaccharide (Sucrose) and polysaccharide (Cellulose). The classification is based on the number of sugar molecules present in each group.

Proteins

- Proteins are the essential nutrients and also the building blocks of the body. They are essential for growth and repair of body cells and tissues. Proteins are made of amino acids.

- Essential amino acids are those that cannot be biosynthesized by the body and must be obtained from the diet. The nine essential amino acids are phenylalanine, valine, threonine, tryptophan, methionine, leucine, isoleucine, lysine and histidine.

Fats

- Fat in the diet provides energy. They maintain cell structures and are involved in metabolic functions.

- Essential fatty acids cannot be synthesized in the body and are provided through diet. Essential fatty acids required in human nutrition are omega fatty acids.

Vitamins

- Vitamins are the vital nutrients, required in minute quantities to perform specific physiological and biochemical functions.

Human skin can synthesize Vitamin D when exposed to sunlight (especially early morning). When the sun rays falls on the skin dehydrocholesterol is converted into Vitamin D. Hence, Vitamin D is called as Sunshine vitamin. Vitamin D improves bone strength by helping body to absorb calcium.

Minerals

- Minerals are inorganic substances required as an essential nutrient by organisms to perform various biological functions necessary for life. They are the constituents of teeth, bones, tissues, blood, muscle and nerve cells.

- The macrominerals required by the human body are calcium, phosphorus, potassium, sodium and magnesium. The microminerals required by the human body also called trace elements are sulfur, iron, chlorine, cobalt, copper, zinc, manganese, molybdenum, iodine and selenium.

Protein Energy Malnutrition (PEM)

- Absence of certain nutrients in our daily diet over a long period of time leads to deficiency diseases. This condition is referred as Malnutrition. Deficiency of proteins and energy leads to severe conditions like: Kwashiorkar and Marasmus.

- **Kwashiorkar:** It is a condition of severe protein deficiency. It affects children between 1-5 years of age, whose diet mainly consists of carbohydrates but lack in proteins.

- **Marasmus:** It usually affects infants below the age of one year when the diet is poor in carbohydrates, fats and proteins.

Dietary sources of major foodstuffs

Major food Stuffs	Dietary sources	Daily requirements (grams)
Carbohydrates	Honey, Sugarcane, fruits, whole grains, starchy vegetables, rice	150-200
Proteins	Legumes, pulses , nuts, soya bean, green leafy vegetables, fish, poultry products, egg, milk and dairy products	40

Fats	Egg Yolk, saturated oil, meat	35

Vitamins-Dietary sources, Deficiency disorders and Symptoms

Vitamins	Dietary sources	Deficiency disorders	Symptoms
Fat Soluble Vitamins			
Vitamin A(Retinol)	Carrot, Papaya, leafy vegetables, fish liver oil, egg yolk, liver, dairy products	XerophthalmiaNyctalopia (Night blindness)	Dryness of Cornea unable to see in the night (dim light) scaly skin.
Vitamin D (Calciferol)	Egg, liver, dairy products, Fish, Synthesized by the skin in sunlight	Rickets (in children)	Bow legs, defective ribs, development of pigeon chest.
Vitamin E (Tocopherol)	Whole Wheat, meat, vegetable oil, milk.	Sterility in rats, Reproductive abnormalities	Sterility
Vitamin K (Derivative of Quinone)	Leafy vegetables, Soyabeans, milk	Blood Clotting is prevented	Excessive bleeding due to delayed blood clotting.
Water Soluble Vitamins			
Vitamin B1 (Thiamine)	Whole grains, Yeast, eggs, liver, sprouted pulses	Beriberi	Degenerative changes in the nerves, muscles become weak, Paralysis.
Vitamin B2 (Riboflavin)	Milk, eggs, liver, green vegetables, whole grains	Ariboflavinosis (Cheilosis)	Irritation in eyes, dry skin, inflammation of lips, fissures in the corners of the mouth.
Vitamin B3 (Niacin**)**	Milk, eggs, liver, lean meat, ground nuts, bran	Pellagra	Inflammation of skin, loss of memory, diarrhoea
Vitamin B6 (Pyridoxine)	Meat, fish, eggs, germs of	Dermatitis	Scaly skin, nervous

	grains and cereals, rice polishings.		disorders.
Vitamin B12 (Cyanocobalamine)	Milk, meat, liver, pulses, cereals, fish	Pernicious anaemia	Decrease in red blood cell production, degeneration of spinal cord.
Vitamin C (Ascorbic acid)	Leafy vegetables, sprouts, citrus fruits like gooseberry (Amala), lemon, orange	Scurvy	Swollen and bleeding gums, delay in healing of wounds, teeth and bones malformed.

