
بسم الله الرحمن الرحيم
In the name of ALLAH
the most Beneficent and the most merciful

NUTRITION AND HEALTH-5

MICRONUTRIENTS – MINERALS

MINERALS

- More than 50 chemicals are found in human body, which are required for growth, repair and regulation of vital body functions

MINERALS

- These can be divided into 3 major groups

1:Major Minerals: These include calcium, phosphorus, sodium, potassium and magnesium

MINERALS

2:Trace Elements: These are elements required by the body in quantities of less than a few milligrams per day, such as, iron, iodine, zinc, fluorine, copper, cobalt, chromium, manganese, molybdenum, selenium, nickel, silicon, vanadium

MINERALS

3:Trace Contaminants with no known function:

These include lead, mercury, barium, boron and aluminium

MINERALS

- Only a few mineral elements (e.g. iodine, iron, calcium, phosphorus, sodium, fluorine) are associated with recognizable clinical situations in man
- For none of the other elements do we know with any certainty for their metabolic role and much less the clinical effects of dietary insufficiency

MINERALS

- Presence of substances like oxalic acid, phytic acid, fatty acids, dietary fiber etc, inhibit absorption of minerals from intestines
- Man is not likely to suffer from trace elements deficiency as long as he is omnivorous

MINERALS

- In fact, man's need for trace elements has not yet been precisely determined
- Trace elements should not be used as dietary supplements, since excessive amounts can have injurious effects

CALCIUM

- Calcium is a major mineral element of body
- It constitutes 1.5-2% of body weight of an adult human
- An average adult body contains about 1200 grams of calcium

CALCIUM

- Over 98% calcium is found in bones
- The amount of calcium in the blood is usually about 10mg/dl
- The developing fetus requires about 30 gram calcium

CALCIUM

- There is a dynamic equilibrium between the calcium in the blood and that in the skeleton; this equilibrium is maintained by the interaction of **vitamin D , parathyroid hormone** & probably **calcitonin**

CALCIUM

FUNCTIONS : Ionized calcium in the plasma has many vital functions in the body including:-

- Formation of bone and teeth
- Coagulation of blood
- Contraction of muscles
- Cardiac action

CALCIUM

(FUNCTIONS)

- Milk production
- Relay of electrical and chemical messages
- Metabolism of enzymes and hormones
- Transformation of light to electrical impulses in retina

CALCIUM

SOURCES

- The best natural sources are milk and milk products(e.g. cheese, curd) and eggs & fish
- Calcium occurs in milk as calcium caseinogenate, which is readily assimilated by the body

CALCIUM

(SOURCES)

- Other dietary sources are green leafy vegetables, cereals and millets
- Drinking water and some fruits are additional sources of calcium
- Rice is very deficient in calcium

CALCIUM

ABSORPTION OF CALCIUM

- Overall about 20-30% of dietary calcium is normally absorbed
- Absorption of calcium is enhanced by vitamin D and is regulated to some extent by body needs

CALCIUM

ABSORPTION OF CALCIUM

- Limiting factors like oxalic acid and phytic acid hinder the complete absorption of calcium from vegetables and cereals respectively. These form insoluble compounds with calcium such as calcium oxalate and calcium phytate

CALCIUM

- No clear-cut disease due to deficiency of calcium has ever been observed, but tetany and osteoporosis can occur
- No deleterious effects have been observed in man as a result of prolonged intake of large amounts of dietary calcium, neither have any benefits been observed

CALCIUM

- Daily intake of 600 mg of calcium has been suggested for adults
- The requirements are higher in children,
- expectant
- and nursing mothers

IRON

- Iron is of great importance in human nutrition
- The adult human body contains 3-4 gram iron
- 60-70% iron is present in blood(Hb iron)
- Each gram of Hb contains about 3.34 mg iron

FUNCTIONS OF IRON

Iron is necessary for many functions in the body including:

- Formation of haemoglobin
- Brain development and function
- Regulation of body temperature, muscle activity and catecholamine metabolism

FUNCTIONS OF IRON

- Lack of iron affects the immune system, it diminishes the number of T-cells and production of antibodies
- Besides haemoglobin, iron is a component of myoglobin, the cytochromes, catalase and certain enzyme systems

FUNCTIONS OF IRON

- Iron is essential for binding oxygen to the blood cells
- The central function of iron is "oxygen transport" and "cell respiration"

SOURSES OF IRON

There are two forms of iron:

1. Haem iron
2. Non haem iron

Haem iron is better absorbed than non haem iron

SOURSES OF IRON

- **Haem-Iron**

Foods rich in haem iron are liver, meat, poultry and fish. It is better absorbed and also promotes absorption of non-haem iron present in plant foods

SOURSES OF IRON

- **Non-Haem Iron**

It is of vegetable origin found in cereals, green leafy vegetables, legumes, nuts, oilseeds and dried fruits. Bioavailability of non-haem iron is poor owing to the presence of phytates, oxalates, carbonates, phosphates & fiber

