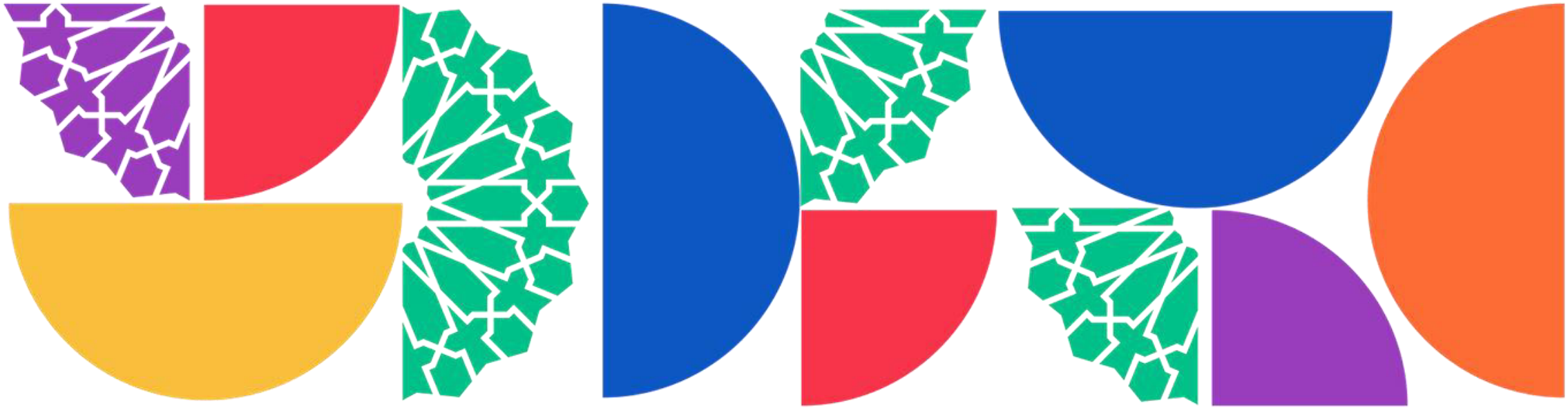
Health Awareness and Nutrition

Minerals and Water

Department of Clinical Nutrition and Dietetics
College of Health Sciences




Minerals
and Water

Introduction

Twenty two (22) minerals of inorganic nature.

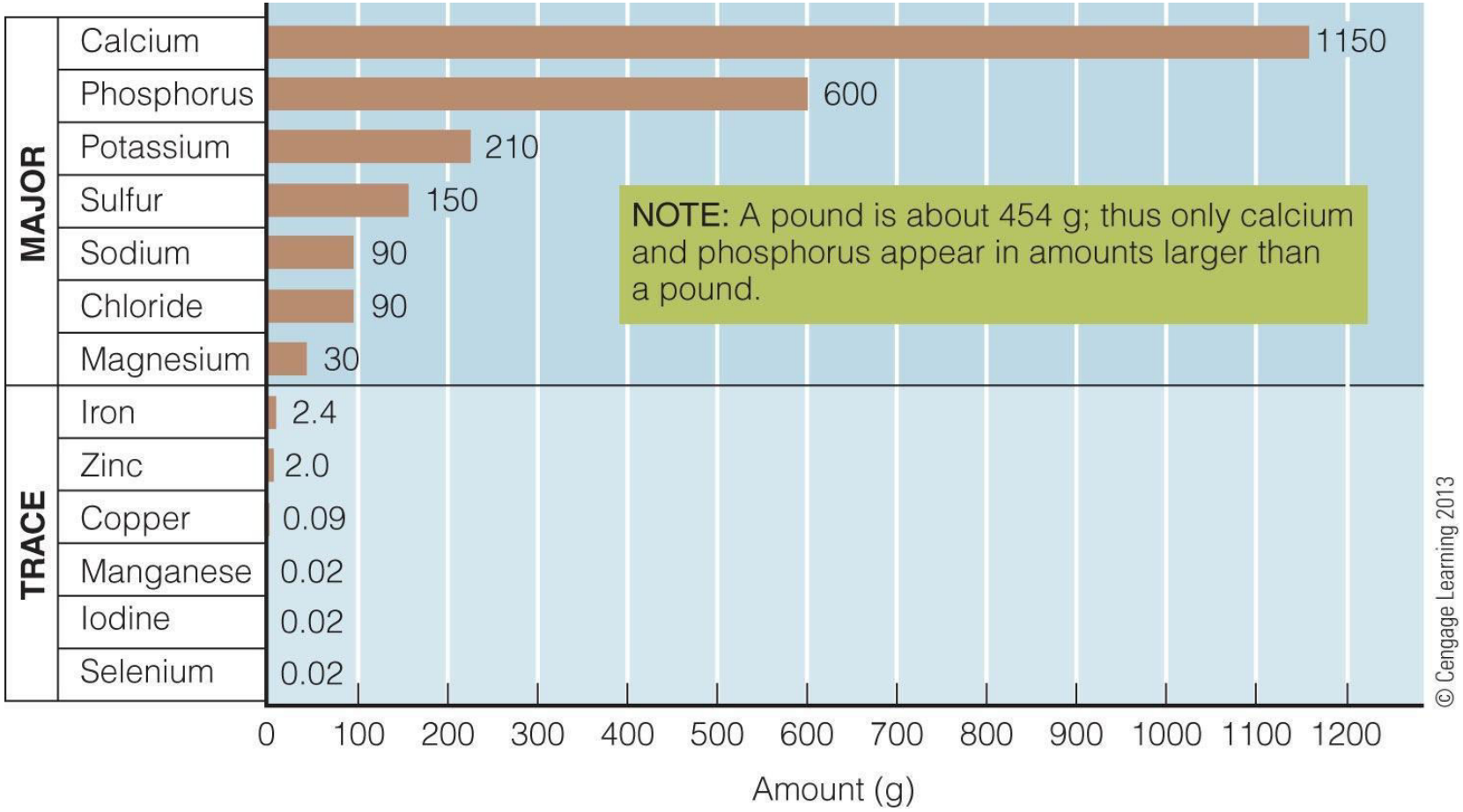
General functions:

