

# Minerals

- Out of a total of 50 chemical elements 21 are present in the human body and constitute 4 to 5 % of the total body weight in an adult and are required for growth, repair and regulation of vital body functions.

Three major groups ie

a) **Major minerals** -:

Calcium, Phosphorus, Sodium, Potassium, Magnesium.

b) **Trace elements** -:

Iodine, Iron, Fluorine, Zinc, Copper, Cobalt, Chromium, Manganese, Nickel, Tin, Silicon, Selenium, Molybdenum, Vanadium.

c) **Trace contaminants with known function** -:

Lead, Barium, Mercury, Boron, Aluminium

Man not likely to suffer from trace elements deficiency as long as he is omnivorous.



# Calcium

- Constitutes 1.5-2.0 % of body wt of an adult human i.e.
  - 1200 gm total body reserves.
  - 98 % Ca found in bones.
  - Blood concentration is 10 mg/dl.
  - Foetus requires 30 mg of Ca for development.
  - Equilibrium between Ca in blood and skeleton is maintained by Vit-D, Parathyroid hormone and calcitonin.
  - 30 % of Ca in the diet is absorbed.
  - Vit-D enhances absorption of Ca.
  - Phytates, Oxalates and Fatty acids decrease absorption.



# Calcium

## Sources

- Milk and Milk products, eggs, cereals, millets, fish.
- cow milk contains 1200 mg / litre whereas human milk contains 300 mg / litre of calcium as calcium caseinogenete.
- green leafy vegetables cheapest source of calcium
- Drinking water may deliver upto about 200mg/day

## Functions

- Bone and Teeth formation, Blood coagulation, muscle contraction, cardiac action, milk production, Relay of electric and chemical messages , keeping membranes of cells intact , metabolism of enzymes and hormones , cell division , transformation of light to electrical impulses in retina

## RDA

Adult --- 600mg and children 800mg

Pregnant and Lactating women 1200 mg.



# Calcium

## Deficiency diseases

- No clear cut deficiency disease if the intake of vitamin D is adequate

## Toxicity

- No deleterious affects.



# Phosphorus

- Total body reserves 400-700 gm.
- Occurs in bones and teeth.





# Phosphorus

## Sources

- Eggs, beans, meat, cereals, milk

## Functions

- Protein, fat, carbohydrate metabolism, Bone and teeth formation, all metabolisms

## RDA

- Intake should be equal to that of calcium except in infancy (ratio 1:1.5)

Deficiency rarely occurs



# Sodium

- Present in all body fluids.
- Body reserves are 100 gm of Na ion.
- Excretion is through urine and sweat.



# Sodium

## Sources

- Table salt, fish, meat, vegetables

## Functions

- Imp. Constituent of ECF
- Action Potential in nerve and muscle

## RDA

- 5 gm/day depends on climate

## Deficiency Diseases

- Muscle cramps , Anorexia , fatigue.
- >10gm/day intake raises hypertension

# Potassium

- Total body reserves 250 gms in adults

## Sources

Dry fruits, Cereals, Legumes, Lean meat

## Functions

Important constituent of ICF

RDA

Ideal sodium : potassium ratio is 1:1 (in m mol)

## Deficiency Diseases

Hypokalemia, Paralysis, Cardiac disturbances



# Magnesium

- Present in all body cells specially bones.
- Total body reserves are 25 gms
- Half of body reserves are in bones.
- Deficiency occurs in Chronic Alcoholics, Cirrhosis of liver, Toxemia of pregnancy ,PEM and Malabsorption syndrome.



# Magnesium

## Sources

- Wheat bran, whole grain, raw green vegetables, banana, apricot

## Functions

- Bone growth and integrity, Regulates normal cardiac cycle, Normal function of nerve and muscle

RDA

- 340 mg / day for adults

## Deficiency Diseases

- Neuro-muscular irritability, tetany, hyper-reflexia, sometimes hypo-reflexia



# Iron

- Total body reserves are 3-4 gm of which 60-70 % is in blood (Hb Iron) as circulating Iron.
- Remaining 30 % or 1.5 gm is storage Iron
- 1 gm of Hb contains 3.34 mg of Iron.