Minerals - Dietary sources, Functions and Deficiency disorders

Minerals	**Sources**	**Functions**	**Deficiency disorders**
Macro nutrients			
Calcium	Dairy Products, beans, cabbage, eggs, fish	Constituent of bones and enamel of teeth, clotting of blood and controls muscle contraction.	Bone deformities, poor skeletal growth, Osteoporosis in adults.
Sodium	Common Salt	Maintains fluid balance and involved in neurotransmission	Muscular cramps, nerve impulses do not get transmitted.
Potassium	Banana, Sweet Potato, nuts, whole grains, citrus fruits	Regulates nerve and muscle activity	Muscular fatigue, nerve impulses do not get transmitted.
Micro nutrients			
Iron	Spinach, dates, greens, broccoli, whole cereals, nuts, fish, liver	Important component of haemoglobin	Anaemia
Iodine	Milk, Seafood, Iodised salt	Formation of thyroid hormones.	Goitre

Food Preservation

- Food preservation is the process of prevention of food from decay or spoilage, by storing in a condition fit for future use. Food is preserved to:

- increase the shelf life of food
- retain the colour, texture, flavour and nutritive value
- increase food supply
- decrease wastage of food

Methods of Food Preservation
The various method of food preservation are explained below

- Drying**:** Drying is the process of preservation of food by removal of water/moisture content in the food. It can be done either by sun-drying, (e.g. cereals, fish) or vacuum drying (e.g. milk powder, cheese powder) or hot air drying (e.g. grapes, dry fruits, potato flakes). Drying inhibits the growth of microorganism such as bacteria, yeasts and moulds.

- Smoking**:** In this process, food products like meat and fish are exposed to smoke. The drying action of the smoke tends to preserve the food.

- Irradiation**:** Food irradiation is the process of exposing food to optimum levels of ionizing radiations like x-rays, gamma rays or UV rays to kill harmful bacteria and pests and to preserve its freshness.

- Cold **storage:** It is a process of storing the perishable foods such as vegetables, fruits and fruit products, milk and milk products etc. at low temperature. Preserving the food products at low temperature slows down the biological and chemical reactions and prevents its spoilage.

- Freezing**:** Freezing is one of the widely used methods of food preservation. This process involves storing the food below 00C at which microorganisms cannot grow, chemical reactions are reduced and metabolic reactions are also delayed.

Pasteurization: Pasteurization is a process of heat treatment of liquid food products. e.g. For preservation of milk and beverages. This process also involves boiling of milk to a temperature of 63°C for about 30 minutes and suddenly cooling to destroy the microbes present in the milk.

Bananas are best stored at room temperature. When it is kept in a refrigerator, the enzyme responsible for ripening becomes inactive. In addition, the enzyme responsible for browning and cell damage becomes more active thereby causing the skin colour change from yellow to dark brown

- Canning**:** In this method of food preservation, most vegetables, fruits, meat and dairy products, fruit juices and some ready-to-eat foods are processed and stored in a clean, steamed air tight containers under pressure and then sealed. It is then subjected to high temperature and cooled to destroy all microbes.

Addition of Preservatives

- Food can be preserved by adding natural and synthetic preservatives.

Natural preservatives

- Some naturally available materials like salt, sugar and oil are used as food preservatives.

- Addition **of salt:** It is one of the oldest methods of preserving food. Addition of salt removes the moisture content in the food by the process of osmosis. This prevents the growth of bacteria and reduces the activity of microbial enzymes. Meat, fish, gooseberry, lemon and raw mangoes are preserved by salting. Salt is also used as a preservative in pickles, canned foods etc.

- Addition **of sugar:** Sugar/Honey is added as a preservative to increase the shelf life of fruits and fruit products like jams, jellies, squash, etc. The hygroscopic nature of sugar/honey helps in reducing the water content of food and also minimizing the process of oxidation in fruits.

- **Addition of oil:** Addition of oil in pickles prevents the contact of air with food. Hence microorganisms cannot grow and spoil the food.

