Accelerated Efforts to achieve Elimination of Iron Deficiency Anemia

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Outline

1. Iron and its importance

2. Iron Deficiency Anemia

3. Burden of Iron Deficiency Anemia

4. Prevention and Control of Anemia – Global Efforts

5. Millennium Development Goals (MDGs) and Iron Deficiency Anemia

6. Anemia Control Program in India

7. National Iron Plus Initiative

8. Way forward
Iron and its Importance

• Iron is an essential micronutrient

• Integral component of several proteins and enzymes
  – Essential component of oxygen carrying proteins, hemoglobin and myoglobin
  – Essential component of cytochromes and catalase enzyme systems
Functions of Iron

• Carrier of oxygen from lungs to the tissues as haemoglobin in red blood cell

• Transport medium for electrons in cells

• Functions of iron-containing enzymes
  – Synthesis of steroid hormones, and bile acids;
  – Detoxification of foreign substances in the liver;
  – Signal controlling in neurotransmitters, such as the dopamine and serotonin systems in the brain
# Iron Distribution in Human Body

<table>
<thead>
<tr>
<th>Details</th>
<th>Men mg (%)</th>
<th>Women mg (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>3450 (100%)</td>
<td>2450 (100%)</td>
</tr>
<tr>
<td><strong>Functional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemoglobin (Blood)</td>
<td>2100 (61%)</td>
<td>1750 (71%)</td>
</tr>
<tr>
<td>Myoglobin (Muscles)</td>
<td>300 (9%)</td>
<td>250 (10.2%)</td>
</tr>
<tr>
<td>Enzymes (Catalase, peroxidase)</td>
<td>50 (1%)</td>
<td>50 (2.5%)</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferritin (Liver)</td>
<td>1000 (29%)</td>
<td>400 (16.3%)</td>
</tr>
</tbody>
</table>
Iron Cycle in Humans

Iron in food
(heme \(Fe^2+\)/non-heme\(Fe^3+\))

Absorbed in duodenum
(15-35% of heme/1-2% of non-heme)

Hepcidin

Inhibits

Majority of iron excreted

Ferritin
(26-30%)

Storage iron

Transport iron
(0.1%)

Plasma Iron - transferrin

Released iron in RES*

RBC

Hemoglobin
(70% iron)

Bone marrow

Hepatocytes

Iron Cycle in Humans
Iron Metabolism (simplified)

Iron absorbed mainly from duodenum in the ferrous form

Stored as ferritin in spleen, liver and bone marrow

Absorbed iron transferred to plasma protein Transferrin

- Ferritin is a protein-iron complex
- Serum ferritin level is an indicator of body iron stores
# Recommended Daily Allowance (RDA) of Iron

<table>
<thead>
<tr>
<th>Age group</th>
<th>Sub-group</th>
<th>RDA (mg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;18 years</td>
<td>Adult man</td>
<td>17</td>
</tr>
<tr>
<td>&gt;18 years</td>
<td>Adult woman</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Pregnant woman</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Lactating woman (0-6 months)</td>
<td>25</td>
</tr>
<tr>
<td>0-6 months</td>
<td>Infants</td>
<td>46 microgram/kg/day</td>
</tr>
<tr>
<td>6-12 months</td>
<td>Infants</td>
<td>5</td>
</tr>
<tr>
<td>1-3 years</td>
<td>Children</td>
<td>9</td>
</tr>
<tr>
<td>4-6 years</td>
<td>Children</td>
<td>13</td>
</tr>
<tr>
<td>7-9 years</td>
<td>Children</td>
<td>16</td>
</tr>
</tbody>
</table>

ICMR (2010). Nutrient Requirement and Recommended Dietary Allowances for Indians. A report of the expert group of ICMR.
RDA of iron among adolescent age group in India

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>RDA mg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-12 years</td>
<td>Boys</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>27</td>
</tr>
<tr>
<td>13-15 years</td>
<td>Boys</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>27</td>
</tr>
<tr>
<td>16-17 years</td>
<td>Boys</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>26</td>
</tr>
</tbody>
</table>

ICMR (2010). Nutrient Requirement and Recommended Dietary Allowances for Indians. A report of the expert group of ICMR
Sources of Iron

• Dietary iron has two main forms - Non-heme and Heme

• Heme iron
  ▪ Directly derived from hemoglobin
  ▪ Found in animal food sources - meat, poultry, fish
  ▪ Absorption is higher

• Non-heme iron
  ▪ Found in plant sources and fortified foods
  ▪ Absorption lower
Iron Rich Foods

- Green leafy vegetables like spinach, fenugreek, mustard, drumsticks, mint
- Legumes and lentils like bengal gram, black gram, red lentils, soyabean
- Poultry, meat, and fish
Food Enhancing Iron Absorption

- Almost all foods containing Vitamin C
- Citrus fruits like lemon, orange
- Amla, Tomatoes
- Sprouts
Foods Reducing Iron Absorption

