

Iron Deficiency Anemia

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IRON DEFICIENCY

- ❑ Iron deficiency is the most common micronutrient deficiency in the world affecting 1.3 billion people i.e. 24% of the world population.**
- ❑ In comparison only 275 million are iodine deficient and 45 million children below age 5 years are Vitamin A deficient.**

- **Iron deficiency can range from sub-clinical state to severe iron deficiency anemia.**
- **Different stages are identified by clinical findings & lab tests.**
- **Anemia is defined as a hemoglobin below the 5th percentile of healthy population.**
- **Most studies showed this cutoff point to be around 11 g/dl (-2SD below the mean).**

Who is most at risk?

Young children and pregnant women are at higher risk of iron deficiency because of rapid growth and higher iron needs.

Adolescent girls and women of childbearing age are at risk due to menstruation.

□ Among children, iron deficiency is seen most often between six months and three years of age due to rapid growth and inadequate intake of dietary iron.

Infants and children at highest risk are the following groups:

- Babies who were born early or small.**
- Babies given cow's milk before age 12 months.**
- Breastfed babies who after age 6 months are not being given plain, iron-fortified cereals or another good source of iron from other foods.**
- Formula-fed babies who do not get iron-fortified formulas.**

- **Children aged 1–5 years who get more than 24 ounces of cow, goat, or soymilk per day.**

Excess milk intake can decrease child's desire for food items with greater iron content, such as meat or iron fortified cereal.

- **Children who have special health needs, for example, children with chronic infections or restricted diets.**

Causes of Iron Deficiency

- **Blood Loss**
 - **Gastrointestinal Tract**
 - **Menstrual Blood Loss**
 - **Urinary Blood Loss (Rare)**
 - **Blood in Sputum (Rarer)**
- **Increased Iron Utilization**
 - **Pregnancy**
 - **Infancy**
 - **Adolescence**
 - **Polycythemia Vera**
- **Malabsorption**
 - **Tropical Sprue**
 - **Gastrectomy**
 - **Chronic atrophic gastritis**
- **Dietary inadequacy (almost never single cause)**
- **Combinations of above**

DIETARY IRON

- ❑ There are 2 types of iron in the diet; haem iron and non- haem iron**
- ❑ Haem iron is present in Hb containing animal food like meat, liver & spleen**
- ❑ Non- haem iron is obtained from cereals, vegetables & beans**
- ❑ Milk is a poor source of iron, hence breast-fed babies need iron supplements**

IRON ABSORPTION

- **Haem iron is not affected by ingestion of other food items.**
- **It has constant absorption rate of 20-30% which is little affected by the iron balance of the subject.**

The haem molecule is absorbed intact and the iron is released in the mucosal cells.

Iron from meat, poultry, and fish (i.e., hem iron) is absorbed two to three times more efficiently than iron from plants (i.e., non-hem iron).

□ The absorption of non-haem iron varies greatly from 2% to 100% because it is strongly influenced by:

- The iron status of the body**
- The solubility of iron salts**
- Integrity of gut mucosa**
- Presence of absorption inhibitors or facilitators**

The amount of iron absorbed from plant foods (non-heme iron) depends on the other types of foods eaten at the same meal.

INHIBITORS OF IRON ABSORPTION

☐ Food with polyphenol compounds

- **Cereals like oats**
- **Vegetables such as spinach and spices**
- **Beverages like tea, coffee, cocoa and wine.**
- **A single cup of tea taken with meal reduces iron absorption by up to 11%.**

OTHER INHIBITORS

- ☐ **Food containing phytic acid i.e. Bran, cereals like wheat, rice, maize & barely. Legumes like soya beans, black beans & peas.**
- ☐ **Cow's milk due to its high calcium & casein contents.**

Promoters of Iron Absorption

- ❑ Foods containing ascorbic acid like citrus fruits, broccoli & other dark green vegetables because ascorbic acid reduces iron from ferric to ferrous forms, which increases its absorption.**
- ❑ Foods containing muscle protein enhance iron absorption due to the effect of cysteine containing peptides released from partially digested meat, which reduces ferric to ferrous salts and form soluble iron complexes.**

- **Some fruits inhibit the absorption of iron although they are rich in ascorbic acid because of their high phenol content e.g strawberry ,banana ,and melon.**

Dietary Sources of Iron

Food Sources of Iron ranked by milligrams of iron per standard amount; also calories in the standard amount. (All amounts listed provide 10% or more of the Recommended Dietary Allowance (RDA) for teenage and adult females, which is 18 mg/day.)

