**SYLLABUS POINT** : **6. PRINCIPLES & MANAGEMENT OF NUTRITION DEFICIENCY DISORDERS**

**NUTRITION**

**DEFINITION**

* The word ‘nutrition’ is derived from the Latin word “ nutrire” to suckle or feed – the primary act of suckling which is characteristic of the process of nutrition.
* Nutrition is the process of nourishment.
* Nutrient is the substance that provides nutrition.

**CLASSIFICATION OF NUTRIENTS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. **WATER** |  | | | |
| 1. **MACRO-NUTRIENTS** | 1. Carbohydrates | 1. Energy Yielding | 1. Monosaccharides | 1. Glucose 2. Fructose 3. Ribose |
| 1. Disaccharides | 1. Lactose 2. Maltose 3. Sucrose |
| 1. Non- Energy Yielding | 1. Dietary Fibres | 1. Water Soluble Fibres 2. Water Insoluble Fibres |
| 1. Fats |  | | |
| 1. Proteins |
| 1. **MICRONUTRIENTS** | 1. Organic | 1. Vitamins | 1. Fat-Soluble | 1. Vitamin- A 2. Vitamin-D 3. Vitamin-E 4. Vitamin-K |
| 1. Water Soluble | 1. Vitamin-B 2. Vitamin-C |
| 1. Inorganic | 1. Electrolytes | 1. Sodium 2. Potassium 3. Chlorine |  |
| 1. Minerals | 1. Calcium 2. Phosphorous 3. Iron 4. Magnesium |
| 1. Trace Elements | 1. Zinc 2. Copper 3. Iodine 4. Selenium 5. Chromium 6. Manganese |

**CLASSIFICATION OF NUTRITIONAL DISORDERS**

1. **UNDERNUTRITION**
   1. In Children – Marasmus
   2. In Adults – Starvation, Anorexia Nervosa
2. **MALNUTRITION**
   1. Protein Deficiency – PEM
   2. Vitamin – D – Rickets
   3. Vitamin – C – Scurvy
3. **EXCESS NUTRITION**
   1. Quantitative – Obesity
   2. Qualitative :
      1. Excess Cholestrol – Hyperlipidaemia
      2. Excess Vitamins – Hypervitaminosis A & D
4. **EFFECT OF TOXINS IN BODY** 
   1. Migraine
   2. Urticaria
   3. Coeliac Disease
   4. Lathyrism

**PATHOLOGICAL CAUSES OF NUTRITIONAL DISORDERS**

1. **DEFECTIVE INTAKE**
   1. Poor Economic Status
   2. Loss of Appetite
   3. Systemic Disorders
   4. Psychiatric Disorders
   5. Persistent Vomiting
   6. Food Faddism
   7. Prolonged Parenteral Therapy
2. **DEFECTIVE DIGESTION AND ABSORPTION**
   1. Prolonged use of antimicrobials
   2. Various types of Malabsorption Syndromes
3. **DEFECTIVE UTILISATION**
   1. End organ failure – Cardiac Failure, Hepatic Failure
   2. Severe systemic infections
   3. Malignancy of various organs
4. **EXCESSIVE LOSS OF NUTRIENTS**
   1. Nephrotic Syndrome
   2. Protein Losing Enteropathy
5. **ALTERED METABOLISM**
   1. Hyperthyroidism
   2. DM
   3. Trauma
   4. Prolonged fever
   5. Malignancy
   6. Burns
   7. Surgery
6. **INCREASED REQUIREMENTS**
   1. Pregnancy & Lactation
   2. Growth- Infancy, Childhood, Adolescence

**UNDERNUTRITION**

**DEFINITION**

* Optimal nutrition is necessary for optimal health, but neither variables can be measured accurately; thus it is difficult to define undernutrition.

**CAUSES**

1. Starvation or famine
2. Reduced food intake for psychophysiological reasons
3. Intestinal disorders leading to anorexia or malnutrition
4. Severe pathology of any kind e.g. infection, inflammatory and neoplastic disorders and organ failure which may lead to anorexia and enhanced catabolism.

