

# Lesson - 1 Human Physiology

(INTRODUCTION)  
u.p to obesity

## INTRODUCTION

1. Physiology the study of function of organs and organ systems
2. All the physiological activities are aimed to maintain
  - a) homeostasis
  - b) Living
  - c) Reproduction
3. Homeostasis;- stabilizing an optimum level of water, minerals and other components of the body fluids and other thermal regulations.
4. Homeostatic equilibrium is achieved by bio-physical, bio-chemical processes, hormonal secretions and related modifications
5. Living made possible by several types of evolved organs and their well co-ordinated functions  
'e.g' :- circulatory system
6. Reproduction  
Sexual reproduction, genetically oriented ~~mechanism~~ mechanisms for sex cells production

## Nutrition:-

1. Steps invoved in the process of nutrition are
  - a) Ingestion
  - b) Digestion
  - c) Absorption and
  - d) Assimilation
2. Composition of food:-  
Carbohydrates, proteins, lipids, vitamins, minerals and water
3. Factors that control the intake of food
  - a) Stage of growth
  - b) Sex
  - c) health condition
  - d) bodily activities and
  - e) Environmental situations

## CARBOHYDRATES

1. It is chemically composed of carbon, Hydrogen and oxygen
2. Carbon, H and O<sub>2</sub> ratio is 1:2:1/(CH<sub>2</sub>O)<sub>n</sub>
3. Types:-
  - a) Monosaccharides
  - b) Disaccharides
  - c) Polysaccharides
4. Monosaccharides :-
  - a) Simplest form comprised of a single organic molecule
  - b) On the basis of number of carbon atoms they are classified in to trioses, tetroses, pentoses and hexoses
    - c) Trioses (C<sub>3</sub>H<sub>6</sub>O<sub>3</sub>)  
Intermediate product of Carbohydrate metabolism play an important role in inter conversion of biomolecules (eg:Glyceraldehyde)
    - d) Pentoses (C<sub>5</sub>H<sub>10</sub>O<sub>5</sub>)  
The integral components of RNA and DNA. eg. ribose and deoxyribose.
    - e) Hexoses (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>)  
The food components commonly consumed. eg. Glucose, Fructose and Galactose.
5. Disaccharides:
  - a) These are the carbohydrates formed by condensation of two monosaccharide monomers.
  - b) They are commonly found in food substances
  - c) Common disaccharides are
    - i) Maltose → glucose + glucose - germinating seeds
    - ii) Sucrose → glucose + fructose - canesugar
    - iii) Lactose → glucose + galactose - Milk
6. Poly saccharides:-
  - a) They are complex carbohydrates formed by polymerization of a large number of monosaccharides:

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b) Examples:-

- i) Structural component :- Chitin, Cellulose
- ii) Storage food material :- Starch
- iii) Food grains:- Pectin, Amylopectin
- iv) Liver, muscles:- Glycogen.

7. Functions of carbohydrates:- (3 marks)

- a) One gram of carbohydrate is capable of yielding 4.1 calories of energy
- b) Provide energy to cells.
- c) Energy metabolism takes place through glycolysis, Oxidative and citric acid cycle ]
- d) The released energy is stored in the form of ATP.

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## PROTEINS (Polypeptides)

3

1. Proteins are chemically composed of carbon, Hydrogen, oxygen and Nitrogen. It also contain sulphur
2. Types of proteins:
  - a) structural:- eg: cell membrane, muscles, hairs and nails
  - b) Functional :- eg: Enzymes and some hormones
3. Aminoacids are the building blocks of proteins. Approximately 20 different types of aminoacids are present
4. Classification on aminoacids:-
  - a) Essential aminoacids: These aminoacids cannot be synthesised in our body. We can take these only through food.  
e.g. Arginine, Histidine, Methionine, Phenylalanine, Tryptophan, Threonine, Leucine, lycine and valine
  - b) Non-essential aminoacids  
These aminoacids can be synthesized in our body from other compounds. Such aminoacids need not be added in the diet.
5. A Protein is formed of Several aminoacids linked with each other by peptide bonds.
6. The Linear arrangement of aminoacids represent the primary structure. The straight chain gets complicated to form secondary, tertiary and quaternary structures.
7. The genome responsible for the production of specific types of proteins for bringing out genetical characteristics.
8. The daily requirement of protein according to INMR and WHO is 1 gm per kg body weight.
9. Protein deficiency diseases:
  - a) Marasmus:- i) Child loses weight ii) severe diarrhea iii) Body muscles get wasted.
  - b) Kwashiorkor:- i) wastage of muscle ii) Face and feet will have oedema iii) Enlarged belly

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**LIPIDS**

1. Lipids are the important cellular constituents.
2. The most common type of lipids are the simple lipids / Triglycerides. It is a naturally occurring substance and the main constituent of adipose tissue.
3. Triglycerides are chemically composed of fatty acids and glycerol.
4. Two types of fatty acids are present namely saturated and unsaturated.
5. unsaturated fatty acids:-
  - a) They undergo easier oxidative breakdown.
  - b) Poly unsaturated fatty acids (PuFA) are favoured for persons having high BP and other related ailments.  
e.g. Sunflower Oil, Saff flower Oil,
6. Each gram of lipid is capable of yielding 9.3 calories of energy.
7. 25 % to 30 % of total calories should come from fat diet:-
8. Uses of lipids:
  - a) Energy rich compounds.
  - b) Most important storage food in the body
  - c) Fat serves as an insulating material.
  - d) Fat beneath the skin adds to beauty.
  - e) Steroidal hormones are produced from certain lipids.

