

Mineral, Vitamins & Energy

PAPER 1 BA I HONS

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Objectives

- 1) Demonstrate minerals source, absorption and side effect of their deficiency**
- 2) Illustrate vitamins function, source, and condition related to deficiency**
- 3) Define fibers, their effects and diseases related to deficiency**
- 4) Introducing energy requirements and BMR calculation**

Mineral elements

- Account 3% body weight
- Essential constituent of soft tissue, fluid & skeleton

Calcium Phosphorus potassium sulphur
sodium chlorine iron fluorine copper zinc
iodine cobalt manganese chromium
selenium

Function

1. Are constituent of bone & teeth
(calcium, phosphorus, magnesium)
2. Control the composition of body fluid
(extracellular & blood= sodium & chloride)
(intracellular = Potassium, phosphorus, magnesium)
3. Incorporate into enzyme & protein (Sulphur is part of A.A methionine & cysteine)

Calcium

- **Adult body contains 1-1.5kg of ca**
- **Function**
 - **Deposit in soft tissue to harden them**
 - **Plays part in controlling heart action, skeletal muscle & excitability of the nerve**
 - **Has role in blood clotting**
- **Absorption**

Facilitated by vit. D, proteins

Reduced by phytic acid, oxalic acid

Calcium

- **Sources**

dairy product, fortified flour, egg, leafy vegetable, fish, cabbage, broccoli

- **Requirement**

Adult 500mg/day, Pregnancy 1200mg/day

excreted in urine and feces

- **Deficiency**

Rickets in children & Osteomalacia in adult

Phosphorus

- **Function**

- Combined with calcium to form the bone & teeth
- Essential cell component (phospholipid)
- Maintain acid/ base balance
- Release energy from carbohydrate & fat

- **Absorption:** Assisted by formation of soluble salt

- **Sources:** Meat, egg, dairy, fish, cereals

- **Deficiency:** Teeth decay

Iron

- **Function**

- **Formation of hemoglobin**
- **Constituent of enzyme**

- **Storage**

- **Liver, bone marrow & spleen in the form of ferritin**

- **Absorption**

facilitated by ascorbic acid

inhibited by phytic acid, lack of gastric secretion

Iron

- **Sources**

Meat, egg, flour, bread, leafy vegetable, liver, kidney, dried fruits

- **Requirement (10-15mg/day)**

- To replace loss from urine, bleeding & menstruation
- Formation of additional hemoglobin
- In lactation

- **Deficiency**

IDA

Iodine

- **Function**

Formation of thyroxin

- **Source**

vegetables, seafood

cabbage, turnip & hard water (goitrogens)

- **Deficiency**

Endemic goiter, cretinism in children

Fluorine

- **Found in teeth & skeleton**

- **Sources**

water, tea , seafood

- **Function**

prevent dental caries

- **Excessive**

intake cause discoloration of the teeth

Sodium

- **Function**

Plays part in the fluid exchange between cell and tissue fluid

- **Source**

Salt, egg, meat, fish, cheese

- **Excessive**

Hypertension

- **Deficiency**

Fatigue, muscle cramps

Potassium

- Found in the body cell
- Its action is complementary to that of sodium
- **Source:** fruit, veg, coffee
- Kidney regulate potassium in the body
- **Excessive** cardiac arrest
- **Deficiency** cause muscle paralysis

Other minerals

- **Chlorine:** from NaCl deficiency cause vomiting
- **Magnesium:** essential element, deficiency occur in some disease
- **Copper:** improve anemia.
- **Zinc:** deficiency cause growth failure, poor wound healing it occurs with parasitic infection, malabsorption
- **Cobalt:** B12, necessary for RBC development

Water

- **65-70% of body weight**
- **It is the basis of all body fluids**
- **Function**
 - **Needed for all chemical reactions**
 - **Maintain body temp. & lubrication**
 - **Person can live on it , die without it**
- **Sources**
 - **Fluids 1000-2500ml**
 - **Food 1000-1500ml**
 - **Metabolic activity 200-400ml**

Water

- **Balance:** maintain by kidney, lost through urination, sweating, defecation
- **Dehydration:** loss of water usually happens during excessive vomiting, diarrhea, hemorrhage, burns, uncontrolled D.M

