MINERALS

Minerals are essential nutrients that our body needs for many functions like building bones, making hormones, and keeping the heart beating properly. They come from food and water since the body cannot make them.

Minerals are divided into two groups: major minerals (also called macrominerals).

Macrominerals (Major Minerals): These are essential minerals required by the human body in larger amounts, typically more than 100 mg per day. They are vital for functions like building bones, maintaining fluid balance, and supporting muscle and nerve activity. Examples include calcium, phosphorus, magnesium, sodium, potassium, chloride, and sulfur.

Microminerals (Trace Minerals): These are essential minerals needed by the human body in smaller amounts, typically less than 100 mg per day. Despite their low requirements, they are crucial for processes like enzyme function, oxygen transport, and immune support. Examples include iron, zinc, copper, manganese, iodine, selenium, fluoride, chromium, and molybdenum.

Calcium

Sources:

Dairy products like milk, cheese, and yogurt; leafy green vegetables such as kale and broccoli; fortified foods like orange juice and cereals; fish with bones like sardines.

Biochemical Functions:

Builds and maintains strong bones and teeth;

helps muscles contract and relax;

supports nerve signals;

aids blood clotting;

regulates heart rhythm.

Daily Requirements:

1,000 mg for adults aged 19-50; 1,300 mg for women over 50 and men over 70.

Deficiency Disorders:

Osteoporosis (a condition where bones become weak and brittle, increasing fracture risk);

rickets (softening and weakening of bones in children, leading to deformities);

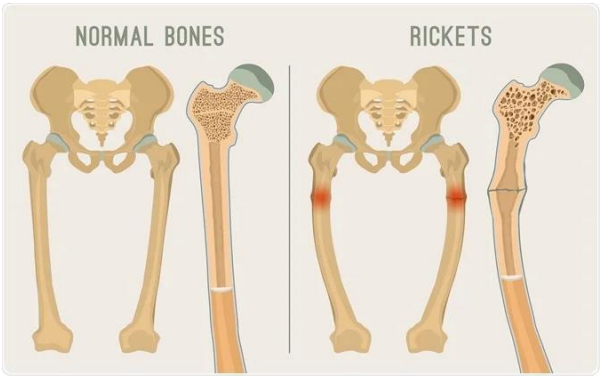
osteomalacia (softening of bones in adults, causing pain and fractures);

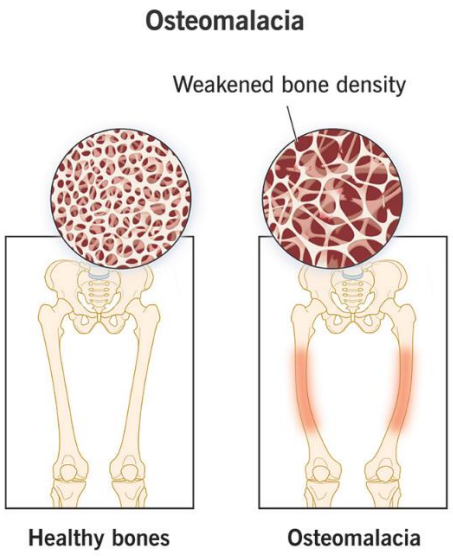
muscle cramps;

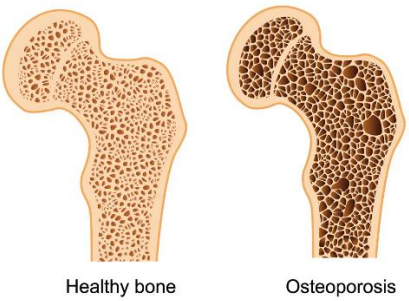
numbness;

poor teeth health;

tetany (muscle spasms due to low blood calcium).