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**Minerals**

1. Minerals vitamins and water are the accessory food factors needed for the normal functioning of human beings.
2. The minerals are found in greater concentration are sodium, calcium, potassium, magnesium, phosphorus, sulphur and chlorine.
3. Trace elements: The minerals required in slightly lower concentration for performing useful functions in our body.  
e.g Iron, Copper, zinc, cobalt, manganese Iodine and fluorine.

| S.No | Functions   | Minerals Involved.                 |
|------|---|------------------------------------|
| 1.   | Formation of bones and teeth (Body building activities)                 | Calcium, Magnesium and phosphorus. |
| 2.   | Physiological activities<br>a) Oxygen transport<br>b) Hormone Synthesis | Iron<br>Iodine                     |
| 3.   | Intermediary metabolism   | manganese, copper, and zinc        |
| 4.   | Maintenance constituents of the body fluids like CSF                    | Chlorine, sodium and potassium     |
| 5.   | Neuro muscular irritability   | Magnesium, Sodium and potassium    |
| 6.   | Blood clotting  | Calcium                            |
| 7.   | Cardiac functions   | Calcium and potassium              |

## Water

(5)

1. It is the major constituent in the body of all mammals.
2. The proportion of water in lean body Mass is constant at around 71 - 78 % in all animals.
3. In animals a new born child the content of water is 85 - 90% of body weight but in adults it ranges from 55-60%
4. Distribution of water in the body:-
  - a) 2/3 - Intracellular fluid (ICF)
  - b) 1/3 - Extra cellular fluid (ECF)
  - c) 25% of ECF is blood plasma.
5. The average water intake is around 2500 ml / day (as water 1400 ml)
6. Loss of water from our body happens through four routes.
  - a) urine (about 1400 ml)
  - b) Expiration (400ml)
  - c) Through skin (600ml)
  - d) Loss in faeces (100ml)
7. Role / functions of water
  - a) Water is an essential constituents of all the cells of the body.
  - b) It serves as a site for chemical reactions.
  - c) It plays a vital role in the maintenance of body temperature.
  - d) Water helps to maintain form and texture of tissues.
  - e) It is a valuable solvent for electrolytes enzymes etc.
  - f) It serves as a transport medium for nutrients and excretory products.

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## VITAMINS

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### Introduction:

1. Vitamins are complex organic compounds.
2. Essential for growth and other physiological activities in organisms.
3. No energy value, however control the energy yielding processes.
4. Types:
  - a) water soluble vitamins. e.g. Vitamin B and C
  - b) Fat soluble vitamins eg:-vitamin A,D,E and K
5. Vitaminosis:- The excess intake of vitamin A,D,E and K causes this disease
6. Sunshine Vitamin:-
  - a) Vitamin - D or calciferol is known as sunshine vitamin.
  - b) This vitamin can be synthesized by our body through the lipid compound called ergosterol found below our skin on exposure to sunlight

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6

| S.No | Vitamins  | PHYSIOLOGICAL PROCESSES                     | MAINTENANCE OF BODY TISSUES       | METABOLIC PROCESS  |
|------|-----------|---|-----------------------------------|--|
| 1.   | Vitamin A | Visual perception                           | Maintenance of epithelial tissues |  |
| 2.   | B1        | -   | Nourishment of nerve cells        | -Coezyme in tissue metabolism<br>-Glucose oxidation in CNS |
| 3.   | B2        | -   | Maintenance of epithelial tissue  | Carbohydrate metabolism                                    |
| 4.   | B6        | -   | -                                 | Fat and aminoacid metabolism                               |
| 5.   | B12       | -   | Maturation of erythrocytes CRBC   |  |
| 6.   | Niacin    | -   | -                                 | Act as coenzyme in oxidation reduction reactions           |
| 7.   | Biotin    | -   | -                                 | Coenzyme and cofactor in oxidative metabolism              |
| 8.   | C         | Immunity against infections supports growth | -                                 | Activation of intracellular enzymes                        |
| 9.   | D         | -   | Growth of bones                   | Calcium and phosphate metabolism                           |
| 10.  | E         | Fertility in animals                        | Rejuvenation of tissues           | Anti oxidant   |
| 11.  | K         | Blood clotting                              | -                                 |  |

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## VITAMIN DEFICIENCY AILMENTS