SOURSES OF IRON

- Iron may also be derived from cooking in iron vessels

ABSORPTION OF IRON

- Absorption is influenced by:

(a) Body iron reserves

(b) Presence of inhibitors and promoters

(c) Disorders of duodenum and jejunum

ABSORPTION OF IRON

- Iron is absorbed in ferrous state, mostly from duodenum & upper small intestine according to body needs
- Foods which inhibit iron absorption are milk, eggs and tea
- Ascorbic acid and ascorbic acid rich foods promote iron absorption

ABSORPTION OF IRON

- Iron absorption is greater when there is an increased demand e.g. during pregnancy
- Absorbed iron is transported in plasma ferritin and stored in liver, spleen, bone marrow and kidney

ABSORPTION OF IRON

- Conservation is a feature of iron metabolism. Iron liberated from broken red blood cells, is re-utilized in new red blood cell formation

IRON LOSSES

- **Basal losses** – excretion of iron through urine, sweat, bile and desquamated cells
- Losses also occur in hemorrhages, wounds, varices, menstruation, childbirth, hemorrhoids, peptic ulcer, epistaxis etc

IRON LOSSES

- In diseases like hookworm, malaria
- Daily iron loss of an adult is 1 mg and about 12.5 mg during menstruation
- IUCD's (Intra Uterine Contraceptive Devices) **increase** blood loss between 35-146% and hormonal contraceptives **decrease** blood/iron loss by about 50%

IRON DEFICIENCY

Three stages of iron deficiency have been described

1. First Stage :

It is characterized by decreased storage of iron without any other detectable abnormalities

IRON DEFICIENCY

2. Second(intermediate)Stage :

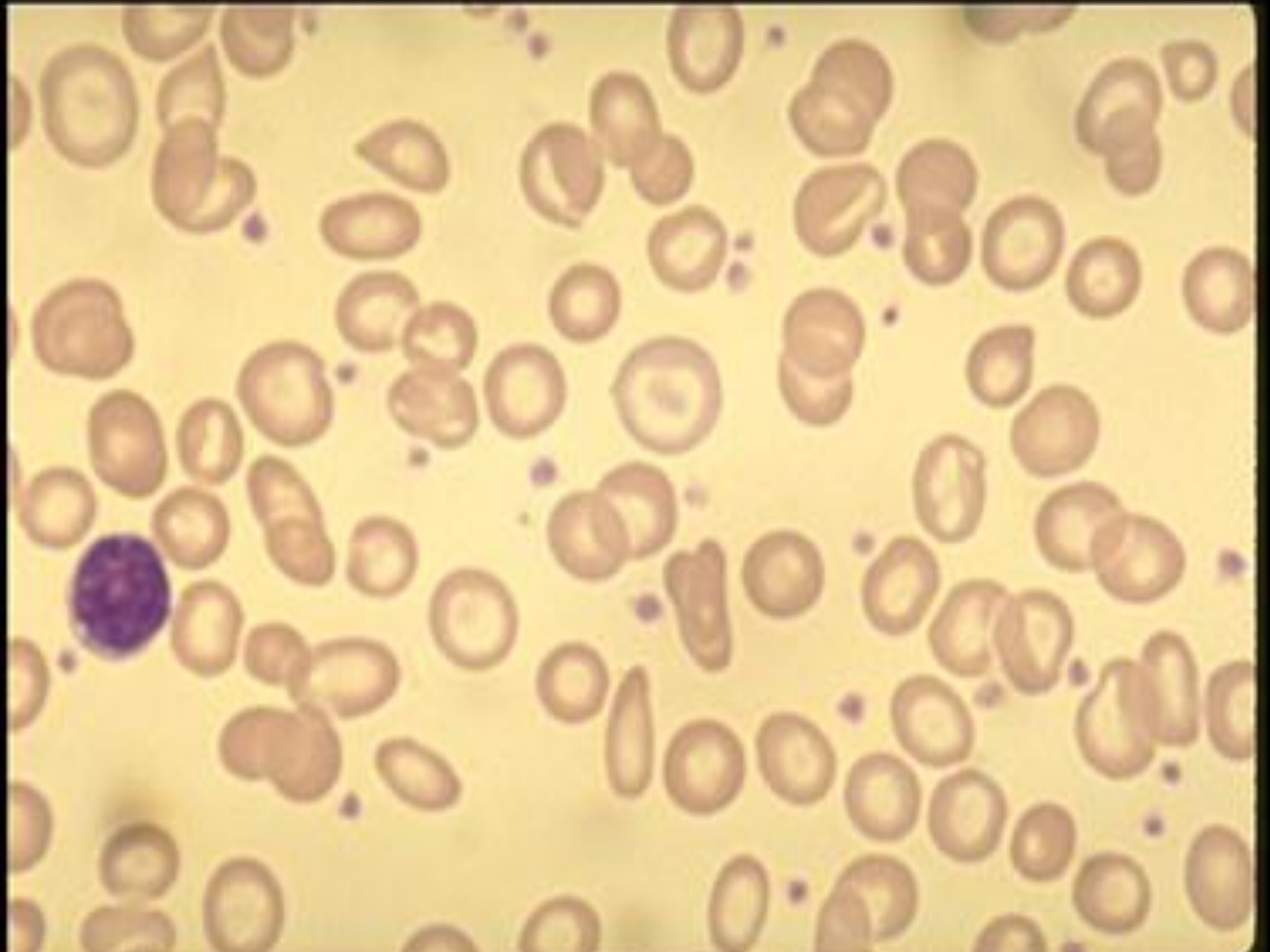
It is a stage of “latent iron deficiency”, that is, iron stores are exhausted but anaemia has not occurred as yet