Vitamins

- **Organic substance which an organism must obtain from it's environment in minute amount it is essential for normal metabolism**
- **Function:** they act by promoting a specific chemical reaction in a metabolic process
- **Classification**
 - Fat soluble (A, D, E, K)**
 - Water soluble (B group, C)**

Vitamin A

- **The chemical name of vitamin A is retinol. The major storage site of vitamin A in the body is in the liver.**
- **Function**
 - 1) night vision the best known function of vitamin A is in vision, where it participates in the formation of retinal pigment that helps the eye to see in dim light**
 - 2) healthy epithelial tissue this function maintains differentiation of epithelial cells such as skin, lung, and intestinal tissue.**
 - 3) normal development of teeth and bones.**

Vitamin A

- **Sources:** liver, egg yolk, fortified foods, green leafy vegetables, orange and red fruits and vegetables, carrot, peach, apricot, prune, kidney, butter, oily fish and milk.
- **Destroyed by cooking and exposure to light**

Vitamin A

- **Diet recommendations:** For adult human males, the Recommended Dietary Allowance (RDA) is 750ug Retinol for adult females, 1200ug

Vitamin A

- **Deficiencies:**

- 1. Night blindness is one of the early signs of vitamin A deficiency, because of the role of vitamin A in vision.**
- 2. Bacterial invasion and permanent scarring of the cornea of the eye (xerophthalmia) is a symptom of more profound deficiency, but this is due to a different mechanism,**
- 3. The lack of vitamin A for control of gene expression. Profound vitamin A deficiency also results in altered appearance and function of skin, lung, and intestinal tissues**

VITAMIN D

- **Calciferol**
- **Function** to increase the efficiency of intestinal calcium absorption and to mobilize calcium stores from bone in order to maintain the serum calcium and phosphorus concentrations within the normal physiological range.

Vitamin D

- **Formation** Vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol) are stored in body fat.

The vitamin D precursors produced in yeast and plants (ergosterol) and animals(7-dehydrocholesterol) are converted to vitamin D by exposure to ultraviolet light.

Vitamin D (either vitamin D2 or vitamin D3) is metabolized in the liver to 25-hydroxyvitamin D and then to 1, 25-dihydroxyvitamin D in the kidney. 1, 25-Dihydroxyvitamin D is considered to be the biologically functioning form of vitamin D.

Vitamin D

- **Food sources:**

- 1. Non dietary by conversion inside the body**

- 2. Dietary Good food sources are milk properly fortified with vitamin D, fatty fish such as salmon and mackerel, cod liver oil, fish liver oil, some breads and cereals, and some egg yolks.**

Not affected by storage or preservation or cooking

- **Diet recommendations**

Based on the available literature and assuming some exposure to sunlight, an AI for ages 0 - 50 years was set at 200 IU (5 µg)/day. There was no compelling data to increase the vitamin D requirement either during pregnancy or lactation..

Vitamin D

- **Deficiencies:** In humans, deficiency symptoms include rickets in children, osteomalacia in adults, muscle weakness, bony deformities, neuromuscular irritability causing muscle spasms of the larynx (laryngospasm) and hands (carpopedal spasm), generalized convulsions and tetany.

Vitamin E

- **Tocopherol**
- **Function** The most widely accepted biological function of vitamin E is its antioxidant properties
- **Food sources:** Vegetables and seed oils including soybean, and corn; sunflower seeds; nuts; whole grains; and wheat germ are the main sources of the tocopherols. Leafy vegetables also supply an appreciable amount of this nutrient.

Vitamin K

- **Function** Essential for blood clotting and its regulation
- **Sources** Cooked dark green vegetables, such as spinach, kale and broccoli
- **Deficiency** disruption of blood clotting
- **Absorption** along with fat that assisted by emulsifying action of bile

Vitamin B1

- **Thiamine**
- **Function**
 - **COH metabolism**
- **Sources**
 - **Germinating part of cereal, whole meal, milk, egg, liver, peas, beans**
- **Effect of cooking**
 - **Destroyed by very high temp.**

B1

- **Deficiency**

- **Beriberi:** occur for men in the sea, alcoholic with poor diet, eating polished rice, polyneuritis.
- **Wet:** pain, muscle weakness, inability to perform coordinated movement
- **Dry:** edema, swelling, heart failure
- **Infantile:** cardiovascular symptoms

