



**SNS COLLEGE OF ALLIED HEALTH SCIENCES**

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai



**TOPIC : TRACE ELEMENTS**



# TRACE ELEMENTS



- Trace elements are minerals that are required in a minute quantity but **play a vital role in the growth, development, and function of the body.**
- Utilized by the body in small quantities, but they play an essential role in biological activities.
- Primarily act as **catalysts for enzyme actions** while some metallic ions **take part in oxidation-reduction reactions involved in energy metabolism.**
- Plays an important roles in **body structure.**
- Zinc (Zn), Copper (Cu), Selenium (Se), Chromium (Cr), Cobalt (Co), Iodine (I), Manganese (Mn), Fluorine (F), Boron (B), and Molybdenum (Mo) are the trace mineral which play multiple vital roles in the human body.



# ZINC (Zn)



- Zn is an essential trace element that functions as a cofactor for certain enzymes involved in metabolism and cell growth.
- **Function**
- As a component of nearly 300 specific enzymes, Zn is involved in the **metabolism of proteins, carbohydrates, lipids, and energy production.**
- Essential trace element for a **healthy immune system** and plays an important role in wound healing.
- Required for **insulin activity.**



- **RDA:**

**12 mg/day** for men and **10 mg/day** for women, **12 mg/day** for pregnant and lactating women.

- **Deficiency**

Zn deficiency may occur due to insufficient dietary intake.

- Cause impaired immune function, hair loss, delayed sexual maturation and eye and skin lesions.
- Delayed healing of wounds, taste abnormalities and mental lethargy can also occur.

**Food Sources:** Wheat, brown rice, soybeans, peanuts, cashews, meat, eggs, milk, yogurt, walnut, and almonds are good sources of zinc.



# COPPER (Cu)



- 3rd most abundant trace element with only 75–100 mg of the total amount in the human body.
- Present in almost every tissue of the body and is stored chiefly in the liver along with the brain, heart, kidney, and muscles.

## Function

- Copper containing enzyme cytochrome c oxidase plays a vital role in **energy production** during aerobic respiration.
- Involved in **synthesis of collagen and elastin**, essential for maintaining the strength of the skin, blood vessels, and epithelial and connective tissue throughout the body.
- Copper-containing enzyme tyrosinase **converts tyrosine to melanin** which gives color to the skin.
- Copper is also required to **produce the thyroid hormone thyroxine**.



- **RDA:** 1.7 mg/day

- **Deficiency**

Hypopigmentation of hair and skin, abnormal bone formation with skeletal fragility and osteoporosis, lowered immunity, and vascular aberrations

Molybdenum has an antagonistic effect against copper; thus, high concentrations of Molybdenum can reduce Copper absorption and subsequently lead to Copper deficiency.

- **Food Sources:** Barley, brown rice, wheat bread, beans, cashew, almond, potatoes, organ meats (kidney, liver), dark leafy greens vegetables.



# MANGANESE (Mn)



- Present in tiny amounts and the average human body contains about 12 mg of Manganese.
- About 43% of it is found in the skeletal system, with the rest occurring in soft tissues including the liver, pancreas, kidneys, brain, and central nervous system.

## Function

- Helps the body to **form connective tissue, bones, blood-clotting factors, and sex hormones.**
- Role in **fat and carbohydrate metabolism, calcium absorption, and blood sugar regulation.**
- Necessary for **normal brain and nerve function.**
- It is a component of the antioxidant SOD (superoxide dismutase), which helps fight free radicals.



- **RDA:** 4 mg/day

- **Deficiency**

May cause hypercholesterolemia, impaired glucose tolerance, changes in hair color, skeletal abnormalities, infertility, deafness, and impaired synthesis of Vitamin K-dependent clotting factors.

- **Food Sources:**

Whole grains such as brown rice, almond, walnuts, legumes, pineapples, tea, leafy greens vegetables, sweet potatoes, and beets<sup>1</sup>.





# Selenium (Se)



- Selenium content in the human body is about 13-20 mg.
- Selenium containing protein also known as seleno-protein carries out various functions in normal health and metabolism.

## Function

- Glutathione peroxidase (G-Px), a **selenoprotein**, is an antioxidant that protects the body from the damaging effect of free radicals, if it lowers thus increased risk of various diseases, such as cancer and heart disease.
- Important for a **healthy immune system**, enhances T-lymphocyte immune responses.



- **RDA:** 40 mcg/day

- **Deficiency**

May cause myalgia and whitening of the nail bed.

Care must be taken in consuming large amounts of selenium as it is toxic if taken in excess amounts.