Its recognition depends upon measurement of serum ferritin level

IRON DEFICIENCY

3. Third Stage :

It is that of overt iron deficiency, when there is decreased haemoglobin, due to impaired synthesis of Hb. The end result is nutritional anaemia accompanied by various signs and symptoms.



ANAEMIA

- Haemoglobin levels below normal is called anaemia.
- A level below 10 g/dl is marked anaemia
- MCHC should be 34 % in all ages

ANAEMIA

- Cut-off points for diagnosis of anaemia

	g/dl (Venous blood)
Adult males	13
Adult females, non pregnant	12
Adult females, pregnant	11
Children 6 months to 6 years	11
Children 6 years to 14 years	12

EVALUATION OF IRON STATUS

It is done by:

1. Haemoglobin Concentration
2. Serum Iron Concentration

Normal range : 0.8-1.8mg/Liter

Value below 0.5mg/Liter indicate probable iron deficiency

EVALUATION OF IRON STATUS

3. *Serum ferritin*: It is the single most sensitive tool for evaluating the iron status. Values below 10 mcg per Liter indicate an absence of stored iron
4. *Serum Transferrin Saturation*

   Normal value is 30%

   Value below 16% is abnormal

IODINE

- Iodine is essential nutrient
- It is required for synthesis of T4 and T3
- It is essential for the normal growth and development & well being of all humans

IODINE

- Adult human body contains 50 mg of iodine
- Blood level of iodine is 8-12 mcg/dl

SOURCES OF IODINE

- The best source is sea food(e.g. sea fish & sea salt) and cod liver oil
- Smaller amounts occur in milk, meat, vegetables, cereals
- Iodine content of fresh water is 1-50 mcg/Liter

SOURCES OF IODINE

- 90% of iodine comes from foods eaten and the rest from drinking water
- Iodine content of soil determines its presence in water and locally grown foods
- The deficiency is geochemical in nature

IODINE DEFICIENCY DISORDERS (IDD)

Consequences of iodine deficiency include:

- Goiter
- Hypothyroidism
- Retarded physical development
- Impaired mental function

IODINE DEFICIENCY DISORDERS (IDD)

- Increased rate of spontaneous abortion and stillbirth
- Cretinism(dwarfism & severe mental retardation)
- Hearing defects

IODINE DEFICIENCY DISORDERS (IDD)

- Speech defects
- Nystagmus
- Neuromuscular weakness etc.

Iodine deficiency is thus a problem with grave socioeconomic consequences

PREVENTION OF IDD

- "Appropriate technology" exists for successful prevention of Iodine Deficiency Disorders, that is **'universal iodization of common salt'**
- Daily requirement of iodine is 150 mcg


Iodized Salt

EPIDEMIOLOGICAL ASSESSMENT OF IDD

Indicators:

1. Prevalence of goitre
2. Prevalence of cretinism
3. Prevalence of neonatal hypothyroidism
4. Urinary iodine excretion

EPIDEMIOLOGICAL ASSESSMENT OF IDD

(Indicators)

5. Measurement of T4 and TSH

   (serum T4 level is a more sensitive indicator of thyroid insufficiency than T3)

FLUORINE

- Fluorine is the most abundant element
- In the body, 96% of fluorine is found in bones and teeth
- It is essential for normal mineralization of bones and formation of dental enamel

FLUORINE

- ***Sources*** are drinking water and foods like sea fish, cheese and tea
- ***Deficiency*** of fluorine causes dental caries

FLUORINE

- ***Excess intake*** of fluorine is associated with dental and skeletal fluorosis
- Use of fluorine is recognized as the most effective means available for the prevention of dental caries

FLUORINE

- The recommended level of fluorine in drinking water, in tropics, is accepted as 0.5-0.8 mg per liter
- In temperate countries, where the water intake is low, the optimum level of fluorine in drinking water is accepted as 1 to 2 mg per liter

- T
- H
- A
- N
- K

- Y
- O
- U