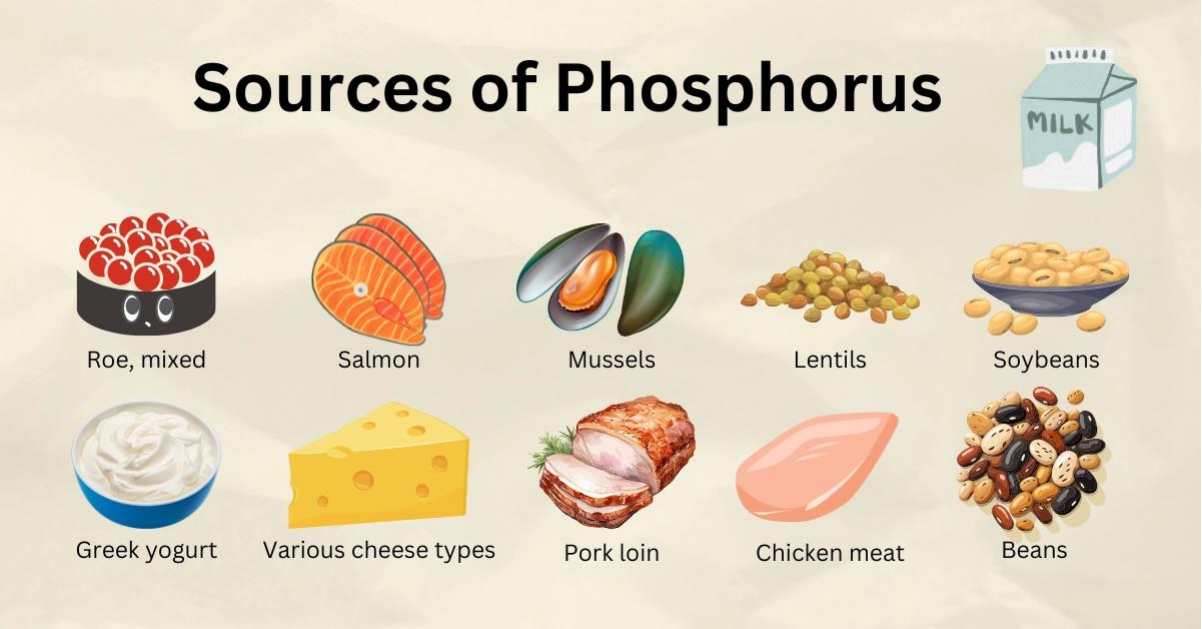




Phosphorus

Source:

Meat, poultry, fish; dairy products; nuts and seeds; whole grains; eggs.



Biochemical Functions:

Works with calcium to form bones and teeth;

part of DNA and RNA (genetic material);

helps make ATP (energy molecule);

maintains cell membranes;

supports kidney function.

Daily Requirements:

700 mg for adults over 18.

Deficiency Disorders:

Hypophosphatemia (low phosphate levels in blood, leading to weak bones and muscles);

rare in healthy people but can cause muscle weakness,

bone pain,

fatigue,

loss of appetite;

in severe cases, rickets or osteomalacia (softening of bones)

Magnesium

Sources:

Green leafy vegetables like spinach; nuts and seeds (almonds, pumpkin seeds); whole grains; legumes (beans); dark chocolate; some shellfish and spices.

Biochemical Functions:

Acts as a cofactor for over 300 enzymes;

helps produce energy;

supports muscle and nerve function;

regulates blood pressure;

builds bones;

controls blood sugar;

maintains cell membrane potential.

Daily Requirements:

220 mg for women; 260 mg for men (aged 19-65).

Deficiency Disorders:

Hypomagnesemia (low magnesium in blood, causing muscle and nerve issues);

muscle cramps,

tiredness,

irregular heartbeat,

nausea,

loss of appetite;

long-term deficiency linked to osteoporosis (weak bones), high blood pressure, type 2 diabetes;

in severe cases, neurologic defects like anorexia, staggering, convulsions, or cardiac arrhythmia.

<u>Sodium</u>

Sources:

Table salt; processed foods like chips, canned soups, and fast food; cheese; bread; pickled foods.

Biochemical Functions:

Maintains fluid balance in the body;

helps nerve impulses;

supports muscle contractions;

regulates blood pressure.

Daily Requirements:

Adequate intake is 1,500 mg; upper limit is 2,300 mg to avoid health risks.

Deficiency Disorders:

hyponatremia (low sodium in blood, causing brain swelling); can lead to headache, confusion, seizures, fatigue; usually from excessive water intake or medical conditions.

Potassium

Sources:

Fruits like bananas, oranges, and avocados; vegetables such as potatoes, spinach, and tomatoes; beans; dairy products.

