# **CHS (269) Lecture 8-9**

# **Iron deficiency anaemia**

* Anaemia is a condition in which the number of red blood cells or their oxygen-carrying capacity is insufficient to meet physiologic needs.
* It is from the greek word (Anaimia)------an -----without, haima-----blood
* Iron deficiency is thought to be the most common cause of anaemia globally, although other conditions, such as folate, vitamin B12 and vitamin A deficiencies, chronic inflammation, parasitic infections, and inherited disorders can all cause anaemia
* Iron deficiency is probably the commonest micronutrient deficiency in the world

***Haemoglobin thresholds used to define anaemia***

**Age or gender group Haemoglobin threshold (g/l)**

Children (0.50–4.99 yrs) 110

Children (5.00–11.99 yrs) 115

Children (12.00–14.99 yrs) 120

Non-pregnant women (15.00 yrs or more) 120

Pregnant women 110

Men (15.00 yrs or more) 130

***Classification of anaemia as a problem of public health significance***

**Prevalence of anaemia (%) Category of public health significance**

≤4.9 ---------------------------------- No public health problem

5.0–19.9---------------------------------- Mild public health problem

20.0–39.9 ---------------------------------- Moderate public health problem

≥40.0 ---------------------------------- Sever public health problem

***Global anaemia prevalence :***

**Population group Prevalence of anaemia**

Preschool-age children 47.4 %

School-age children 25.4 %

Pregnant women 41.8 %

Non-pregnant women 30.2 %

Men 12.7 %

Elderly 23.9 %

Total population 24.8 %





**Iron metabolism:  
A- Bioavailability**

## It is the proportion of iron ingested that becomes available to the body for metabolic processes .

## Bioavailability of haem iron is high i.e. 20- 30% is absorbed and is found in meat, seafood and chicken

## Non-haem iron is found in cereals, pulses, fruits, vegetables and dairy products and comprises the major source of dietary iron. Absorption of non-haem iron is highly variable. Figures of 1%–20% absorption have been found in various studies of mixed diets

## Absorption of non-haem iron is highly variable, depending on enhancing and inhibiting factors

## calcium inhibits the absorption of not only non-haem but also haem iron. This inhibition is not reversed by ascorbic acid

# **B -Absorption modifiers:**



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# **C- Host-related factors:**

## Intestinal parasites such as *Giardia lamblia* and *Ascaris lumbricoides* possibly reduce the absorption of iron. Such a negative effect on bioavailability is quite separate from that of hookworm in increasing iron loss from the body

# **D-Cooking procedures:**

## It also influence iron availability.Iron is lost from foods if they are cooked in large amounts of water which is subsequently discarded. In contrast, the use of cast-iron cookware can add to daily iron intake

## All of these factors should be taken into account when designing a programme to control iron-deficiency anaemia





# **Body iron**

## body iron can be considered as having two main components, functional iron and storage iron.

## The functional component is found largely in the circulating haemoglobin (73% ) and a smaller quantity in body tissue, myoglobin and enzymes. (15%)

## The remaining iron 12% in the storage complexes ferritin and hemosiderin in liver, spleen and bone marrow, serves as a reserve source for the functional component

## A deficiency of iron in the functional component does not ordinarily occur until stores are completely exhausted

* Blood is by far the richest tissue in iron; 1 ml contains 0.5 mg so that a regular loss of only 2 ml/day—for example, from epistaxis or haemorrhoids—doubles the iron requirements

# **Etiology of iron deficiency: A) Increased requirements:**

## During childhood, inadequate intake of iron during periods of rapid growth is the major cause of iron deficiency

## Premature infants are at risk for iron deficiency anaemia because there is not enough time to store an adequate amount of iron during the last trimester of pregnancy

## Premature infants also need more iron because they grow faster than term infants

## Full-term infants are rarely born anaemic, even when their mothers were anemic during pregnancy

## This is because iron is actively transferred to the fetus even when the mother is iron deficient

## Among full-term infants who are exclusively or predominantly breastfed, the iron in breast milk and iron stores are generally adequate for about six months. About fifty percent of the iron in breast milk is absorbed compared with about fourteen percent of the iron in other milks or breast milk substitutes

## If introduction of iron-rich complementary foods is delayed beyond six months, infants are at risk of iron deficiency

## Many of the complementary foods such as cereal porridge or mashed bananas that are fed to infants and young children are poor sources of iron.

## Continued breastfeeding until children are two or more years old help protect them from iron deficiency because they continue to receive the readily absorbed iron from breast milk . Where iron-fortified complementary foods are not widely and regularly consumed by young children, routine iron supplementation is recommended beginning at six months

* Adolescents incorporate twice the amount of calcium, iron, zinc and magnesium into their bodies during the year of growth spurt than at other times. Both males and females have high requirements of iron. In males, the build up of muscle mass is accompanied by greater blood volume and in females, iron is lost monthly with the onset of menses (Women of reproductive age lose an average of 30 ml blood per period, corresponding to 0.5 mg iron per day over the month, so they need more iron than men).