• Calcium containing food
  – Milk
  – Curd
  – Cheese

• Food containing high fiber

• Foods rich in phytates
  – Pulses
  – Legumes
  – Grains

• Tea
• Coffee
## Iron content of common foods

<table>
<thead>
<tr>
<th>Food item</th>
<th>Iron (mg) per 100mg of edible portion</th>
<th>% of RDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leafy vegetables</td>
<td>7*</td>
<td>43</td>
</tr>
<tr>
<td>Other vegetables</td>
<td>3.4*</td>
<td>20</td>
</tr>
<tr>
<td>Pulses</td>
<td>4.7*</td>
<td>28</td>
</tr>
<tr>
<td>Egg</td>
<td>2*</td>
<td>12</td>
</tr>
<tr>
<td>Chicken</td>
<td>0.7**</td>
<td>4</td>
</tr>
<tr>
<td>Mutton</td>
<td>2.5**</td>
<td>15</td>
</tr>
<tr>
<td>Fish</td>
<td>0.7**</td>
<td>4</td>
</tr>
<tr>
<td>Liver</td>
<td>6.3**</td>
<td>37</td>
</tr>
</tbody>
</table>

* (low bioavailability)  ** High bioavailability (nearly 25%)
Causes of Iron Deficiency

• Increased iron demand
  – Pregnancy
  – Phases of growth

• Decreased dietary iron intake

• Low/inadequate absorption of iron
Poor Diet - Nutritional Anemia

• Nutritional Anemia most common anemia in South Asia

• Caused due to deficiency of iron and other essential nutrients (Vitamin B12, Folic Acid) in diet required for haemoglobin synthesis

• Anemia develops slowly after body stores of iron depleted
Low/Inadequate Absorption

- Malabsorption syndrome
- Steatorrhoea
- Chronic diarrhoea
- Intestinal surgery
Excessive Blood Loss

• In women excessive blood loss during menstruation or during childbirth

• Worm infestation (Hook worm)

• Infections such as Malaria

• Internal bleeding -
  - Gastric ulcer, colon polyp, colon cancer
  - Prolonged use of aspirin, nonsteroidal anti-inflammatory drugs (ibuprofen and naproxen)
  - Urinary tract bleeding
  - Piles, severe injuries, surgery or frequent blood drawings
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Iron Deficiency Anemia

- Anemia is a condition where hemoglobin is less than normal range for specified age and sex

- Groups at high risk of anemia
  - Infants and Under 5 children
  - School age children (6-14 yrs)
  - Adolescent girls (10 to 19 yrs)
  - Women of child bearing age (15-44 yrs)

- More than 50% cases of anemia attributed to iron deficiency*

*WHO | Worldwide prevalence of anaemia 1993-2005
Anemia, Iron Deficiency and Iron Deficiency Anemia (IDA)

- Excessive blood loss
- Infections e.g. malaria
- Worm infestation
- Anemia of chronic diseases
- Haemolytic anemia
- Thalassemia

- Increased iron demand like pregnancy, periods of growth
- Decreased dietary intake
- Low/inadequate absorption of iron

*Iron deficiency is the most common cause of anemia (>50%)

*WHO | Worldwide prevalence of anaemia 1993-2005
Signs and Symptoms of Anemia

- Pale skin, lips, tongue and inner surface of eyelids (conjunctiva)
- Fatigue, irritability and weakness
- Shortness of breath
- Fall in blood pressure with position change from lying or sitting to standing (orthostatic hypotension)
- Sore tongue (Glossitis)
- Unusual food cravings (pica)
- Decreased appetite (especially in children)
- Brittle concave nails (koilonychia)

*Mild anemia may be asymptomatic*
Consequences of Iron Deficiency Anemia

Iron Deficiency Anemia

Reduced physical development
- Decreased work output
- Decreased work capacity

Impaired sexual and reproductive development
- Irregular menstruation
- Low pre-pregnancy iron stores
- LBW babies and pre-term delivery

Reduced cognitive development
- Diminished concentration
- Disturbance in perception
- Poor learning ability
## Bio markers for anemia

<table>
<thead>
<tr>
<th>Cause</th>
<th>Biomarkers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron deficiency</td>
<td>Serum Ferritin, soluble transferrin receptors, serum iron, bone marrow examination, red cell morphology</td>
</tr>
<tr>
<td>Other nutritional deficiencies (such as Folate, Vitamin B12)</td>
<td>Red cell morphology, dietary intake data,</td>
</tr>
<tr>
<td>Malaria</td>
<td>Parasite antigen, thick and thin blood smear</td>
</tr>
<tr>
<td>Helminthic infections</td>
<td>Stool and/or egg counts, Immunological tests</td>
</tr>
<tr>
<td>Chronic infections (HIV/AIDS, tuberculosis, cancer, rheumatoid arthritis)</td>
<td>Specific clinical tests for pathogens</td>
</tr>
<tr>
<td>Inflammation</td>
<td>Acute phase proteins</td>
</tr>
<tr>
<td>Haemoglobinopathies (e.g. Sickle-cell disease and Thalassemia)</td>
<td>Genetic screening, electrophoresis</td>
</tr>
<tr>
<td>Gastric and intestinal diseases</td>
<td>Feecal blood</td>
</tr>
<tr>
<td>Iron status indicator</td>
<td>Change</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>Decreased</td>
</tr>
<tr>
<td>Serum Ferritin</td>
<td>Decreased</td>
</tr>
<tr>
<td>Serum Iron</td>
<td>Decreased</td>
</tr>
<tr>
<td>Transferrin Saturation</td>
<td>Decreased</td>
</tr>
<tr>
<td>Total Iron Binding Capacity(TIBC)</td>
<td>Increased</td>
</tr>
<tr>
<td>Soluble Transferrin receptor</td>
<td>Increased</td>
</tr>
</tbody>
</table>
### Hemoglobin levels to diagnose Anemia (g/dl)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>No Anaemia</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children 6–59 months of age</td>
<td>≥11</td>
<td>10–10.9</td>
<td>7–9.9</td>
<td>&lt;7</td>
</tr>
<tr>
<td>Children 5–11 years of age</td>
<td>≥11.5</td>
<td>11–11.4</td>
<td>8–10.9</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Children 12–14 years of age</td>
<td>≥12</td>
<td>11–11.9</td>
<td>8–10.9</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Non-pregnant women (15 years of age and above)</td>
<td>≥12</td>
<td>11–11.9</td>
<td>8–10.9</td>
<td>&lt;8</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>≥11</td>
<td>10–10.9</td>
<td>7–9.9</td>
<td>&lt;7</td>
</tr>
<tr>
<td>Men</td>
<td>≥13</td>
<td>11–12.9</td>
<td>8–10.9</td>
<td>&lt;8</td>
</tr>
</tbody>
</table>