Biochemical Functions:

Balances fluids with sodium; supports muscle contractions including heart rhythm; helps nerve signals; reduces blood pressure; aids kidney function.

Daily Requirements:

About 3,500 mg for adults (varies by body weight).

Deficiency Disorders:

Hypokalemia (low potassium in blood, affecting heart and muscles);

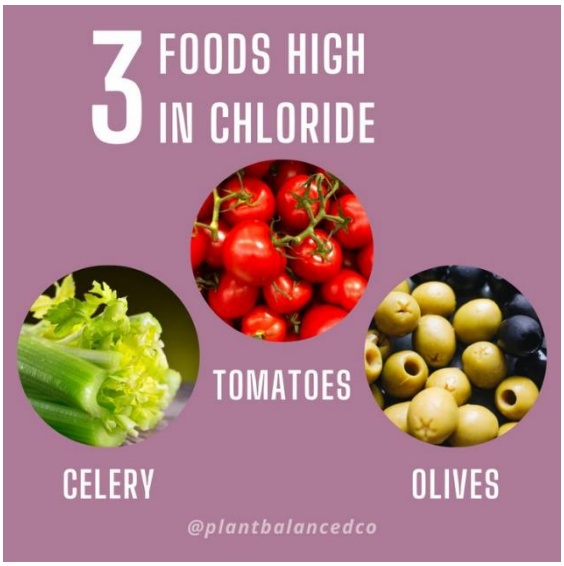
muscle weakness, cramps, fatigue, irregular heartbeat, constipation;

increased risk of high blood pressure and kidney stones.

Chloride

Sources:

Table salt (sodium chloride); seaweed; vegetables like tomatoes and lettuce; processed foods.



Biochemical Functions:

Maintains fluid balance;

part of stomach acid (HCl) for digestion;

supports nerve and muscle function;

helps keep blood pH normal.

Daily Requirements: About 2,300 mg for adults.

Deficiency Disorders:

hypochloremia (low chloride in blood, leading to pH imbalance);

can cause metabolic alkalosis (high blood pH, making body too alkaline),

muscle twitching, breathing problems.

Sulfur

Sources:

Protein-rich foods like meat, fish, eggs; garlic, onions, cruciferous vegetables (broccoli, cabbage); nuts.

Biochemical Functions:

Part of amino acids (methionine, cysteine) for protein building;

supports detoxification in liver;

helps form collagen for skin and joints;

aids in energy production.

Daily Requirements:

No specific RDA; typically 800-900 mg from a balanced protein-rich diet (about 13-14 mg/kg body weight).

Deficiency Disorders:

may cause joint pain, skin issues, slow wound healing; linked to poor glucose metabolism and growth issues in some cases.

Trace Minerals

Iron

Sources:

Red meat, poultry, fish (heme iron, better absorbed); beans, lentils; fortified cereals; spinach (non-heme iron, absorption improved by vitamin C).

Biochemical Functions:

Part of hemoglobin for oxygen transport in blood;

supports energy production;

aids immune function;

helps make DNA.

Daily Requirements: 9.1-27.4 mg for men; 19.6-65.4 mg for premenopausal women (depending on diet bioavailability).

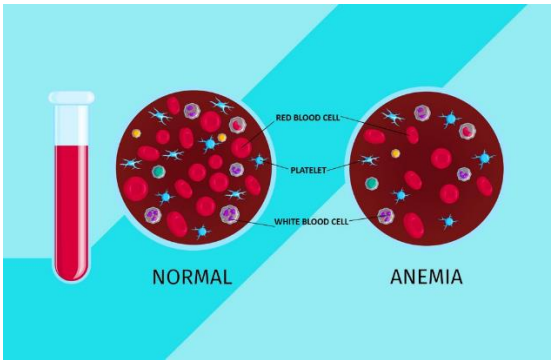
Deficiency Disorders:

Iron-deficiency anemia (low red blood cells, causing fatigue and weakness);

pale skin, shortness of breath, dizziness, cold hands/feet;

impairs growth in children

reduced physical capacity and immune function.



Zinc

Sources:

Meat, shellfish (oysters); dairy; nuts, seeds; whole grains; legumes (absorption affected by phytates).