Synthetic preservatives

- Synthetic food preservatives like sodium benzoate, citric acid, vinegar, sodium meta bisulphate and potassium bisulphate are added to food products like sauces, jams, jellies, packed foods and ready- to- eat foods. These preservatives delay the microbial growth and keep the food safe for long duration.

Food Adulteration

- Adulteration is defined as the addition or subtraction of any substance to or from food, so that the natural composition and the quality of food substance is affected. Adulterant is any material which is used for the purpose of adulteration.

- Some of the common adulterated foods are milk and milk products, cereals, pulses, coffee powder, tea powder, turmeric powder, saffron, confectionary, non-alcoholic beverages, spices, edible oils, meat, poultry products etc. The adulterants in food can be classified in three categories:

- Natural adulterants
- Incidental/unintentionally added adulterants
- Intentionally added adulterants.

Natural adulterants

- Natural adulterants are those chemicals or organic compounds that are naturally present in food. e.g. toxic substances in certain poisonous mushrooms, Prussic acid in seeds of apples and cherry, marine toxins, fish oil poisoning, environmental contaminants.

Incidental/unintentionally added adulterants

- These types of adulterants are added unknowingly due to ignorance or carelessness during food handling and packaging. It includes:

- Pesticide residues
- Droppings of rodents, insects, rodent bites and larva in food during its storage
- Microbial contamination due to the presence of pathogens like Escherichia coli, Salmonella in fruits, vegetables, ready-to-eat meat and poultry products.

Intentionally added adulterants

- These adulterants are added intentionally for financial gain and have serious impact on the health of the consumers. These types of adulterants include:

- Additives and preservatives like vinegar, citric acid, sodium bicarbonate (baking soda), hydrogen peroxide in milk, modified food starch, food flavours, synthetic preservatives and artificial sweeteners.

- Chemicals like calcium carbide to ripen bananas and mangoes.

- Non certified food colours containing chemicals like metallic lead are used to give colours to vegetables like green leafy vegetables, bitter gourd, green peas etc. These colours are added to give a fresh look to the vegetables.

- Edible synthetic wax like shellac or carnauba wax is coated on fruits like apple, pear to give a shining appearance.

Health Effects of Adulterated Foods

- Consumption of these adulterated foods may lead to serious health effects like fever, diarrhoea, nausea, vomiting, gastrointestinal disorders, asthma, allergy, neurological disorder, skin allergies, immune suppression, kidney and liver failure, colon cancer and even birth defects.

Food Quality Control

- The government always ensures that pure and safe food is made available to the consumers. In 1954, the Indian Government enacted the Food Law known as Prevention of Food Adulteration Act and the Prevention of Food Adulteration Rules in 1955 with the objective of ensuring pure and wholesome food to the consumers and protect them from fraudulent trade practices.

- Minimum standards of quality for food and strict hygienic conditions for its sale are clearly outlined in the Act

A slogan From farm to plate, make food safe was raised on World Health Day (7th April 2015) to promote and improve food safety.

Food Quality Control Agencies

- ISI, AGMARK, FPO, FCI and other health departments enforce minimum standards for the consumer products. FCI (Food Corporation of India) was set up in the year 1965 with the following objectives:

- Effective price support operations for safeguarding the interest of farmers.
- Distributing food grains throughout the country.
- Maintaining satisfactory levels of operational and buffer stock of food grains to ensure national security.
- Regulate the market price to provide food grains to consumers at reliable price.

Unit – 22 – Worlds of Microbes

Airborne Diseases

Human beings inhale atmospheric air. Due to continuous inhalation of contaminated air the chances for airborne microorganisms to find a host and cause infection are higher.

Most of the respiratory tract infections are acquired by inhaling air containing the pathogen that are transmitted through droplets caused by cough or sneeze, dust and spores.

Airborne diseases are caused by bacteria and viruses. A few air borne diseases and their modes of transmission are given in the table below.