Source: Haemoglobin concentration for the diagnosis of anaemia and assessment of severity. WHO
The Anemia Life Cycle

1. Anemia
   - Non pregnant women

2. Pregnancy
   - Erythropoiesis
   - Fetal needs
   - Blood loss

3. Anemia
   - Pregnancy

4. Anemia
   - Infants and children

- Birth weight
- Pre term birth
- Breast milk
- Iron
Anemia and Pregnancy

• In India, 70% of maternal deaths occur due to anemia, out of which 20% maternal deaths are directly due to anemia and another 50% associated with anemia.

• India contributes to 50% of global maternal deaths due to anemia.

• Maternal anemia leads to increase in perinatal mortality, low birth weight, and pregnancy wastage.

• Three-fold greater incidence of premature births in severely anemic women.

• Immune depression and increased morbidity in anemic pregnant women.


Classification of Anemia in Pregnancy

- **Definition:** Anemia in pregnancy is defined as hemoglobin concentration less than 11g/dl*

<table>
<thead>
<tr>
<th>Severity of anemia</th>
<th>Hemoglobin level (g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>10.0-10.9</td>
</tr>
<tr>
<td>Moderate</td>
<td>7.0-9.9</td>
</tr>
<tr>
<td>Severe</td>
<td>&lt;7.0</td>
</tr>
</tbody>
</table>

Outline

1. Iron and its importance
2. Consequences of Iron Deficiency
   **Burden of Iron Deficiency Anemia**
4. Prevention and Control of Anemia – Global Efforts
5. Millennium Development Goals (MDGs) and Iron Deficiency Anemia
6. Anemia Control Program in India
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8. Way forward
Anemia: Global Burden

Affects 1.6 billion population globally

Anemia: Global Scenario; WHO data base, 1993-2005
Anemia - Global Burden

- Anemia is the most common public health problem affecting 2 billion people world-wide

- 90% of the cases in developing countries

- Africa and Asia account for 85% of anemia

- Iron deficiency anemia (IDA) resulted in 273,000 deaths, with 97% occurring in low- and middle-income countries

- Contribute to 115,000 maternal deaths and 591,000 perinatal deaths per year

Anemia – Burden amongst Women

• Half a billion women of reproductive age group have anemia.

• 30% non-pregnant women and 41% pregnant women aged 15-49 years were anemic (in 2011)

## Anemia – Burden across Age and Gender

<table>
<thead>
<tr>
<th>Group</th>
<th>Prevalence of anemia (Percent)</th>
<th>Population affected Number in million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre school children</td>
<td>47.4</td>
<td>293</td>
</tr>
<tr>
<td>School age children</td>
<td>25.4</td>
<td>305</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>41.8</td>
<td>56</td>
</tr>
<tr>
<td>Non pregnant women</td>
<td>30.2</td>
<td>468</td>
</tr>
<tr>
<td>Men</td>
<td>12.7</td>
<td>260</td>
</tr>
<tr>
<td>Elderly</td>
<td>23.9</td>
<td>164</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24.8</strong></td>
<td><strong>1620</strong></td>
</tr>
</tbody>
</table>

Anemia – DALY Loss and Economic Loss

• Anemia causes loss of 19.7 million disability-adjusted life years annually, accounting for 1.3% of the global total

• The median annual economic loss because of IDA in 10 developing countries was estimated at $16.78 per capita or 4% of gross domestic product

## Burden of Anemia - India

<table>
<thead>
<tr>
<th>Age group</th>
<th>Prevalence of anemia (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children (6-35 months)</td>
<td>79.0</td>
</tr>
<tr>
<td>Children (6-59 months)</td>
<td>69.5</td>
</tr>
<tr>
<td>All women (15-49 years)</td>
<td>55.3</td>
</tr>
<tr>
<td>Ever married women (15-49 years)</td>
<td>56.0</td>
</tr>
<tr>
<td>Pregnant women (15-49 years)</td>
<td>58.7</td>
</tr>
<tr>
<td>Lactating women (15-49 years)</td>
<td>63.2</td>
</tr>
</tbody>
</table>