7

| S.No   | Vitamin                                | Deficiency Ailments  |
|--|--|--|
| 1.   | Vitamin- A                             | <ul style="list-style-type: none"> <li>a) May cause night blindness (<u>NYCTALOPIA</u>)</li> <li>b) Atrophy of lacrymal glands of the eye and reduction in tear secretions</li> <li>c) Red and dry corneal epithelium (<u>Xerosis</u>)</li> <li>d) Corneal epithelium wrinkled and carotinised (<u>xerophthalmia</u>)</li> <li>e) Appearance of <u>Bitot's spot</u> in the cornea</li> <li>f) cornea may get necrosed and get infected (<u>Keromalacia</u>)</li> </ul> |
| 2.   | Vitamin -D                             | <ul style="list-style-type: none"> <li>a) Defective calcitcation of bone</li> <li>b) Deficiency <u>children</u> causes <u>Rickets</u></li> <li>c) Deficiency in <u>adult</u> causes <u>osteomalacia</u></li> </ul>   |
| 3.   | Vitamin-E                              | Causes sterility in experimental animals   |
| 4.   | Vitamin-K                              | <ul style="list-style-type: none"> <li>a) defect in blood coagulation process.</li> <li>b) Deficiency in human leads to <u>haemorrhagic manifestations</u>.</li> </ul>   |
| 5.   | Vitamin-B <sub>1</sub>                 | <ul style="list-style-type: none"> <li>-Deficiency leads to <u>BERIBERI</u></li> <li>This affects cardiovascular and nervous system</li> <li>- Beriberi is acute in children and Infants.</li> </ul>   |
| 6.   | Vitamin-B <sub>2</sub><br><br>Dy. N.S  | <ul style="list-style-type: none"> <li>a) Loss of appetite, gastro intestinal tract is affected</li> <li>b) Soreness and burning of Lips, mouth and tongue</li> <li>c) Fissures appear at the edges of mouth</li> </ul>  |
| 7.   | Niacin                                 | <ul style="list-style-type: none"> <li>a) Its deficiency causes pellagra.</li> <li>b) <u>Symptoms of pellagra:-</u> <ul style="list-style-type: none"> <li>i) Stomatitis</li> <li>ii) The tongue becomes smooth, red and painful.</li> </ul> </li> </ul>   |
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| 8.   | Vitamin B <sub>6</sub><br>(Pyridoxine) | <ul style="list-style-type: none"> <li>i) Dermatitis around eyes, nose and behind ears.</li> <li>ii) Fissures appear above the lips and angles of mouth.</li> </ul>  |
| 9.   | Vitamin-B <sub>12</sub>                | <ul style="list-style-type: none"> <li>i) Deficiency causes perinicious anaemia.</li> <li>ii) Sore tongue</li> <li>iii) Neurological problems in the spinal cord.</li> </ul>   |
| 10.  | Vitamin-C                              | <ul style="list-style-type: none"> <li>i) Deficiency leads to scurvy</li> <li>ii) Symptoms of Scurvy:- Bleeding gums, muscular haemorrhages.</li> <li>iii) Collagen and connective tissue proteins are not formed.</li> </ul>  |

**BALANCED DIET**

1. The diet have all food supplements in needed propotion is said to be a balanced diet
2. Uses of balanced diet:-
  - a) For normal growth
  - b) To give working capabililty
  - c) Nitrogen balance and
  - d) For full calorie requirement.
3. Calorie content of the food:-
  - a) 10-15% obtained from proteins
  - b) 25-30% of carorie from fat
  - c) Rest from carbohydrates.
4. Calorie Values:-
  - a) Calorie means the amount of heat required to raise 1kg water by 1°C
  - b) Calorie requirement for Indian Reference to man (IRM):- 25 years of age, 1.62 sq.mt of body surface 55kg body weight and remains healthy
  - c) Calorie requirement for IRW (Woman) 25 years of age, 1.4 sq.mt of body surface, 45kg body weight and remains healthy
  - d) IRM:-
    - i) Sedantary work:- 2430 Calories
    - ii) Moderate work:- 2780 Calories
    - iii) Heavy work:- 3880 Calories
  - e) IRW:-
    - i) Sedantary work:- 1790 Calories
    - ii) Moderate work:- 2080 Calories
    - iii) Heavy work:- 2980 Calories
  - f) Formulating and planning the diet:- (Assessment)
    - i) It is based on the requirement of IRM and IRW
    - ii) Age, weight and working conditions
    - iii) Calorie value of each item of food
    - iv) Palatability and social food habit

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**OBESITY**

1. Definition:-
  - a) The storage of excess of body fat resulting in a significant impairment of health from a variety of diseases, notably hypertension, Atherosclerotic heart diseases and diabetes.
  - b) A Level of 10% above the standard weight for subjects of same age and sex is considered as obesity.
2. Assessment:-
  - a) It is assessed by the Body Mass Index (BMI)
  - b) BMI = Weight (kg)/Height (Met<sup>rs</sup>)
  - c) Example:- 70kg person with a height of 180 Cms would have a BMI of 21.6 (70 / 1.8<sup>2</sup>)
  - d) Normal BMI range for adults is 19-25
3. Reasons for obesity:-
  - a) Heredity
  - b) Increased appetite
  - c) Excessive intake of food than is needed by the body
  - d) Endocrine factors and /-or
  - e) Metabolic disorders.