Two forms -:

-Haem Iron -: meat, liver, poultry and fish.

Better absorbed

-Non-Haem Iron -: cereals, green leafy vegetables, legumes, nuts

- Iron content of breast milk is less than 0.2 mg/dl.

- Bio availability of Non-Haem Iron is poor.



# Iron

## Absorption -:

- Absorbed from Duodenum and upper small intestine in ferrous state.
- Rate of absorption is influenced by many factors like -:
  - iron reserves of the subject
  - Presence of inhibitors and promoters.
  - Disorder of duodenum and jejunum.
  - Increased demand as in pregnancy.
- Absorbed Iron is transported as plasma ferritin.
- Iron conservation or re-utilization.



# Iron

Iron loss :-

Total daily loss in adults is 1 mg and in menstruating women is 2 mg

Major routes of Iron loss :-

- Haemorrhage (Physiological and Pathological )
- Basal losses (sweat , urine , bile)
- IUCDS

**Iron deficiency** occurs in

Three stages :-

1<sup>st</sup> :-

Decreased storage- without detectable abnormalities



# Iron

2<sup>nd</sup> -:

## Intermediate ie

- Latent iron deficiency
- Iron stores exhausted
- Anaemia has not occurred yet,

3<sup>rd</sup> -:

- Overt iron deficiency
- Haemoglobin decreases

Diagnosis of anaemia -:

Hb level <11 gm/dl - Early anaemia

Hb level below 10gm/dl - marked anaemia

Evaluation of iron status

- Hb concentration
- Serum iron concentration
- Serum ferritin
- Serum transferrin saturation



# Iron

## Sources

- Dried fruits, legumes, cereals, lean meat, fish, liver, iron vessels
- Haem Iron (Animal sources only) ie Liver, meat fish, poultry milk
- Non Haem Iron (vegetable origin only) ie cereals, legumes, nuts, oil seeds, jaggery, dried fruits Green leafy vegetables

## Functions

- Hb formation, Brain development and function, Body temperature regulation, muscle activity, Oxygen transport, cellular respiration, catecholamine metabolism

## RDA

- Adults 0.84mg/ day
- pregnancy and lactation 1.65 mg

## Deficiency Diseases

- Microcytic hypochromic anaemia (Nutritional anaemia), Lowered resistance to infections, Reduced work performance, Impaired learning abilities, Enteropathy, Reduced T-cell number, Reduced Antibodies, Enhanced Mortality and Morbidity



# Iodine

- Total body reserves 50 mg
- Blood level is 8-12 mcg/dl

Goitrogens -:

These are chemical substances leading to development of goitre. (cabbage, cauliflower)



# Iodine

## Sources

- Sea food
- sea salt, milk, meat, cereals, vegetables, cod liver oil, fresh water (1-50 mcg/L)

## Functions

- Synthesis of T3 and T4 by Thyroid gland, Growth, Development and Wellbeing

RDA

- 150 mcg

## Deficiency Diseases

- IDD,s i.e endemic goitre (hypothyroidism, Growth retardation, Dwarfism, Cretinism, Deaf mutism, Mental retardation, Spontaneous abortion, Stillbirths)



## Fluorine

- Most abundant element in nature.
- 96 % in bones and teeth.
- Drinking water contains normally 0.5 - 0.8 mg/L.



# Fluorine

## Sources

- Sea fish, cheese, tea, drinking Water

## Functions

- Normal Bone mineralization, Dental enamel formation

## RDA

- 0.5-0.8 mg / L of fluorine should be in drinking water

## Deficiency Diseases

- Dental caries (in deficiency) Dental and skeletal fluorosis (in excess), two edged sword



## Other trace elements

### Zinc -:

- Total body reserve is 1.4-2.3 gm.
- RDA is 12 mg.
- Component of many enzymes
- Present in all tissues.
- Plasma level is 96 Microgm / 100ml in adults and 89 Mcg / 100 ml in children
- Animal sources are more dependable.