**CLINICAL FEATURES**

1. Loss of body fat
2. Wasting of skeletal muscle

**MANAGEMENT**

* Artificial Nutritional Support by Total Parenteral Nutrition

**VITAMINS DEFICIENCY DISORDERS**

**FAT SOLUBLE VITAMINS**

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| **VITAMINS** | **SOURCES** | **DAILY INTAKE** | **DEFICIENCY DISORDERS** | **INVESTIGATIONS** | **THERAPEUTIC DOSE / DAY** |
| **A**  **(Retinol)** | * Milk * Butter * Egg yolk * Fish liver oil * Carrots * Sweet potatoes * Apricots * Spinach | 5000 IU | * Night Blindness * Xeropthalmia * Bitot’s Spots * Conjunctival Xerosis * Corneal Xerosis & Ulceration * Impaired Enamel Formation * Immune Dysfunction * Keratomalacia | Plasmin Vitamin A low  (Serum Retinol) | 5000 IU / kg Body weight |
| **D (Ergocalciferol)** | * Milk * Butter * Egg yolk * Fish liver oil * Yeast | 400 IU | * Rickets * Tetany * Osteomalacia * Anorexia * Bowed Legs * Osteoporosis * Bone Pain * Muscle Weakness | Serum 25-hydroxy  vitamin - D | 5000 IU / day |
| **E**  **(α - Tocopherol)** | * Wheat germ oil * Lettuce * Maize * Mollasses * Peas * Rice * Wheat * Milk * Eggs | 10-15 IU | * Neuropathy * Retinopathy * Abnormal Clotting * Haemolysis | Serum Tocopherol | 100-600 mg / day |
| **K (Phyloquinone)** | * Green vegetables * Spinach * Cabbage * Egg yol * Cheese * Tomatoes | 80 µg | * Easy Brusing * Bleeding | Prolonged Prothrombin Time | 10 mg for 3-5 Days |
| **WATER SOLUBLE VITAMINS** | | | | | |
| **VITAMINS** | **SOURCES** | **DAILY INTAKE** | **DEFICIENCY DISORDERS** | **INVESTIGATIONS** | **THERAPEUTIC DOSE / DAY** |
| **B1**  **(Thiamine)** | * Yeast * Meat * Beans * Liver * Egg Yolk * Potatoes | 1-2 mg | * Beri – Beri * Cardiomegaly * Fatigue * Ophthalmoplegia * Peripheral Neuropathy * Wernicke’s Encephalopathy | RBC Transketolase Activity | 50-100 mg |
| **B2**  **(Riboflavin)** | * Milk * Eggs * Liver * Germinating Seeds | 1-2 mg | * Angular Stomatitis * Sore Tongue & Mouth * Eye Irritation * Seborrhoeic Dermatitis | RBC Glutathione Reductase Activity | 5-10 mg |
| **B3**  **(Niacin)** | * Milk * Eggs * Liver * Yeast * Rice * Fish | 15-20 mg | * Pellagra * Sore Mouth & Tongue * Nausea * Vomiting * Diarrhoea * Depression * Psychosis | Urinary N- methyl nicotinamide | 500 mg |
| **B5**  **(Pantothenic Acid)** | * Liver * Kidney * Eggs * Meat * Milk | 5-10 mg | * Weakness * Fatigue * Tenderness of Heels & Feet * Brittle nails * Xerosis | Urinary Pantothenic Acid | 10 mg |
| **B6**  **(Pyridoxine)** | * Milk * Eggs * Liver * Yeast * Meat * Cereals * Fish * Spinach | 12 mg | * Glossitis * Seborrhoeic Dermatitis * Peripheral Neuropathy * Convulsions * Rashes on face, scalp, neck , shoulders, buttocks & perineum * Pellagra like dermatitis * Confusion | Plasma Pyridoxal Photostat | 50-100 mg |
| **B7**  **(Biotin)** | * Eggs * Liver * Meat | 100-200 µg | * Alopecia * Seborrhoeic Dermatitis * Myalgia * Seizures | Plasma Biotin | 10 mg |
| **B9**  **(Folic Acid)** | * Yeast * Green Vegetables * Liver & Kidney * Cereals * Meat | 400 µg | * Megaloblastic Anemia * Glossitis * Diarrhoea * Stomatitis | Serum Folic Acid | 0.15 mg |
| **B12**  **(Cobalamin)** | * Eggs * Meat * Liver * Kidney | 5 µg | * Megaloblastic Anemia * Neuropathy * Anorexia * Diarrhoea * Optic Neuritis * Mental Changes | Serum Cobalamin | 2.5 µg |
| **C**  **(Ascorbic Acid)** | * Green Vegetables * Citrus Fruits * Black Currants * Strawberries * Potatoes | 100 mg | * Scurvy * Gingival Inflammation * Gingival Bleeding * Purpura * Petechiae * Ecchymosis * Weakness * Depression * Joint Effusion * Poor Wound Healing | Plasma Ascorbic Acid  Leukocyte Ascorbic Acid | Adults : 100 mg  Children : 25 mg |

**MAJOR MINERALS**

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| **MAJOR MINERALS** | **SOURCES** | **DAILY INTAKE** | **DEFICIENCY DISORDERS** |
| **Calcium** | * Milk & its products * Millets * Dried small fish | 600-800 mg | * Decreased Growth * Osteoporosis |
| **Phosphorous** | * Milk * Egg * Meat * Almonds * Fish | 600-800 mg | * Hyperthyroidism * Rickets |
| **Sodium** | * Milk * Pulses | 200-500 mg | * Heat Cramps * Headache |
| **Potassium** | * Banana * Orange * Apple * Pineapple * Tender coconut water | 3-4 mg | * Weakness * Muscular Paralysis |
| **Magnesium** | * Vegetables * Cereals * Pulses * Coffee * Tea | 200-300 mg | * Cardiac Arrhythmias * Neuromuscular Hyperirritability |
| **Chloride** | * Egg * Pulses * Whole & skimmed milk | 300-750 mg | * Excess Sweating * Vomiting * Addison Disease |
| **Sulphur** | * Amino acid cysteine * Methionine | 850 mg | * Obstructive Jaundice * Aminoacidurias |

**TRACE ELEMENTS**

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| --- | --- | --- | --- | --- |
| **MINOR MINERALS** | **SOURCES** | **DAILY INTAKE** | **DEFICIENCY DISORDERS** | **INVESTIGATIONS** |
| **Iron** | * Green Leafy Vegetables * Pulses * Jiggery * Poultry * Fish * Egg Yolks * Liver | * 1. mg | * Iron Deficiency Anemia * Impairment of growth in children * Impairment of work capacity in adults | * Serum Iron * Total Iron Binding Capacity |
| **Zinc** | * Oysters & Shell Fish * Poultry * Cheese * Meat * Nuts * Dry Beans | 10-15 mg | * Growth Retardation * Delayed Genital Maturation | * Plasma Zinc |
| **Iodide** | * Shell Fish * Sea Weeds * Sea Fish | 150-200 µg | * Goitre * Mental Retardation | * TSH * Urine Iodine |
| **Copper** | * Shell Fish * Legumes * Nuts | 1-2 mg | * High BP * Fragile Bones | * Serum Copper |