• The mineral depletion of foods available to us as a nation (1940-2002)—a review of the 6th Edition of McCance and Widdowson. Thomas D
• Abstract: Over the past 60 years there have been fundamental changes in the quality and quantity of food available to us as a nation. The character, growing method, preparation, source and ultimate presentation of basic staples have changed significantly to the extent that trace elements and micronutrient contents have been severely depleted. This trend, established in a review of the 5th Edition of McCance & Widdowson's The Composition of Foods, is still apparent in this review of the 6th edition of the same work. Concurrently there has been a precipitous change towards convenience and pre-prepared foods containing saturated fats, highly processed meats and refined carbohydrates, often devoid of vital micronutrients yet packed with a cocktail of chemical additives including colourings, flavourings and preservatives. It is proposed that these changes are significant contributors to rising levels of diet-induced ill health. Ongoing research clearly demonstrates a significant relationship between deficiencies in micronutrients and physical and mental ill health.
Categories of Essential Minerals

- **Bulk Essential**
  - Electrolytes
  - Structural

- **Trace Essential**
  - Co-factor
  - Structural

- **Beneficial Micronutrients**
  - Chromium
  - Molybdenum

Recommendations

- Minerals are necessary for the normal functioning of the body's cells.

- Minerals are an essential part of a healthy diet.

- Consuming too little or too much of certain minerals can cause a *nutritional disorder.*
Recommendations

People who follow restrictive diets may not consume enough of a particular mineral.

Some minerals—especially the macrominerals—are important as electrolytes.

To function normally, the body must keep the concentration of electrolytes in its compartments within very narrow limits.

Recommendations

If the balance of electrolytes is disturbed, disorders can develop.

To detect nutritional disorders or an electrolyte imbalance, doctors measure the levels of minerals in a sample of blood or urine.

Let’s Meet the characters!!
### Important Minerals for Human Health

<table>
<thead>
<tr>
<th>Calcium</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bulk</td>
<td>• Dairy</td>
<td>• Structural (bone &amp; teeth)</td>
</tr>
<tr>
<td>• 1000+ mg</td>
<td>• Vegetables</td>
<td>• Neuromuscular</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chloride</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bulk</td>
<td>• Salt</td>
<td>• Electrolyte balance</td>
</tr>
<tr>
<td>• 1000 mg</td>
<td>• Meat/cheese</td>
<td>• Stomach acid</td>
</tr>
</tbody>
</table>
### Important Minerals for Human Health

<table>
<thead>
<tr>
<th>Copper</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trace</td>
<td>• Meats</td>
<td>• Enzymes</td>
</tr>
<tr>
<td>• 900 µg</td>
<td>• Grains</td>
<td>• Antioxidation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fluoride</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trace</td>
<td>• Water</td>
<td>• Bone formation</td>
</tr>
<tr>
<td>• 3-4 mg</td>
<td>• Tea/coffee</td>
<td>• Spare dental caries</td>
</tr>
</tbody>
</table>
### Important Minerals for Human Health

<table>
<thead>
<tr>
<th>Iodine</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trace</td>
<td>• Seafood</td>
<td>• Formation of thyroid hormones</td>
</tr>
<tr>
<td>• 150 µg</td>
<td>• Water supply</td>
<td>• Breast health</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Iron</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trace</td>
<td>• Meat</td>
<td>• Enzymes</td>
</tr>
<tr>
<td>• 8-27 mg</td>
<td>• Spinach</td>
<td>• O₂ carrier</td>
</tr>
<tr>
<td></td>
<td>• Cereals</td>
<td></td>
</tr>
</tbody>
</table>
### Important Minerals for Human Health

<table>
<thead>
<tr>
<th>Magnesium</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bulk</td>
<td>• Leafy veggies</td>
<td>• Enzymes</td>
</tr>
<tr>
<td>• 320-420 mg</td>
<td>• Cereal</td>
<td>• Bone &amp; teeth</td>
</tr>
<tr>
<td></td>
<td>• Seafood</td>
<td>• Nerve &amp; muscle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phosphorus</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bulk</td>
<td>• Dairy</td>
<td>• Bone &amp; teeth</td>
</tr>
<tr>
<td>• 700 mg</td>
<td>• Meats</td>
<td>• Structural (NAs, phosphoproteins)</td>
</tr>
<tr>
<td></td>
<td>• Nuts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Legumes</td>
<td></td>
</tr>
</tbody>
</table>
### Important Minerals for Human Health