- **Food Sources:**

Grains, meat, poultry, fish, and eggs are rich sources of Selenium





# Chromium (Cr)



- Essential trace element - improve insulin sensitivity and enhance protein, carbohydrate, and lipid metabolism.
- **Function**
- Mainly associated with **insulin function**.
- Inorganic chromium compounds display little or no insulin potentiating activity but upon conversion to organic chromium complexes acquire significant insulin potentiating activity.
- Chromium picolinate is one such example of organic chromium.



- **RDA:** 50 mcg/day
- **Deficiency**
- May cause a diabetic-like state due to impaired body's ability to use glucose.
- Weakness and fatigue occurs due to the inability of the body to utilize glucose for energy.
- Diabetics, pregnant women, and the elderly are especially at risk of chromium deficiency leading to impaired insulin function that may cause diabetes and heart diseases.
- **Food Sources:**
- Broccoli, potatoes, green beans, beef, poultry, fruits including apples and bananas are good sources of Chromium.



# Molybdenum (Mo)



- It influences protein synthesis and growth of the body.
- Important for the functioning of enzymes involved in the metabolization of drugs and toxins.
- **Function**
- Molybdenum acts as cofactor for 4 key enzymes – sulfite oxidase that converts sulfite to sulfate and **prevents large buildup of sulfites in the body.**
- Aldehyde oxidase which **breaks down the toxic aldehydes.**
- Xanthine oxidase that converts xanthine to uric acid **breaking down unused DNA.**



- **RDA:** 45 mcg/day
- **Deficiency**
- Cause genetic disorder - Molybdenum cofactor deficiency is a rare condition characterized by brain dysfunction (encephalopathy).
- Can cause seizures and severe brain damage that usually leads to death within days after birth.
- **Food Sources:**
- Black-eyed peas, beef liver, yogurt, milk, banana, chicken, egg, and spinach.



# Cobalt (Co)



- The adult human body contains approximately 1 mg of Cobalt, 85% of which is in the form of Vitamin B12.
- **Function**
- **Central part of Vitamin B12 chemical structure** - role in the formation of erythrocytes (red blood cells).
- Vitamin B12 also plays a significant role in nerve repair and regeneration.
- Plays an integral role in **generating neurotransmitters**, which are requisite for the proper operation of an organism.



- **RDA:** 5 to 8 mcg/day

- **Deficiency**

The deficiency of Cobalt is strongly related to disturbances in Vitamin B12 synthesis resulting in anemia and peripheral neuropathy.

- **Food Sources:**

Green leafy vegetables, dairy products, organ meat, egg, milk, and fish.





# Fluorine (F)



- Makes a negligible part of body weight and enters the system principally through drinking water.
- **Function**  
Present as fluorapatite crystals in the **matrix of bone and teeth**.  
In combination with calcium, **improves bone formation**
- **RDA:**  
4 mg/day for men and 3 mg/day for women.
- **Deficiency**  
Low levels of fluoride in drinking water have been associated with dental decay.
- **Food Sources:**  
Drinking water either fluoridated or naturally containing fluoride. Dietary sources of Fluorine include spinach, grapes, potato, and raisins.



# Boron



- Boron plays important roles in metabolism that render it necessary for human health.
- **Function**
- Boron is essential for the **growth and maintenance of bone**.
- It raises the levels of antioxidant enzymes, such as superoxide dismutase (SOD) and glutathione peroxidase that **protects from the damaging effect of free radicals**.
- It **improves wound healing** by stimulating specific enzymes like elastase, collagenase, and alkaline phosphatase.
- Boron is also found to **improve the brain's electrical activity**.



- **RDA:** 1 to 13 mcg/day

- **Deficiency**

Increase the risk of arthritis development.

Used for [vaginal yeast infections](#), athletic performance, [menstrual cramps](#), [osteoarthritis](#) and [osteoporosis](#).

- **Food Sources:**

Fresh vegetables and fruits, avocado, apples, coffee, nuts, beans, peas are commonly found sources of Boron.



# Iodine (I)



- Iodine is a vital trace element required at all stages of life especially during developmental years.
- **Function**
- An **essential component of thyroid hormones**, that is, tetraiodothyronine (T4 or thyroxine) and triiodothyronine (T3)
- Thus, plays an important role in **maintaining metabolic processes and general growth and development of the body.**
- These hormones control the body's metabolism and for proper bone and brain development during pregnancy and infancy.



- **RDA:**

**90 mcg/day** for children (1 – 5y),

**120 mcg/day** for children (6-12),

**150 mcg/day** for adolescents and adults,

**250 mcg/day** for pregnant and lactating women.

- **Deficiency**

Enlargement of the thyroid gland which is also known as goiter.

Extreme fatigue, irritability, mental disturbances, weight gain, facial puffiness, constipation, and lethargy.

- **Food Sources:**

Iodized salt, bread, dairy products like milk, yogurt, and cheese



**THANK YOU**