Biochemical Functions:

Supports immune system;

aids wound healing;

helps make proteins and DNA;

supports growth and taste/smell senses;

cofactor for over 300 enzymes.

Daily Requirements: 14 mg for men; 9.8 mg for women

Deficiency Disorders:

Weak immune system (frequent infections);

slow growth in children;

hair loss (alopecia);

diarrhea;

loss of appetite;

delayed wound healing;

skin lesions;

acrodermatitis enteropathica (a rare genetic disorder causing severe zinc malabsorption, with diarrhea and immune issues).

Copper

Sources:

Shellfish, nuts (cashews), seeds; liver; whole grains; dark chocolate.

Biochemical Functions:

Helps form red blood cells;

supports iron absorption;

acts as antioxidant;

builds connective tissue

aids nerve function;

part of enzymes like cytochrome c oxidase.

Daily Requirements: 900 mcg for adults.

Deficiency Disorders:

Anemia (low red blood cells);

weak bones; high cholesterol

fatigue;

skin/hair color changes;

Menkes disease (a genetic disorder causing severe copper deficiency, with neurological deterioration and steely hair).

Manganese

Sources:

Nuts, whole grains; leafy greens; tea; pineapple; beans.

Biochemical Functions:

Helps metabolize carbs, proteins, and fats;

supports bone formation;

acts as antioxidant;

aids wound healing;

activates enzymes like superoxide dismutase.

Daily Requirements: 1.8-2.3 mg for adults.

Deficiency Disorders:

may cause weak bones,

poor growth,

skin rashes (dermatitis),

hair depigmentation;

abnormal glucose levels;

dyslipidemia (abnormal blood fats).

Iodine

Sources:

Iodized salt; seafood (fish, seaweed); dairy products; eggs.

Biochemical Functions:

Essential for thyroid hormones (T3 and T4) that control metabolism, growth, and brain development.

Daily Requirements: 150 mcg for adults; 200 mcg for pregnant/lactating women.

Deficiency Disorders:

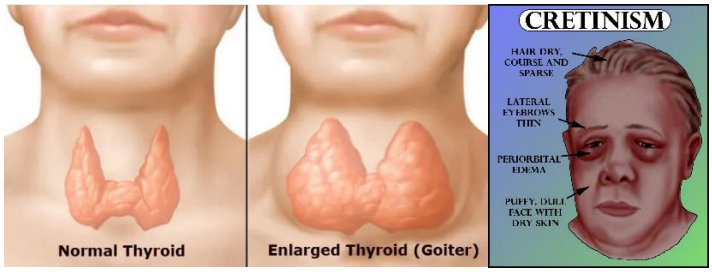
Goiter (enlarged thyroid gland);

hypothyroidism (underactive thyroid, causing fatigue and weight gain);

cretinism (severe mental retardation and physical deformities in children from maternal deficiency);

increased miscarriage risk;

myxedematous cretinism (a form with dwarfism and thyroid atrophy, often with selenium deficiency).



Selenium

Sources:

Brazil nuts; seafood; meat; eggs; grains (varies by soil selenium levels).

Biochemical Functions:

Acts as antioxidant (via glutathione peroxidase);

supports thyroid function (converts T4 to T3);

boosts immune system;

aids reproduction.

Daily Requirements: 26 mcg for women; 34 mcg for men.

Deficiency Disorders:

Weak immune system;

heart disease like Keshan disease (cardiomyopathy, or heart muscle disorder, causing heart failure, often in children);

muscle pain (myalgia);

thyroid problems;