Disease	Causative Organism	Mode of Transmission	Tissue/ Organ Affected	Symptoms
Common Cold	Rhino virus	Droplet infection	Upper respiratory tract (Inflammation of nasal chamber)	Fever, cough, running nose, sneezing and headache
Influenza	Myxovirus	Droplet Infection	Respiratory tract, (Inflammation of nasal mucosa, pharynx)	Fever, body pain, cough, sore throat, nasal discharge, respiratory congestion
Measles	Rubeola virus	Droplet infection, droplet nuclei and direct contact with infected person	Respiratory tract	Eruption of small red spots or rashes in skin, cough, sneezing, redness of eye (conjunctiva), pneumonia, bronchitis
Mumps	Myxovirus parotidis	Droplet infection, droplet nuclei and direct contact with infected	Upper respiratory tract	Enlargement of parotid gland, movement of jaw becomes difficult

		person		
Chicken Pox	Varicella zoster virus	Droplet infection, droplet nuclei and direct contact with infected person	Respiratory tract	Eruptions of the skin, fever and Uneasiness
Tuberculosis	Mycobacterium Tuberculosis	Droplet infection from sputum of infected persons	Lungs	Persistent cough, chest pain, loss of weight and appetite
Diptheria	Cornyebacterium Diphtheria	Droplet infection, droplet nuclei	Upper Respiratory tract (nose, throat)	Fever, sore throat, choking of air passage
Whooping Cough	Bordetalla pertussis	Droplet infection, direct contact with infected person	Respiratory tract	Mild fever, severe cough ending in whoop (loud crowing inspiration)

Waterborne Diseases

Microbes present in the contaminated water cause various infectious diseases. Some of the water borne diseases are cholera, typhoid,infectious hepatitis, poliomyelitis, diarrhoea, etc. The most common waterborne diseases and their causative microbial agents, symptoms of these diseases and preventive measure are given in the tables below .

Waterborne diseases caused by virus

Disease	**Causative Organism**	**Mode of Transmission**	**Tissue/ Organ Affected**	**Affected Symptoms**	**Preventive and Control Measures**
Poliomyelitis	Polio virus	Droplet infection, sputum discharge, secretion from nose, throat, contaminated	Central nervous system	Paralysis of limbs	Salk's vaccine or Oral Polio Vaccine (OPV) is Administered

		water, food and milk				
Hepatitis A or Infectious Hepatitis	Hepatitis A virus (HAV)	Contaminated water, food and oral route	Inflammation of liver	Nausea, anorexia, acute fever and jaundice	Prevention of food contamination, drinking chlorinated boiled water, personal hygiene	
Acute Diarrhoea	Rotavirus	Contaminated water, food and oral route	Intestine	Vomiting, fever, watery stools with mucus	Proper sanitation and hygiene	

Waterborne diseases caused by bacteria

Disease	Causative Organism	Mode of Transmission	Tissue/ Organ Affected	Symptoms	Preventive and Control Measures
Cholera (Acute diarrhoeal disease)	Vibrio Cholera	Contaminated food, water, oral route and through houseflies	Intestinal tract	Acute diarrhoea with rice watery stools, vomiting, muscular cramps, nausea and dehydration	Hygienic sanitary condition, intake of Oral Rehydration Solution (ORS
Typhoid (Enteric fever)	Salmonella typhi	Food and water contaminated with faeces of infected person and	Small intestine	High fever, weakness, abdominal pain, headache, loss of appetite,	Preventing contamination of food by flies and dust, improvement of basic

		through houseflies		rashes on chest and upper abdomen	sanitation, treatment with antibiotic drugs

Vector Borne Diseases

Vector is an agent that acts as an **intermediate carrier** of the pathogen. Many insects and animals act as vectors. Diseases transmitted by vectors are called vector borne diseases. These vectors can transfer infecting agents from an infected person to another healthy person. Some of the insect vector borne diseases are Malaria, Filaria, Chikungunya, Dengue, and the diseases which are transmitted through animals are Bird flu and Swine flu.

Malaria

Malaria continues to be one of the major health problems of developing countries. Malaria is caused by **protozoan** parasite *Plasmodium*. Four species of *Plasmodium* namely, *P.vivax, P.malariae, P.falciparum* and *P.ovale* cause malaria. Malaria caused by *Plasmodium falciparum* is malignant and fatal. Approximately 300 million people around the world get infected with Malaria every year.

It spreads through the bite of an insect vector, the female *Anopheles* mosquito which feeds on human blood and usually lasts less than 10 days. A person affected by malaria will show symptoms of headache, nausea, muscular pain, chillness and shivering, followed by rapid rise in temperature. Fever subsides with profuse sweating. Use of Quinine drugs kills the stages of malaria parasite.