### Burden of Anemia - Adolescent Girls, India

<table>
<thead>
<tr>
<th>Age group</th>
<th>Prevalence (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 - 14 years</td>
<td>68.6*</td>
</tr>
<tr>
<td>15 - 17 years</td>
<td>69.7*</td>
</tr>
<tr>
<td>15 - 19 years</td>
<td>55.8**</td>
</tr>
</tbody>
</table>

* National Nutrition Monitoring Bureau Survey (NNMBS), 2006
# Severity of Anemia among Pregnant Women, India

<table>
<thead>
<tr>
<th></th>
<th>Mild (10.0-10.9 g/dl)</th>
<th>Moderate (7.0-9.9 g/dl)</th>
<th>Severe (&lt;7.0 g/dl)</th>
<th>Any Anemia (&lt; 11g/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25.8</td>
<td>30.6</td>
<td>2.2</td>
<td>58.7</td>
</tr>
</tbody>
</table>

Burden of Anemia - India

- **Children (6–59 months)**: 69.5%
- **Children (5-11 years)**: 41.8%
- **Adolescent girls (12–14 years)**: 68.6%
- **Adolescent girls (15–19 years)**: 55.8%
- **Pregnant women (15–49 years)**: 58.7%

**Sources:**
- NFHS-III
- NNMB, 2006
Causes of Anemia in Indian Women

- Insufficient quantity of iron-rich foods in diet
- Low bioavailability of dietary iron (non-heme iron)
- Deficiency of “iron enhancers” (citrus fruits, sprouts) in diet and excess of “iron inhibitors” (tea, coffee, phytates, calcium-rich foods) in diet
- Iron loss during menstruation and child birth
- Poor iron stores due to infancy & childhood deficiency
- Teenage pregnancy and pregnancies with <2 year interval
- Parasitic infestations (e.g. malaria, intestinal worms)
Causes of Anemia in Indian children

- Low iron stores at birth due to maternal anemia
- Faulty Infant Young Child Feeding Practices
  - No Exclusive Breast Feeding
  - Inappropriate, non-fortified substitutes of breast milk
  - Inappropriate complementary food
- Insufficient quantity of iron and iron enhancers in diet, and low bioavailability of dietary iron
- Iron loss due to parasitic infestations (e.g. malaria, intestinal worms)
Causes of Anemia

- Decreased RBC production
  - Iron Deficiency, Vit. B12 Deficiency
- Increased demand
  - Growth, Pregnancy
- Increased RBC destruction.
  - Malaria, Hemoglobinopathies
- Relative (increased plasma volume)
  - Acute blood loss, Burn
Socio-epidemiological and Politico-developmental Causes of Anemia

**Economic, Political, institutional, Climatic/Environmental conditions**

**Agricultural output**
- Food/cash crops, crop yield, livestock

**Economic circumstances**
- Regional/ local wealth
- Equity/equality
- Literacy/education

**Health policies**
- Health coverage/insurance
- Anemia control program
- Fortification policies

**Food availability**
- Food security
- House hold income/ wealth
- Access to cereals /vegetables/meat
- Food fortification
- Access to fortified food

**Health Care**
- Access to care
- Access to iron supplements
- Health worker knowledge

**Sanitation & Hygiene**

**Nutritional iron intake**
- Iron content of food
- Iron availability, heme-non iron, consumptions of inhibitors & enhancers

**Blood loss**
- Hook worm
- H pylori

**Malaria endemicity**
- Recurrent inflammation
- Malaria/diarrhea/pneumonia

**Genetics**
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Anemia Prevention and Control – Global Efforts

Project Iron Deficiency Elimination Action (IDEA) Micronutrient Deficiencies Program:

- Develops and implements country-specific fortification strategies to reduce the incidence of iron deficiency anemia
- Project IDEA has ongoing activities in China, Mexico, India, Indonesia, Vietnam, Egypt and Zambia.

The Global Alliance for Improved Nutrition (GAIN):

- Alliance of public and private sector partners launched during the Special Session on Children (SSC) meeting to save lives and improve health by eliminating vitamin and mineral deficiencies

(SSC, a follow up to the 1990 World Summit for Children, was held on 8-10 May 2002 at the United Nations in New York)
Global Target for Anemia Prevention and Control

• In 2012, the World Health Assembly Resolution 65.6 endorsed comprehensive implementation plan on maternal, infant and young child nutrition, with six global nutrition targets for 2025.