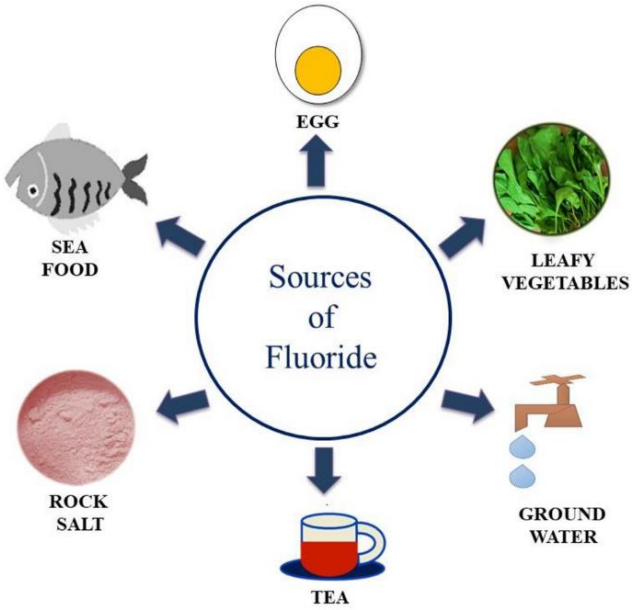
infertility;

Kashin-Beck disease (joint necrosis and bone deformities in children, leading to growth retardation).

Fluoride

Sources:

Fluoridated water; tea; fish; toothpaste (non-dietary).



Biochemical Functions:

Strengthens teeth enamel to prevent decay;

supports bone health.

Daily Requirements: 3-4 mg for adults.

Deficiency Disorders:

Increased dental caries (tooth decay);

weaker bones in rare cases.

Chromium

Sources:

Whole grains; meat; fruits (apples); vegetables (broccoli); nuts.

Biochemical Functions:

Enhances insulin action for glucose metabolism;

supports fat and protein use.

Daily Requirements: 20-35 mcg for adults.

Deficiency Disorders:

impaired glucose tolerance (poor blood sugar control, like diabetes symptoms);

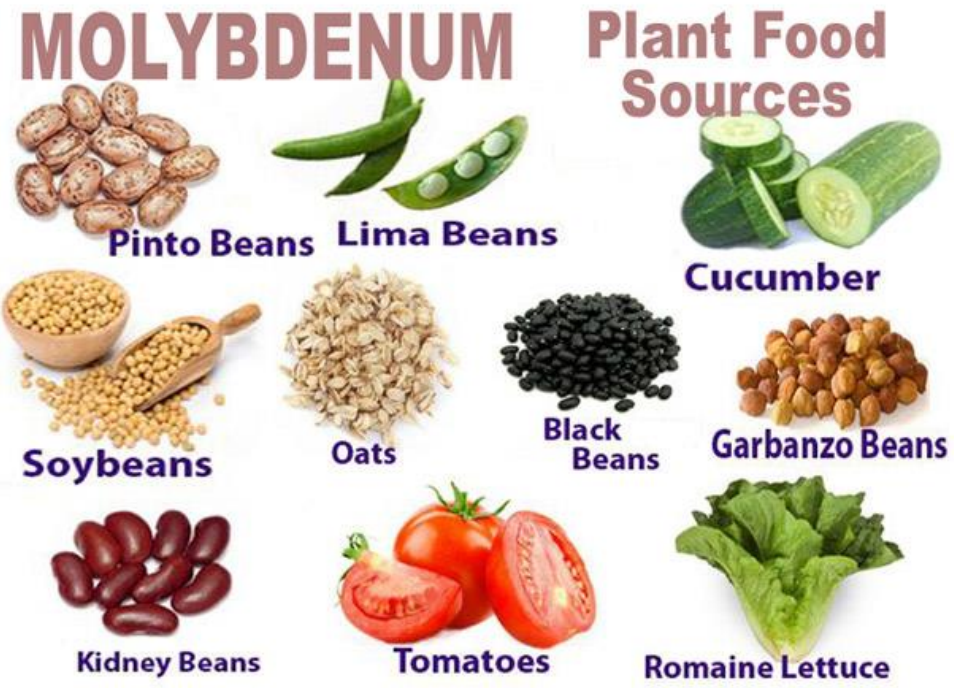
weight loss;

nerve issues.

Molybdenum

Sources:

Legumes (beans, lentils); grains; leafy greens; liver; milk.



Biochemical Functions:

Cofactor for enzymes that break down toxins (like sulfite oxidase);

helps metabolize drugs and sulfites;

supports nitrogen use.

Daily Requirements: 45 mcg for adults.

Deficiency Disorders:

may increase esophageal cancer risk in low-soil areas;

poor detoxification leading to headaches or coma in extreme cases;

reproductive issues and growth retardation.