Chikungunya

Chikungunya is caused by virus. It is transmitted in humans by the bite of infected *Aedes aegypti* mosquito during the day time. It causes severe and persistent joint pain, body rashes, headache and fever. Joint pains can last for a very long time.

Incubation period of the virus is usually 2-12 days. Chillness, high fever, vomiting, nausea, headache, persistent joint pain and difficulty in walking are the common symptoms associated with this disease. The joints get inflamed and the person finds it difficult to walk. Paracetamol is given to relieve pain and reduce fever.

Dengue

Dengue is known as **break bone** fever. The name break bone fever was given due to the cause of intense joint and muscle pain. Dengue fever is caused by virus. It is transmitted by *Aedes aegypti* mosquito.

Incubation period of the virus is usually 5-6 daysOnset of high fever, severe headache, muscle and joint pain, rashes, haemorrhage, fall in blood platelet count are the symptoms associated with this disease. Vomiting and abdominal pain, difficulty in breathing, minute spots on the skin signifying bleeding within the skin are also associated with dengue fever. Paracetamol is given to reduce fever and body ache. Complete rest and increased intake of fluid is essential.

An extraction of tender leaves of papaya and herbal drink Nilavembu Kudineer is given to dengue patients. It is known to increase the blood platelet count. (Source: AYUSH)

Filaria

Filariasis is a major health problem in India. This disease is caused by **nematode** worm *Wuchereria bancrofti*. The adult worms are usually found in the lymphatic system of man. It is transmitted by the bite of infected *Culex* mosquito.
Incubation period of filarial worm is 8-16 months and the symptoms include acute infection, fever and inflammation in lymph glands. In chronic infection the main feature is **elephantiasis** which affects the legs, scrotum and the arms.

Mosquitoes - Prevention and Control

• Prevention of mosquito bites by using mosquito nets, mosquito screens, mosquito repellents and ointments.
• Elimination of breeding places by providing adequate sanitation, underground waste water disposable system and drainage of stagnant water.
• Collection of water in any uncovered container such as water tank, pots, flower pots, discarded tyres should be avoided.
• Control of mosquito larvae by spraying oil on stagnated water bodies.
• Adult mosquitoes can be killed by spraying insecticides.
• Application of citronella oil or eucalyptus oil on the exposed skin.

Diseases Transmitted **by Animals**

Swine Flu

Swine Flu first originated from pigs. It is caused by virus that affects pigs and has started infecting humans. The virus spreads through air. It affects the respiratory system.

Influeuza virus H1N1 has been identified as the cause of this disease. It is transmitted from person to person by inhalation or ingestion of droplets containing virus from people sneezing or coughing. Fever, cough, nasal secretion, fatigue, headache, sore throat, rashes in the body, body ache or pain, chills, nausea, vomiting

and diarrhoea, and shortness of breath are the symptoms associated with the disease.

Prevention and Control

- Administration of nasal spray vaccine.
- Avoiding close contact with a person suffering from flu.
- Intake of water and fruit juices will help prevent dehydration.
- Plenty of rest will help the body to fight infection.
- Always wash hands and practice good hygiene.

Avian Influenza

Avian influenza is a contagious bird disease caused by viruses. Birds that can carry and spread avian influenza virus include poultry (chickens, turkeys or ducks), wild birds and pet birds.

It is caused by **Influenza Virus H5N1.** The incubation period of the virus is 2-7 days. People who have close contact with infected birds orsurfaces that have been contaminated by the bird's secretion from mouth, eyes, mucus, nasal secretion or droppings (bird faeces) transmit this disease.
Fever, cough, sore throat, running nose, muscle and body aches, fatigue, headache, redness of eyes (conjunctivitis) and difficulty in breathing are the symptoms of this disease.

Prevention and Control
- Avoiding open air markets where infected birds are sold.
- Avoiding contact with infected birds or consumption of infected poultry.
- Proper cleaning and cooking of poultry.

The avian influenza virus A (H5N1) emerged in 1996. It was first identified in Southern China and Hong Kong. H5N1 was first discovered in humans in 1997 by World Health Organisation. First outbreak was in December 2003.

Sexually Transmitted Diseases

Some pathogens are transmitted by sexual contact from one partner to another and not by casual physical contact. A few sexually transmitted diseases are AIDS, Gonorrhea, Genital warts, Genital herpes and Syphilis.