• The second target aims at 50% reduction of the 2012 levels of anemia in women of reproductive age by the year 2025.
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3. Burden of iron deficiency
4. Prevention and control of anemia – Global efforts

**Millennium Development Goals (MDGs) and Iron Deficiency Anemia**

6. Anemia control program in India
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Millennium Development Goals and Iron Deficiency Anemia

- Reducing the burden of anemia will make a major contribution to achieving several UN Millennium Development Goals (MDGs)

- Four out of Eight MDGs associated with anemia – goals 2, 3, 4 and 5
<table>
<thead>
<tr>
<th>MDG</th>
<th>Role of Iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Iron reduces maternal anemia. 20% of maternal deaths are due to anemia. Iron prevents maternal deaths during the perinatal period.</td>
</tr>
<tr>
<td>4</td>
<td>Iron prevents intrauterine growth retardation, low birth weight and prematurity. Iron enhances immunity, reduces frequency and severity of infections and decreases childhood morbidity and mortality.</td>
</tr>
<tr>
<td>3</td>
<td>Anemia in girls is often more severe than in boys. Adversely influences school attendance and achievement. Iron improves women’s health, increases work performance and productivity.</td>
</tr>
<tr>
<td>2</td>
<td>Iron reduces frequency and severity of infections/morbidity and mortality. Improves school attendance, retention, learning capacity and school achievement.</td>
</tr>
</tbody>
</table>
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Anemia Control Program in India

• National Nutritional Anemia Prophylaxis Program (NAPP) launched in 1972
  – India one of the first countries to have a national program

• Beneficiaries included pregnant & lactating women, and children (1-5 years age)

• Revamped as National Anemia Control Program (NACP)

• NACP screened all pregnant women for anemia and providing appropriate doses

• NACP became part of Reproductive Child Health Program (RCH) in 1997
# Iron and Folic Acid Supplementation in India

<table>
<thead>
<tr>
<th>Group</th>
<th>Strategy for IFA supplementation</th>
</tr>
</thead>
</table>
| Children (0-5 years)                 | 20 mg elemental iron and 100 mcg folic acid for 100 days  
Age - appropriate deworming                                                             |
| Children (6-10 years)                | 30 mg elemental iron and 250 mcg folic acid for 100 days                                                                                                                                     |
| Adolescent girls (10-19 years)       | Weekly dose of 100 mg elemental iron and 500 mcg of folic acid with bi-annual deworming                                                                                                          |
| Pregnant and lactating women         | 100 mg elemental iron and 500 mcg of folic acid daily for 100 days during pregnancy                                                                                                             |
|                                      | Same dose for 100 days in post partum period                                                                                                                                                    |
|                                      | Long lasting nets (LLINS) and insecticide treated bed nets (ITBN) for pregnant women                                                                                                          |
# Anemia Control Program in India - Other Initiatives

<table>
<thead>
<tr>
<th>Program</th>
<th>Year</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated child Development Services (ICDS) scheme</td>
<td>1975</td>
<td>Supplementary feeding provided for 300 days a year to children below the age of 6 years, and pregnant and nursing mothers</td>
</tr>
<tr>
<td>National Programme for Nutritional Support to Primary Education</td>
<td>1995, Revised in 2006</td>
<td>Cooked mid-day meal in school with 450 kcal and 12 g of protein, and micronutrients like iron, folic acid and vitamin A</td>
</tr>
</tbody>
</table>
## Anemia Control Program in India - Other Initiatives

<table>
<thead>
<tr>
<th>Program</th>
<th>Year</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiatives under National Rural Health Mission</td>
<td>2005</td>
<td>Health and nutrition days, prevention and treatment of anemia, food diversification, awareness and education; improve access to quality antenatal, intra natal, and postnatal care services; distribution of insecticide-treated bed nets</td>
</tr>
<tr>
<td>12 X 12 initiative</td>
<td>2007</td>
<td>To achieve hemoglobin of 12g/dl by the age of 12 for all adolescents by 2012 Health and nutrition education, weekly supplementation of IFA and periodic deworming, appropriate immunizations and measures for capacity building.</td>
</tr>
</tbody>
</table>
## Anemia Control Program in India - Other Initiatives

<table>
<thead>
<tr>
<th>Program</th>
<th>Year</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anemia Chale Jao - Nishchay</td>
<td>2007</td>
<td>To eliminate anemia by 2007 by ensuring that every female in India must know her weight, height, blood group, and hemoglobin level <em>(started by Federation of Obstetrics &amp; Gynecologic Societies of India)</em></td>
</tr>
<tr>
<td>Rajiv Gandhi Scheme for Empowerment of Adolescent Girls</td>
<td>2011</td>
<td>Adolescent girl has to be given at least 600 kcal and 18 to 20 g of protein and the recommended daily intake of micronutrients</td>
</tr>
</tbody>
</table>
## Anemia Control Program in India - Other Initiatives

<table>
<thead>
<tr>
<th>Program</th>
<th>Year</th>
<th>Strategy</th>
</tr>
</thead>
</table>
| National Iron Plus Initiative| 2013 | - A minimum package of services for treatment and management of anemia across levels of care  
- Supplementation throughout life cycle  
Bi-weekly iron supplementation for preschool children 6 months to 5 years  
Weekly supplementation for children from 1st to 5th grade in schools  
Weekly supplementation for out of school children (5–10 years)  
Weekly supplementation for adolescents (10–19 years)  
Supplementation for pregnant and lactating women  
Weekly supplementation for women in reproductive age |
Forms of iron Supplementation

- Tablets
- Capsules
- Syrup
- Intra venous Iron Sucrose
- Iron fortified food
Outline