<table>
<thead>
<tr>
<th>Potassium</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bulk</td>
<td>• Dairy</td>
<td>• Electrolyte</td>
</tr>
<tr>
<td>• 3500 mg</td>
<td>• Bananas</td>
<td>• Nerve &amp; muscle</td>
</tr>
<tr>
<td></td>
<td>• Fruits &amp; veggies</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Selenium</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Trace</td>
<td>• Meats</td>
<td>• Antioxidant</td>
</tr>
<tr>
<td>• 55 µg</td>
<td>• Seafood</td>
<td>• Thyroid function</td>
</tr>
<tr>
<td></td>
<td>• Cereals</td>
<td></td>
</tr>
</tbody>
</table>
# Important Minerals for Human Health

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Source</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>Table salt, Meats, Processed foods</td>
<td>Electrolyte, Nerve &amp; muscle</td>
</tr>
<tr>
<td>Zinc</td>
<td>Organ meats, Eggs, Seafoods</td>
<td>Enzymes (insulin), Wound healing, Growth</td>
</tr>
</tbody>
</table>
*Trace Minerals Up Close

Copper

**Deficiency**
- Rarely diet induced
- Occurs in infants and adults
- Usually in response to malaborption problems

- **Symptoms**
  - Fatigue, bleeding under the skin, enlarged heart, anemia
  - Low blood copper and ceruloplasmin

**Excess**
- Caused by unbound, “free’, copper
- Acids in contact with copper utensils

- **Symptoms**
  - Nausea, vomiting, diarrhea
  - Organ damage, hemolysis of RBCs
  - High blood copper
Copper Cont.

- **Wilson’s Disease**
  - Defective liver excretion into the bile forces copper to increase in the blood and accumulate in certain tissues (eyes and brain).

  ![Kayser-Fleischer ring](image)

Fluoride

**Deficiency**
- Tied to low water levels
- Thus, water supply is supplemented in many locations

**Symptoms**
- Tooth decay
- Weak bones

**Excess**
- Excessive consumption from drinking water is called *fluorosis.*

**Symptoms**
- Mottled or pitted enamel
- Cavities (caries)
- Can make bones too hard and therefore less tough, causing breaks
Fluoride Cont.

Mild fluorosis  Severe fluorosis

Iodine

Deficiency
• Rare in developed countries because it’s supplemented in table salt, but is a problem in under developed countries

• Symptoms
  – Goiter, under active thyroid gland (hypothyroidism)
  – Hoarse voice, impaired mental function, weight gain

Excess
• Uncommon. Usually from supplements of over consumption in rare cases.

• Symptoms
  – Hyperthyroidism
  – Goiter if the thyroid gland becomes overactive and attempts to overproduce thyroid hormones.
goiter (GOY-ter): an enlargement of the thyroid gland due to an iodine deficiency, malfunction of the gland, or overconsumption of a goitrogen. Goiter caused by iodine deficiency is simple goiter.
goitrogen (GOY-troh-jen): a thyroid antagonist found in food; causes toxic goiter. Goitrogens are found in such foods as cabbage, kale, brussels sprouts, cauliflower, broccoli, and kohlrabi.
cretinism (CREE-tin-ism): an iodine-deficiency disease characterized by mental and physical retardation.

**Iron**

**Deficiency**
- Most common mineral deficiency, particularly in women and children
- Usually caused by excess bleeding (menstrual, bleeding or ulcer)

**Symptoms**
- Anemia, fatigue, weakness, paleness

**Excess**
- Excess iron in the body accumulates in the blood and tissues.
- Hemochromatosis

**Symptoms**
- Vomiting, diarrhea, damage to intestinal lining
Iron Cont.

Iron absorption and recycling

Hemoglobin is vital for energy

Selenium

Deficiency
- Rare
- Related to soil content
  - Observed in China where soil content and Se consumption is very low (Keshan's disease)

- Symptoms
  - Cardiomyopathy and muscle weakness
  - Muscle degeneration

Excess
- Occurs by supplementing high levels for the antioxidant properties.
  - Symptoms
    - Nausea, vomiting, loss of hair and nails, rash and nerve damage
Zinc

Deficiency

• Occurs in people who eat little animal or seafood products.
• Also caused by an interaction with phytic acid from grain-based foods, or by mal-absorption.

• Symptoms
  – Loss of appetite, slow growth in youth. Impaired taste and smell, dermatitis

Excess

• Rare
• Acids from food in contact with zinc-coated (galvanized) containers
• Also can be ingested from inhalants

• Symptoms
  – Metallic taste, nausea, vomiting and diarrhea
  – Rapid breathing, sweating, and weakness (metal fume fever)

Zinc Cont.

– Delayed sexual maturation in males
– Hypogonadism
– Growth retardation
– Skeletal abnormalities (defect in epiphyseal cartilage)