# Zinc

## Sources

- Meat, milk, fish, widely distributed in both animal and vegetable foods,

## Functions

- Wound healing, Immunity function, antioxidant

## RDA

- 12 mg

## Deficiency Diseases

- Growth failure, sexual infantilism in adolescents, loss of taste, delayed wound healing.



# Copper

## Copper -:

- Total body reserves 100-150 mg.
- Hypocupremia
- Hypercupremia
- Deficiency or excess is rare
- Widely distributed in nature.



# Selenium

Deficiency Diseases

- PEM, Decreased antibody production



# Chromium

## Chromium :-

- Total body reserves 6 mg.

## Function :-

Helps in the function of CHO and Insulin.



# Molybdenum

## Molybdenum -:

Toxicity causes bone deformities.  
Deficiency causes mouth and  
Oesophageal cancer.



## Balanced diet

- It is a diet which contains optimum req. of food calories & nutrients.
- It is a diet which contains different types of foods in such quantities & proportions that the need for proteins, fat, carbohydrates, vitamins & minerals is adequately met for maintenance of health, vitality & general well being & makes a small provision for extra nutrients to withstand short duration of leanness.



## Principles for constructing balanced diet

- |                 |          |
|-----------------|----------|
| ■ Carbohydrates | 50 – 70% |
| ■ Proteins      | 10 – 15% |
| ■ Fats          | 15 – 30% |

**Q- If Asia 33 years of age has daily caloric req. of 2000 kcal , how much grams of proteins, fats & carbohydrates should be taken by her to meet her caloric requirements?**



## Energy Requirements

- It is defined as level of energy intake from food that balances energy expenditure, when the individual has a body size and composition and level of physical activity, consistent with long term good health, also allowing for maintenance of economically essential and socially desirable activity.

- Components:

- Basal metabolism
- Energy expenditure off work
- Energy expenditure for work



## Basal Metabolism

- It is energy req. of an individual at complete rest in comfortable & relaxed position both physically and mentally.
- It depends on age, sex, body surface area, external temp. & pathological conditions.
- This is about 1Kcal/hour for every Kg of body weight for an adult.



- Energy expenditure for daily activities: It is energy req. of an individual for his daily activities which are of non-occupational nature like sitting, standing, dressing, walking.
- Energy expenditure for work: It is energy req. of an individual for the performance of daily occupational work.



## Recommended daily intake of energy

- **Adult male (60kg):**
  - light work – 2320 kcal
  - moderate work – 2730 kcal
  - heavy work – 3490 kcal
- **Adult female (50kg):**
  - light work – 1900 kcal
  - moderate work – 2230 kcal
  - heavy work – 2850kcal
- **Pregnancy:** +350 kcal
- **Lactation :**
  - for first 6 months - +600 kcal
  - for next 6 months - + 520 kcal



## EMPTY CALORIES

- Are a measurement of the energy present in high energy foods with poor nutritional profiles with most of the energy typically coming from processed carbohydrates, fats, or ethanol
- Empty calorie is also called discretionary calorie.
- It has the same energy content as any other calorie but it lacks many accompanying nutrients such as , Vitamins , Dietary minerals , Antioxidants, Amino acids and Dietary fiber.



## FOODS CONTAINING EMPTY CALORIES

- CAKE , COOKIES , SWEET , CANDY , ICECREAM , SOFT DRINKS , BEVERAGES AND JELLIES
- Refined grains such as WHITE BREAD or WHITE RICE
- MARGARINE
- BUTTER
- TEA , COFFEE and other CAFFEINATED BEVERAGAS
- BEER , WINE and other ALCOHOLIC BEVERAGES