1. Iron and its importance
2. Consequences of Iron Deficiency
3. Burden of Iron Deficiency
4. Prevention and Control of Anaemia – Global Agenda
5. Millennium Development Goals (MDGs) and Iron
6. Anemia control program in India
   National Iron Plus Initiative
7. Way forward
National Iron Plus Initiative - 2013

- To bring to attention of program managers to the serious negative consequences of anemia

- Preventive strategy - to lay out iron folic acid (IFA) supplementation through out the life-cycle

- Curative strategy - to define the minimum standard treatment protocol for facility based management of anemia

- To broadly identify platforms of service delivery and indicate service providers’ role
<table>
<thead>
<tr>
<th>Age group</th>
<th>Intervention/Dose</th>
<th>Regimen</th>
<th>Service delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-60 months</td>
<td>1ml of IFA syrup (20 mg of elemental iron and 100 mcg of folic acid)</td>
<td>Biweekly De-worming for children 12 months and above</td>
<td>Through ASHA Documentation in Mother and Child Protection (MCP) card</td>
</tr>
<tr>
<td>5-10 years</td>
<td>Tablets of 45 mg of elemental iron and 400 mcg of folic acid</td>
<td>Weekly Biannual de-worming</td>
<td><strong>In school</strong> - Teachers <strong>Out of school</strong>- Anganwadi centres Mobilization by ASHA</td>
</tr>
<tr>
<td>10-19 years</td>
<td>100 mg of elemental iron and 500 mcg of folic acid</td>
<td>Weekly Biannual de-worming</td>
<td><strong>In school</strong>- Teachers <strong>Out of school</strong>- Anganwadi centres Mobilization by ASHA</td>
</tr>
<tr>
<td>Pregnant and lactating women</td>
<td>100 mg of elemental iron and 500 mcg of folic acid</td>
<td>1 tablet daily for 100 days starting at 14-16 weeks of gestation To be repeated for 100 days post-partum</td>
<td>ANC/ANM/ASHA Documentation in MCP card</td>
</tr>
<tr>
<td>Women in reproductive age group</td>
<td>100 mg of elemental iron and 500 mcg of folic acid</td>
<td>Weekly</td>
<td>Through ASHA during house visit for condom distribution</td>
</tr>
</tbody>
</table>
# Albendazole Biannual De-worming

<table>
<thead>
<tr>
<th>Age</th>
<th>Dose (Albendazole 400 mg tablet)</th>
<th>Other instructions for administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 years</td>
<td>Half tablet</td>
<td>For children aged 1-3 years, the tablet should be broken and crushed between two spoons, then safe water added to help administer the drug</td>
</tr>
<tr>
<td>2 years and above</td>
<td>One tablet</td>
<td></td>
</tr>
</tbody>
</table>
Weekly iron Folic Acid Supplementation (WIFS) (In schools)
Monitoring formats for WIFS in schools

**Format 3 - Monthly School Report**

<table>
<thead>
<tr>
<th>State:</th>
<th>District:</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village/Town/city:</td>
<td>Month/year</td>
<td></td>
</tr>
<tr>
<td>Name of School:</td>
<td>Classes in school: 6th/7th/8th/9th/10th/11th/12th (tick)</td>
<td></td>
</tr>
<tr>
<td>No. of 6-12th class students:</td>
<td>Girls:</td>
<td>Boys:</td>
</tr>
<tr>
<td>Target population of staff</td>
<td>Teachers:</td>
<td>Others:</td>
</tr>
</tbody>
</table>

**Supply Details**

<table>
<thead>
<tr>
<th>IFA tablets</th>
<th>Albendazole tablets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Supply to school</td>
<td>Quantity received by school</td>
</tr>
<tr>
<td>Date of expiry of tablet</td>
<td>Opening stock for month:</td>
</tr>
</tbody>
</table>

**Population covered in reporting month**

<table>
<thead>
<tr>
<th>Girls</th>
<th>Boys</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescent students given 4/5 IFA tablets per month</td>
<td>Total IFA tablets consumed by students</td>
<td>Total number IFA tablets consumed by teachers/other staff</td>
</tr>
</tbody>
</table>

**GRAND TOTAL OF IFA TABLETS USED IN THE MONTH**

**Balance IFA tablets at school**

<table>
<thead>
<tr>
<th>Number of non-compliant students (consumed less than 4 tablets in month)</th>
<th>Identified</th>
<th>Referred</th>
</tr>
</thead>
</table>

**If February/August month for de-worming**

<table>
<thead>
<tr>
<th>Girls</th>
<th>Boys</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescent students given Albendazole tablet</td>
<td>Total number of Albendazole tablets consumed by teachers/other staff</td>
<td>GRAND TOTAL OF ALBENDAZOLE TABLETS USED IN THE MONTH</td>
</tr>
<tr>
<td>Balance Albendazole tablets in school</td>
<td>Number of non-compliant students for Albendazole in month</td>
<td>Topic of Nutrition Health education sessions conducted in the reporting month by nodal teacher</td>
</tr>
<tr>
<td>Compliance rate (percentage of students received is less than 4 tablets in the month)</td>
<td>Remarks on any side-effects/adverse reactions</td>
<td></td>
</tr>
</tbody>
</table>

