Double Fortification of Salt with Iron and Iodine
Supervisor

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Student name

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Malnutrition

“Pathological state resulting from relative or absolute deficiency of one or more essential nutrients”

(Hawkesworth, 2009)

Micronutrient Malnutrition

- Loss of 1.5 million lives per year

(Fiedler, 2009)

- Common among the children

(Caulfield et al., 2006)
Malnutrition in Pakistan

- Very high level of malnutrition
- Annual GDP loss: 3-4% (USSCN, 2008)
- Undernourished: 24 %
- 37.5 million people (FAO, 2008)
Objectives

- To improve the status of Iron and Iodine our population

- To improve the Iron and Iodine status specifically in target groups
## Recommended Daily Allowance (RDA) for Iron

<table>
<thead>
<tr>
<th>Age group</th>
<th>RDA (mg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 months</td>
<td>0.27</td>
</tr>
<tr>
<td>7-12 months</td>
<td>11</td>
</tr>
<tr>
<td>1-8 years</td>
<td>7-10</td>
</tr>
<tr>
<td>9-13 years</td>
<td>8</td>
</tr>
<tr>
<td>14-18 years (males)</td>
<td>15</td>
</tr>
<tr>
<td>14-18 years (females)</td>
<td>18</td>
</tr>
</tbody>
</table>

(Paul et al., 2004)
19-50 years (males) & 8 \\
19-50 years (females) & 18 \\
Over 50 years & 8 \\
Pregnant women (of all age) & 27 \\
Lactating women (14-18 years) & 10 \\
Lactating women (over 19 years) & 9 \\

(Paul et al., 2004)
### Recommended Daily Allowance for Iodine

<table>
<thead>
<tr>
<th>Age group</th>
<th>RDA (µg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 months</td>
<td>110</td>
</tr>
<tr>
<td>7-12 months</td>
<td>130</td>
</tr>
<tr>
<td>1-8 years</td>
<td>90</td>
</tr>
<tr>
<td>9-18 years</td>
<td>120</td>
</tr>
<tr>
<td>19 and over</td>
<td>150</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>220</td>
</tr>
<tr>
<td>Lactating women</td>
<td>290</td>
</tr>
</tbody>
</table>

(Paul et al., 2004)
Iodine

- Important for thyroid function
- Iodine deficiency may result in:
  - Impaired cognitive development
  - Hypothyroidism
  - Congenital abnormalities
  - Cretinism
  - Goiter

(WHO and UNICEF, 2007)
Iron

- Important for
  - Oxygen transport
  - Transport medium for electron
  - Part of enzymes

- Deficiency may result in
  - Anemia
  - Impaired cognitive performance
  - Increased maternal and child mortality

(Brownlie, 2002)
Salt Fortification

Salt is selected for fortification because

- Large scale consumption
- Regular consumption
- Constant amount
- Not related to socio-economic status

(Caulfield et al., 2006)
Methods of Salt Fortification

- Spray mixing
- Dry mixing

(Ranganathan, 2007)
Criteria for Fortificant Compound

- No discoloration
- No segregation
- No added flavor or odor
- Nutritionally available
- Economically feasible

(Andersson et al., 2008)
Iodine Compounds

- Potassium iodide
- Potassium iodate
- Calcium iodate  
  (Diosady, 2002)
Iron Compounds

- Ferrous ascorbate
- Ferrous fumerate
- Ferrous succinate
- Ferrous gluconate
- Ferrous sulfate.7H2O
- Ferrous sulfate
- Ferric pyrophosphate

(Hurrell, 2002; Swain et al., 2003)
Stabilizing Compound

- Sodium hexametaphosphate
- Sodium acid sulphate
- Orthophosphoric acid

(Diosady, 2002)
Problems in Stability

- Bioavailable form of iron: ferrous
- Ferrous oxidize to ferric
- Oxidation is accelerated by
  - Alkaline conditions
  - Oxidizing agents
  - High humidity
  - High temperature

(Diosady, 2002)
Oxidation results in

- Low bioavailability
- Poor taste
- Unacceptable discoloration
- Loss of iodine

(Diosady, 2002)

Solution

Microencapsylation

(Yao et al., 2010)
Product Analysis

- Iron determination
  Atomic absorption spectrometry

- Iodine concentration
  Sandell-kolthoff method
  (Andersson et al., 2008)
■ Moisture

    Gravimetric method

■ Color

    Colorimetric

(Andersson et al., 2008)
References


Thank You!