B2

- **Riboflavin**
- **Function:**
 - oxidation and reduction in body tissue
- **Sources:**
 - milk, yolk, liver, kidney and heart
- **Effect of cooking:**
 - sun light exposure
- **Deficiency:**
 - inflammation of lips & tongues, waxy eruption, crack , cornea infiltrated with blood vessels

Nicotinic acid

- **Niacin**
- **Function**
 - oxidation and reduction in body tissue
- **Sources**
 - whole grain cereal, milk, egg, liver, meat, veg.
- **Deficiency**
 - Pellagra: maize eating people reddish-brown discoloration of skin, GIT inflammation, 3Ds

B12

- **Cyanocobalamin**
- **Function**
 - Normal development of RBC, treatment of pernicious anemia
- **Sources**
 - Liver, kidney, heart, meat, fish, cheese
- **Deficiency**
 - Lack of intrinsic factors cause pernicious anemia

Folic acid

- **Folate**
- **Function**
 - **Essential development of RBC, treatment of anemia**
- **Sources**
 - **Green leafy veg.**
- **Effect of cooking**
 - **Lost during cooking**
- **Deficiency**
 - **Megaloblastic anemia**

Vit. C

- **Ascorbic acid**
- **Function**
 - **Connective tissue formation, RBC formation**
- **Sources**
 - **Orange, GF, tomato, lemon, G.L.veg.,**
- **Effect of cooking**
 - **Lost by storage, cooking, A. A. oxidase**
- **Deficiency**
 - **Scurvy: weakness, irritability, hemorrhage, gum inflammation, bone degeneration**

Energy

- **Requirement:**
 - Growth and maintenance of body tissue
 - Maintenance of body temp.
 - involuntary muscle movement
 - Voluntary muscle movement
- **Sources: from oxidation, 1gm**
 - CAH 16kJ (4kcal)
 - Fat 37kJ (9kcal)
 - Protein 17kJ (4kcal)

Energy

- **4.2 J = 1cal**
- **Measurements**
 - **Direct calorimetry**
 - **Indirect calorimetry**
- **Basal metabolism**
 - **Amount of energy required to carry out the basic processes such as cellular activity, heart beat & respiration**

- **BMR:**
 - Man 65kg 1.14k cal/min
 - woman 55kg 0.91k cal/min
- **Total energy requirement:**

time X number of unit /min
- **Factors affecting energy requirement**
 - Age
 - Environmental temp.
 - Disease
 - Pregnancy
 - Energy intake

Specific dynamic action of food

- **The increased of energy expenditure due to food metabolism equals 10% of expenditure**
- **Excess energy intake is stored as fat in the body**

Fiber

- **Definition:** plant material that can't be digested by enzymes of GIT
- **Found in the cell wall and within cell of seed, roots, leaves, fruits**

- **Composition:**

- **Cellulose: glucose polysaccharide, tough fibrous strand, leafy veg.**
- **Pectin, plant gum, mucilages: non cellulose polysaccharide**
 - **Pectin combine with water to form gel**
 - **Plant gum to cover site of injury**
 - **Mucilages hold water in seed to prevent drying**
- **Lignin: gives the wood its strength and shape**

- **Analysis of fiber:**
 - Crude fiber content
 - Roughage
- **Effects of dietary fibers:**
 - **Mouth:** keeps teeth, gum healthy
 - **Stomach:** slow emptying of stomach & digestion
 - **Small bowel:** viscosity & transit time, complete absorption
 - **Large bowel:** bacteria in stool, H₂O, stool bulk, defecation, intracolonic pressure, colonic transit time



- **Fiber in diet:** depends on type of diet
- **Fiber hypothesis:** 1970 (degenerative disorder in UK)
- **Low intake of fiber related to the following disease:**
 - **Colonic disorder (con., d.d,c.c,app)**
 - **Disorder which are 2dry to colonic disorder (h.h, dvt, pe)**
 - **Metabolic disorder (ob, dm, ac, gs)**

- **Disadvantage of fiber in diet:**
 - **Mineral deficiency**
 - **Flatulence**