**Nodal Teacher 1**

**Nodal Teacher 2**

**Head Master**

**Monthly School Report**

64
**Weekly iron Folic Acid Supplementation (WIFS) (Anganwadi centres)**

### Format 7A - Monthly format for Anganwadi centre

<table>
<thead>
<tr>
<th>Name of AWC/Village</th>
<th>Area Code</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of AWW</td>
<td>Month/Year</td>
<td>District</td>
</tr>
</tbody>
</table>

#### Supply Details

<table>
<thead>
<tr>
<th>Date of Supply to AWC</th>
<th>IFA tablets</th>
<th>Albendazole tablets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date of expiry of tablets</th>
<th>IFA tablets (week wise)</th>
<th>Reason for non-compliance (less than 4 IFA tablets per month)</th>
<th>Identified for moderate/severe anaemia (Y/N)</th>
<th>Date of consuming Albendazole tablets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3rd W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4th W</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5th W</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Girls ingested 4/5 IFA tablets:

- **TOTAL IFA distributed:**
- **Balance stock of IFA at AWC:**
- **Number of non-compliant girls:**
- **Common Reason of non compliance:**
- **Number of anaemia girls:**
- **Identified:**
- **Referred:**
- **Girls ingested Albendazole:**
- **Total Albendazole given:**
- **Balance stock of Albendazole at AWC:**

#### Monthly ICDS Report

<table>
<thead>
<tr>
<th>Remarks on side effects/adverse reactions</th>
<th>Signature</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aganwadi Worker</td>
<td>ICDS Supervisor</td>
</tr>
</tbody>
</table>
# Management of Anemia in children 6 months-5 years

<table>
<thead>
<tr>
<th>Level of Hb</th>
<th>Treatment</th>
<th>Follow-up</th>
</tr>
</thead>
</table>
| Mild anemia (10.0 - 10.9g/dl) | 3 mg of iron/kg/day for 2 months  
Hb estimation after 2 months to document Hb >11g/dl |                                                |
| Moderate Anemia (7.0 - 9.9g/dl) | Blood transfusion @ 10ml/kg if packed cells or @ 20ml/kg if whole blood over 3-4 hours  
• For all children with Hb≤4g/dl  
• Children with Hb 4-6 g/dl with dehydration, shock, impaired consciousness, heart failure, deep and laboured breathing, very high parasitemia |                                                |
| Severe Anemia (<7.0g/dl)       |                                                                            |                                                |
### Management of Anemia in children 5 years – 10 years

<table>
<thead>
<tr>
<th>Level of Hb</th>
<th>Treatment</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mild anemia</strong></td>
<td>3 mg of iron/kg/day for 2 months</td>
<td>Hb estimation after 2 months to document Hb &gt;11.5 g/dl</td>
</tr>
<tr>
<td>(11.0-11.4 g/dl)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moderate Anemia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8.0-10.9 g/dl)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Severe Anemia</strong></td>
<td>Blood transfusion @ 10ml/kg if packed cells or @ 20ml/kg if whole blood over 3-4 hours</td>
<td></td>
</tr>
<tr>
<td>(&lt;8.0 g/dl)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <strong>For all children with Hb ≤4 g/dl</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <strong>Children with Hb 4-6 g/dl with dehydration, shock, impaired consciousness, heart failure, deep and laboured breathing, very high parasitemia</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Management of Anemia in children 10 years – 19 years

<table>
<thead>
<tr>
<th>Level of Hb</th>
<th>Treatment</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild anemia (11.0-11.9 g/dl)</td>
<td>60 mg of elemental iron daily for 3 months</td>
<td>Hb estimation after 3 months to document Hb &gt; 12.0 g/dl</td>
</tr>
<tr>
<td>Moderate Anemia (8.0-10.9 g/dl)</td>
<td>60 mg of elemental iron daily for 3 months</td>
<td>Hb estimation after 2 months to document Hb &gt; 12.0 g/dl</td>
</tr>
</tbody>
</table>
| Severe Anemia (<8.0 g/dl)            | Blood transfusion @ 10ml/kg if packed cells or @ 20ml/kg if whole blood over 3-4 hours  
  • For all children with Hb ≤ 4g/dl  
  • Children with Hb 4-6g/dl with dehydration, shock, impaired consciousness, heart failure, deep and laboured breathing, very high parasitemia |                                                                  |
## Management of Anemia in Pregnant and Lactating Women

<table>
<thead>
<tr>
<th>Level of Hb</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mild anemia</strong> (9.0-11.0 g/dl)</td>
<td>2 IFA tablets for at least 100 days</td>
</tr>
<tr>
<td><strong>Moderate Anemia</strong> (7.0-9.0 g/dl)</td>
<td>Hb 8-9 g/dl - 2 IFA tablets for at least 100 days</td>
</tr>
<tr>
<td></td>
<td>Hb 7-8 g/dl - Parenteral iron therapy (Iron Dextran or Iron Sorbitol 100 mg daily, deep IM in gluteal region, maximum dose of 1500-2000 mg is given based on body weight)</td>
</tr>
<tr>
<td><strong>Severe Anemia</strong> (&lt;7.0 g/dl)</td>
<td>Hb 5-7 g/dl - Parenteral therapy as per Hb 7-8 g/dl</td>
</tr>
<tr>
<td></td>
<td>Hb &lt;5 g/dl - Injectable IV sucrose preparation, Immediate hospitalisation and plan for blood transfusion if required</td>
</tr>
</tbody>
</table>
Management of Anemia in Pregnant and Lactating Women