STORAGE OF IRON

- **Tissues with higher requirement for iron (bone marrow, liver & placenta) contain more transferrin receptors.**
- **Once in tissues, iron is stored as ferritin & hemosiderin compounds, which are present in the liver, RE cells & bone marrow.**
- **The amount of iron in the storage compartment depends on iron balance (positive or negative).**
- **Ferritin level reflects amount of stored iron in the body & is important in assessing ID.**

ROLE OF IRON IN THE BODY

+ Iron have several vital functions

- Carrier of oxygen from lung to tissues**
- Transport of electrons within cells**
- Co-factor of essential enzymatic reactions:**
 - Neurotransmission**
 - Synthesis of steroid hormones**
 - Synthesis of bile salts**
 - Detoxification processes in the liver**

DIAGNOSIS OF IDA

- ❑ **Clinical:** symptoms (fatigue, dizziness , palpitations..etc.) & signs (pallor, smooth tongue, Koilonychia, splenomegaly & dysphagia in elderly women).
- ❑ **Laboratory**
- ❑ **Stainable iron in bone marrow**
- ❑ **Response to iron supplements**

LAB FINDINGS IN IDA

- **Microcytic hypochromic anaemia**
- **Low Hb level (< 11.0 g/dl)**
- **Low MCV, MCH, MCHC**
- **Low serum ferritin**
- **High iron binding capacity**
- **High erythrocyte protoporphyrin**

Proposed classification of public health significance of anemia in populations on the basis of prevalence estimated from blood levels of hemoglobin or haematocrit

Category of public health significance	Prevalence of anemia (%)
Severe	> or = 40
Moderate	20.0 – 39.9
Mild	5.0 – 19.9
Normal	< or = 4.9

According to IFHS 2006/2007, the prevalence of anemia was 35.5% for all women, and 37.9% for currently pregnant women.

Consequences of Iron Deficiency

- **Increase maternal & fetal mortality.**
- **Increase risk of premature delivery and LBW.**
- **Learning disabilities & delayed psychomotor development.**
- **Reduced work capacity.**
- **Impaired immunity (high risk of infection).**
- **Inability to maintain body temperature.**
- **Associated risk of lead poisoning because of pica.**

MANAGEMENT OF IDA

- **Blood transfusion if heart failure is distinguished**
- **IV or IM iron in pregnant women**
- **Oral iron supplement**
- **Treat underlying cause**
- **Dietary education**

PREVENTION OF IDA

Food-based approaches

Food-based approaches represent the most desirable and sustainable method of preventing micronutrient malnutrition.

Food-based approaches should therefore include strategies to:

improve the year-round availability of micronutrient-rich foods; ensure the access of households, especially those at risk, to these foods; and change feeding practices with respect to these foods.

Applied to iron deficiency, efforts should be directed towards promoting the availability of, and access to, iron-rich foods. Examples include meat and organs from cattle, fish, and poultry; and non-animal foods such as legumes and green leafy vegetables.

Similarly, focus should be upon foods which enhance the absorption or utilization of iron.

Finally, effective nutrition education - and information on health and nutrition for both supply and demand aspects of programs - maybe needed to increase the demand for and consumption of such foods.

Examples of simple but effective modifications in meal patterns that enhance iron absorption might include:

- **separate tea drinking from mealtime - one or two hours later, the tea will not inhibit iron absorption because most of the food will have left the stomach;**
- **include in the meal fruit juices such as orange juice, or another source of ascorbic acid such as cabbage, carrots, or cauliflower**

- **consume milk, cheese, and other dairy products as a between-meal snack, rather than at mealtime; and consume foods containing inhibitors at meals lowest in iron content, e.g. a breakfast of a low-iron cereal(bread) consumed with tea or milk products.**

This meal pattern can provide adequate calcium without obstructing iron nutrition.

❑ **Short term approach:**

- ✓ **supplementation with iron tablets.**
- ✓ **Iron supplementation is the most common strategy currently used to control iron deficiency in developing countries.**
- ✓ **This is likely to remain the case until either significant improvements are made in the diets of entire populations or food fortification is achieved.**

□ **Long-term approach:**

✓ **food fortification with iron either for the whole population (blanket fortification) or for specific target groups like infants. It requires no cooperation from users unlike taking iron supplements.**

There is a consensus that enrichment (or fortification) of food is an effective long-term approach to improving the iron status of populations.

Essential requirements for implementing fortification strategies include the identification of an appropriate food vehicle that reaches the target population, that is centrally processed, and that is widely available and consumed in relatively predictable amounts by vulnerable population groups.

The dietary habits of the population are an important consideration in selecting a food for fortification.

For example, possible appropriate food vehicles range from wheat flour or pasta and condiments like sugar, salt, curry powder.

Other actions that indirectly affect iron status might include:

- **parasitic disease control programs, in particular those directed to hookworm, schistosomiasis and malaria control; these programs can enhance iron deficiency anemia control programme effectiveness in a population with moderate to severe levels of infection.**
- **incentive policies and improved farming systems that favour the development, availability, distribution, and use of foods that enhance iron absorption.**

Integration with other micronutrient control programs

Preventive supplementation is particularly well-suited to strategies that combine multiple micronutrient interventions.

Accordingly, efforts should be intensively directed to this area.

Programs that involve preparations containing iron, folic acid, and vitamins A and C, directed to infants, children, and pregnant and lactating women, are highly desirable.