AIDS

Acquired Immunodeficiency Syndrome (AIDS) is caused by **retrovirus** (RNA virus) known as **Human Immunodeficiency Virus** (HIV). The virus attacks the white blood cells or **lymphocytes** and weakens the body's immunity or self defence mechanism.

It is transmitted through sexual contact (from infected person to a healthy person), blood contact (transfusion of unscreened blood), by surgical equipments (infected needles and syringes), maternal – foetal transmission (from infected mother to the foetus).

Weight loss, prolonged fever, sweating at night, chronic diarrhoea are some of the important symptoms.

Prevention and Control

- Disposable syringes and needles should be used.
- Protected and safe sexual contact.
- Screening of blood before blood transfusion.
- Avoid sharing shaving blades/razors.
- People should be educated about AIDS transmission

HIV was first recognised in Hatai (USA) in 1981. In India the first confirmed evidence of AIDS infection was reported in April 1986 from Tamil Nadu. The AIDS vaccine RV 144 trial was conducted in Thailand in 2003 and reports were presented in 2011.

Hepatitis -B or Serum Hepatitis

It occurs due to infection of **hepatitis-B virus** (HBV). The virus damages the liver cells causing **acute inflammation** and **cirrhosis** of liver.

It is transferred from infected mother to their babies or by sexual contact. It is also transmitted by contact with infected person's secretions such as saliva, sweat, tears, breast milk and blood.

Symptoms observed are fever, loss of appetite, nausea vomiting, yellowness of eyes and skin, light coloured stools, itching of skin, headache and joint pain.

Prevention and Control

- Screening of blood donors before blood donation can prevent the transmission.
- Injection of drugs to be prevented.
- Having safe and protected sex.
- Sharing of razors should be avoided.
- The hepatitis B vaccine offers excellent protection against HBV. The vaccine is safe and highly effective.

Some of the other sexually transmitted diseases caused by bacteria and virus are

Infectious agent	Disease	Causative Organism	Mode of Transmission	Tissue/ Organ Affected	Symptoms
Bacteria	Gonorrhoea	Neisseria gonorrhoea	Sexual contact	Urethra is affected	Discharge from genital openings, pain during urination
	Syphilis	Treponema pallidum	Sexual contact	Minute abrasion on the skin or mucosa, of genital area	Ulceration on genitals, skin eruption
Virus	Genital Herpes	Herpes Simplex Virus	Sexual contact, entry through mucous membrane of genital region	Genital organs of male and female individuals	Painful blisters in mouth, lips, face and genital region
	Genital Warts	Human Papilloma virus	Sexual contact (skin to skin)	Genital areas of male and female individuals	Vaginal discharge, itching, bleeding and burning

The process of vaccination was introduced by Edward Jenner. According to the World Health Organisation (WHO), Jennerian vaccination has eliminated small pox totally from the human population.

Killed Vaccines: Micro organisms (bacteria or virus) killed by heat or chemicals are called killed or inactivated vaccines. They require a primary dose followed by a subsequent booster dose. e.g. Typhoid vaccine, cholera vaccine, pertussis vaccine.

Immunization Schedule

The World Health Organization in the year 1970 has given a schedule of immunization for children. This schedule is carried out in almost all countries.

BCG (Bacillus Calmette Guerin): This was prepared by two French workers Calmette and Guerin (1908-1921). The bacilli are weakened and used for immunization against tuberculosis.

DPT (Triple Vaccine): It is a combined vaccine for protection against Dipetheria, Pertussis (whooping cough) and Tetanus.

MMR: Mumps, Measles, Rubella vaccine gives protection against viral infections.

DT: It is a dual antigen or combined antigen. It gives protection from Diphtheria and Tetanus.

TT (Tetanus Toxoid): Toxin of Tetanus bacteria.

TAB: Combined vaccine for typhoid, paratyphi A and paratyphi B.

8TH BOOK
Unit.6. Microorganisms

Prions

The word prion is derived from "protinaceous infectious particle". Prions have neither DNA or RNA to transmit infection. A prion is a mutted form of a usually harmless protein. Prions cause diseases by affecting brain or neural tissue. Eg.Creutzfeldt-Jackob disease. Another example is Kuru- associated with cannibalism.

Virions

Virion is an entire virus particle consisting of an outer protein shell called a capsid and an inner core of nucleic acid (RNA or DNA). If the virus is found outside the cell (extracellular) it is known as virion. Virion has the capacity to infect the living tissue.