Tablet Iron Folic Acid

Injection Iron Sucrose

A pregnant woman being administered Injection Iron Sucrose
Population Level Strategies to address IDA

- Delayed cord clamping
- Anti-helminthic therapy
- Daily oral iron supplementation
- Intermittent oral iron supplementation (weekly)
- Intravenous iron sucrose supplementation
- Multiple micronutrient powders
- Fortification of food
Outline

1. Iron and its importance
2. Consequences of Iron Deficiency
3. Burden of Iron Deficiency
4. Prevention and Control of Anaemia
5. Millennium Development Goals (MDGs and Copenhagen Consensus)
6. Anemia control program in India
7. National Iron Plus Initiative

Way forward
Approaches to Address Iron Deficiency Anemia

- Food Based
  - Dietary diversification
    - Adding foods with high micronutrient density to staple diets
    - Methods like germination, fermentation etc.
  - Food Fortification
  - Supplementation
    - Tablets
    - Capsules
    - Syrup
    - Injection iron sucrose

- Public health measures
  - Improving sanitation and hygiene
  - Health education
  - Communication for behavioural change

• Potential vehicles
  - Flour
  - Milk
  - Salt
  - Sugar
  - Condiments
  - Bread
  - Biscuits
### Indicative costs of various iron-containing foods

<table>
<thead>
<tr>
<th>Food stuff</th>
<th>Iron content per 100 g</th>
<th>Cost per kg (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken</td>
<td>0.7 mg</td>
<td>100</td>
</tr>
<tr>
<td>Wheat</td>
<td>8.3 mg</td>
<td>25</td>
</tr>
<tr>
<td>Dates</td>
<td>4.0 mg</td>
<td>800</td>
</tr>
<tr>
<td>Potato</td>
<td>16.0 mg</td>
<td>20</td>
</tr>
<tr>
<td>Mutton</td>
<td>2.9 mg</td>
<td>300</td>
</tr>
<tr>
<td>Vegetables</td>
<td>3.3 mg</td>
<td>30</td>
</tr>
<tr>
<td>Kabuli Chana</td>
<td>4.0 mg</td>
<td>70</td>
</tr>
<tr>
<td>Fortified salt</td>
<td>85 mg</td>
<td>20</td>
</tr>
</tbody>
</table>
GLOBAL TARGETS

To improve maternal, infant and young child nutrition

1. 40% reduction in the number of children under 5 who are stunted

2. 50% reduction of anaemia in women of reproductive age

3. 30% reduction in low birth weight

4. No increase in childhood overweight

5. Increase the rate of exclusive breastfeeding in the first 6 months up to at least 50%

6. Reduce and maintain childhood wasting to less than 5%
Global Nutrition Targets 2025

50% reduction of anemia in women of reproductive age

Year 2012
Global prevalence 29%

Year 2025
Global prevalence 15%
Multi - Sectoral Approach

Increase iron intake

- Promotion of iron rich food
- Reduction of foods lowering iron absorption
- Food fortification
- Iron supplementation

Infection control

- Prevention and prompt treatment of hookworm and malaria

Immunity enhancement

- Vitamin B12, folate and Vitamin A

Source: http://www.who.int/nutrition/topics/ida/en/
Strengthen Health Systems

– Provide hospital and health facilities-based capacity for anemia prevention and treatment

– Support antenatal iron and folic acid supplementation care
Partnerships

– Government Departments
  • Health and Family Welfare
  • Women and Child Development
  • Agriculture
  • Food and Civil Supplies

– Academic Institutions and Professional Associations
  • National Institute of Nutrition (NIN)
  • Indian Council of Medical Research (ICMR)
  • All India Institute of Medical Sciences (AIIMS)
  • IAP, FOGSI, IPHA

– Bilateral and Development Agencies
  • WHO, UNICEF, WFP, GAIN, MI, PATH, BMGF

– Food Industry
  • Processed food industry, wheat flour, rice

– Civil Society
Community Support

– Raise awareness regarding iron supplementation and food fortification

– Support community mobilization and social marketing strategies
Summary

• Iron deficiency anemia is a major public health problem

• Anemia leads to increased morbidity and mortality
  – 70% of maternal deaths (20% directly and 50% indirectly) in India are due to anaemia
  – Anemia leads to increased peri-natal mortality, low birth weight and pre term labour

• Anemia leads to poor physical capacity, poor cognitive performance and increased susceptibility to infection
Summary

• Prevention and control of iron deficiency anaemia global and national priority
  – Dietary diversity, supplementation and fortification to address iron deficiency anaemia
  – A multi-sectoral approach with health system strengthening
  – Establishing partnership comprising of government departments, academic institutions, bilateral agencies, civil society and food industry

• Need to accelerate efforts to achieve elimination of iron deficiency anemia
“In the field of nutrition, as in politics, the task is to do what is possible without forgetting to make possible what is necessary”

J H Beaton, JM Bengoa