# **B- Chronic blood loss**

## Parasitic infection

## Excessive menstrual blood loss

## Bleeding peptic ulcer

## Hemorrhoids

## Ulcerative colitis

## Malignancy

## Certain drugs such as anticoagulants and aspirin, which is associated with gastrointestinal bleeding.

## Infections, which involve blood destruction such as malaria

## Helminthes that cause the blood loss leading to iron deficiency include hookworm, schistosomiasis, and trichuriasis (whipworm).

# **C) Inadequate iron intake or absorption:**

## Nutrients such as protein and iron are typically found in high concentration in animal products, which are relatively expensive and often beyond the budgets of the poorest households

## **Low bioavailability:** Most iron in the Eastern Mediterranean Region is of non-haem origin.

## **High intake of inhibitors of iron absorption:** Unleavened bread and tea are severe inhibitors of iron absorption and these are highly consumed everywhere

## **Low intake of enhancers of iron absorption**: The intake of fruits is largely seasonal. In many countries (like the Islamic Republic of Iran) much fruit is consumed, but not during meals

# **Stages of iron deficiency:**

## Depletion of iron stores as indicated by low plasma ferritin level.

## Interference with biochemical processes indicated by low transferrin saturation and low serum iron level.

## Finally anaemia as indicated by low haemoglobin level.

## if the prevalence of anaemia is fifty percent or more, the entire target population is likely to be iron deficient and in need of an iron intervention

# **The clinical picture of ID includes:**

## **A) Mental manifestations:** 1- Cognitive and psychomotor deficits.

## 2- Behavioural changes.

## **B) Physical manifestations:** 1- Increased maternal and child mortality.

## 2- impaired work capacity and productivity.

## 3- Impaired immunity.

## 4- Impaired physical growth.

## 5- Dysfunction of the heart.

## 6- Changes of appetite.

## 7- Changes in skin, hair and mucosa.

# **Cognitive and psychomotor deficits:**

## Cognition, or one’s ability to perceive, think, and remember, is influenced by many factors, one of which is iron deficiency and the extent of this deleterious effect will vary according to the age of its occurrence

## Iron-deficiency anaemia during the first 2 years of life has been shown to be associated with impaired mental and psychomotor development.

## This will lead to delay in the acquisition of new motor skills and explain the lag in motor development and physical activity and perhaps behavioral alterations (Lethargy, irritability, inability to concentrate )

# **Prevention and control of ID:**

## **A) Prevention by iron supplementation:**

## Some countries recommend iron supplementation in infancy .

## Most pregnant women who do not take iron supplements to meet increased iron requirements during pregnancy cannot maintain adequate iron stores, particularly during the second and third trimesters

# **B) Food fortification:**

## School feeding programs provide an excellent opportunity for supplying additional iron to the diet .

## Fortification of centrally processed and widely consumed staple foods such as flour or sugar is an effective and cost effective way of reaching all segments of the population (except infants).National wheat flour fortification programs have been very successful in raising population iron status in developed countries

# **C) Dietary modification:**

## Therefore the goal of dietary modification is behavior change that increase the intake of haem iron, increases the intake of vitamin C (as enhancer of iron absorption) and reduces the intake of inhibitors of iron absorption.

## Education efforts to delay the age of introduction of tea and avoiding drinking tea near the meal time, should be part of education based approach

# **For infants**

## 1. Breastfeed for first six to 12 months of age.

## 2. If using formula, use only iron-fortified infant formula.

## 3. No whole cow’s milk during the first year of life due to increased occult gastrointestinal bleeding (the preparation of infant formula alters the heat labile protein sufficiently to prevent this bleeding).

## 4. When solid foods are introduced at four to six months of age, it should be with iron-enriched cereals.

# **Treatment of IDA:**

## infant or toddler: Elemental iron, at a dosage of 3 mg per kg, is given orally (usually as ferrous sulfate syrup, which is 20 percent elemental iron) once daily Total length of treatment is three months

## For adults the dose is 50 to 200mg. Iron therapy should be continued for several months, even after Hb level has been restored, to allow for repletion of body iron reserves

**Too much iron?**

* • There is no homeostatic mechanism for disposing of excess iron; if too much is absorbed it accumulates in liver, heart and other organs. Chronic iron overload occurs in :
* **hereditary haemochromatosis** absorption is enhanced on an ordinary diet. One in 300 men of North West European descent are affected and fewer women, who have a mutation of the HFE gene, discovered in 1996.
* **repeated blood transfusions** (for example, thalassaemia)