7TH BOOK
6. Health and Hygiene

Specific health problems of children

Anaemia

It is caused by eating food with less iron content and can also caused due to feeding some other foods instead of breast milk. Severe anemia in children may leads to hookworm infection, chronic diarrhoea and dysentery. In recent day school going children, especially the girls are affected by anemia. The Government of Tamil Nadu provides weekly iron folic tablets to all the girls in the schools of all areas.

The signs of anemia are:

- Pale or transparent skin, The inner surface of eye lids are pale, white fingernails, pale gums, weakness and fatigue.
- In severe cases, face and feet may be swollen, the heartbeat is rapid and with shortness of breath.
- Children and women who eats mud are usually anemic.

Consuming iron containing food Sources

- Food – Moringa leaves, Dates, Liver (Sheep and Chicken), Green, green leafy vegetables like beans, peas, lentils and Greed banana.
- Pills - Cod liver oil tablet, Ferrous sulfate.

6TH BOOK
Unit 6 - Health and Hygiene

Vitamins

Vitamins are required for carrying out various biochemical reactions in our body. Fruits, vegetables, grains, meat products are good sources of vitamins. Vitamins are called as protective food. There are six major vitamins A, B, C, D, E and K. Vitamins B and Vitamins C are water soluble, Vitamins A, D, E and K are fat soluble.Gooseberries contains nearly 20 times the vitamin C than Orange.

Minerals

Minerals are required for growth as well as for the regulation of normal body function.Green leafy vegetables like spinach, pulses, eggs, milk, fish and fruits are important sources of minerals in our diet. Minerals are also a protective foods.

80% of the world production of Moringa Leaves is in India. The Major countries which import Moringa Leaves are China, US, Germany, Canada, South Korea and European countries.

Water

Our body needs an adequate supply of water is order to maintain good health. Any human being should take minimum eight tumblers (2 Litres) of water every day.

Health and Nutrients

Health

Health is a state of complete physical, mental and social well-being and not merely absence of diseases. Eating a healthy diet keeps you physically and mentally fit. When you are physically healthy, you feel confident you are more outgoing and have a greater capacity for enjoying life.

Unhealthy food choices lead to obesity and illness, preventing you from socializing with friends and family. So choose your diet carefully.

Balanced Diet

A diet should contain adequate amount of all the necessary nutrients required for healthy growth and activity.

- An increased capacity to work
- Good physical and mental health
- Increased capacity to resist diseases.
- Help in proper growth of the body.

A balanced diet contains sufficient amount of various nutrients to ensure good health. Food should also provide the appropriate amount of energy and adequate amount of water.

Malnutrition: Malnutrition occurs when all the nutrients that the body needs are not obtained in the proper proportions from the diet. The word malnutrition refers to the condition that results when a person does not take a balanced diet. Malnutrition leads to deficiency disease. The diseases that are caused due to lack of Nutrients in the diet are calledDeficiency Diseases.

India has the second highest number of obese children in the world after China,according to a study that has found that 14.4 million children in the country have excess weight.

Physical Exercise and Rest

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons, including

- increase in growth and development,
- strengthening muscles and the cardiovascular system,
- developing athletic skills, weight loss or maintenance, and enjoyment.
- Physical exercise may help to decrease some of the effects of childhood and adult obesity.
- Deep sleep seems to be one of the most critical time for body repair.

Rest

Proper amount of rest is essential for physical and mental health. Rest is as important as nutrition and physical activity for growth and development and good health.

Personal Cleanliness

Hygiene is a set of practices performed to preserve health. According to the World HealthOrganization(WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases."

Personal hygiene involves those practices performed by an individual to care for one's bodily health and well-being, through cleanliness. It includes such personal habit choices as how frequently to bathe, wash hands, trim fingernails, and change clothing. It also includes attention to keep surfaces in the home and workplace, including bathroom facilities, clean and pathogen-free.

Introduction of Microbes

When you neglect personal hygiene, you are increasing the risk of falling sick.Let us name some of the diseases or conditions caused by microorganism due to the negligence of personal hygiene.

1. Diarrhoea
2. Tooth decay
3. Athlete's foot(Madurai's foot)
4. Dandruff.

Most of the microbes belong to four major groups:

- Bacteria
- Virus
- Protozoa
- fungi