- Essential for optimal health and development
- Required for growth, repair & regulation of vital body functions
- Represent **4 to 5%** of body weight (Ca is 50% of this %)

Absorption depends on:

- **Their form:** plant minerals are in general *less* efficiently absorbed than animal minerals
- **The body need:** absorption is increased in deficiency, pregnancy & lactation
- **The presence or absence of other foods in intestines**: which *favor or inhibit* the absorption

Minerals in a 60-Kilogram Human Body



Classification of minerals

Minerals are classified according to their amount in the body

Major minerals	Trace minerals
• Found in the human body in amounts **larger than 5 grams**	• Found in the human body in amounts **less than 5 g**

→ **There are also the trace Contaminants:** Lead, Mercury, Boron, Barium, Aluminum

Classification of minerals

Major minerals

> 5 g

- Calcium (Ca)
- Phosphorus (P)
- Magnesium (Mg)
- Sulfur (S)
- Sodium (Na)
- Potassium (K)
- Chloride (Cl)

Trace minerals

< 5 g

- Iron (Fe)
- Zinc (Zn)
- Iodine (I)
- Fluoride (F)
- Selenium (Se)
- Cobalt
- Manganese
- Molybdenum
- Chromium
- Copper

Minerals

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Absorption

Excess fiber intake interferes with the absorption of minerals during the same meal

Supplements

Minerals should not be taken as supplements without prescriptions, since excessive amounts may be toxic to health

Major minerals

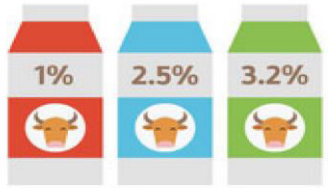
Calcium

- Calcium is the most abundant mineral in the body.
- Calcium and phosphorus are needed for **bone formation.**
- Nearly all of the body's calcium **(99%) is stored in the bone and teeth.**

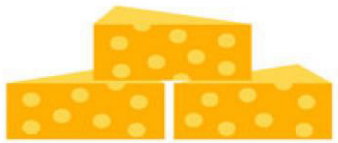
Function

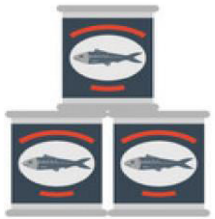
- Mineralization of bones and teeth
- Involved in muscle contraction and relaxation
- **Bones** serve as a bank that releases calcium in the blood when needed and absorbs it when in excess

Calcium



Milk


Cheese


Sardine


Soybeans


Tofu


Broccoli


KALE


Almonds

Sources

- Milk and milk products
- Tofu (soybeans)
- Small fish (with bones) such as sardines
- Nuts (almonds)
- Green leafy vegetables (broccoli, kale, seaweed)

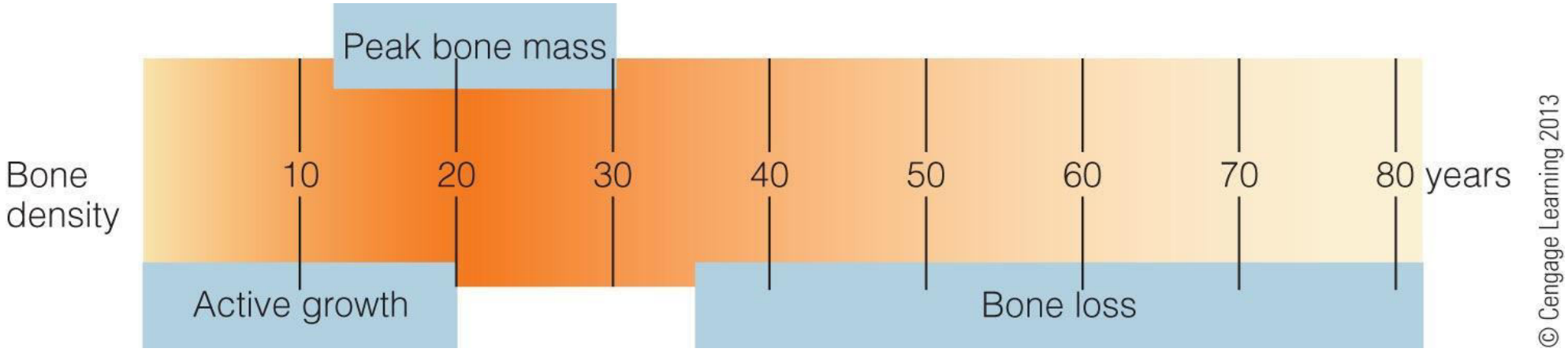
Calcium

Physiological Facts

Peak bone mass is the **highest attainable bone density** for an individual developed during the **first 30 years of age**.

All adults **lose** bone with age.

Bone loss begins **between 30 and 40** years of age.



Calcium

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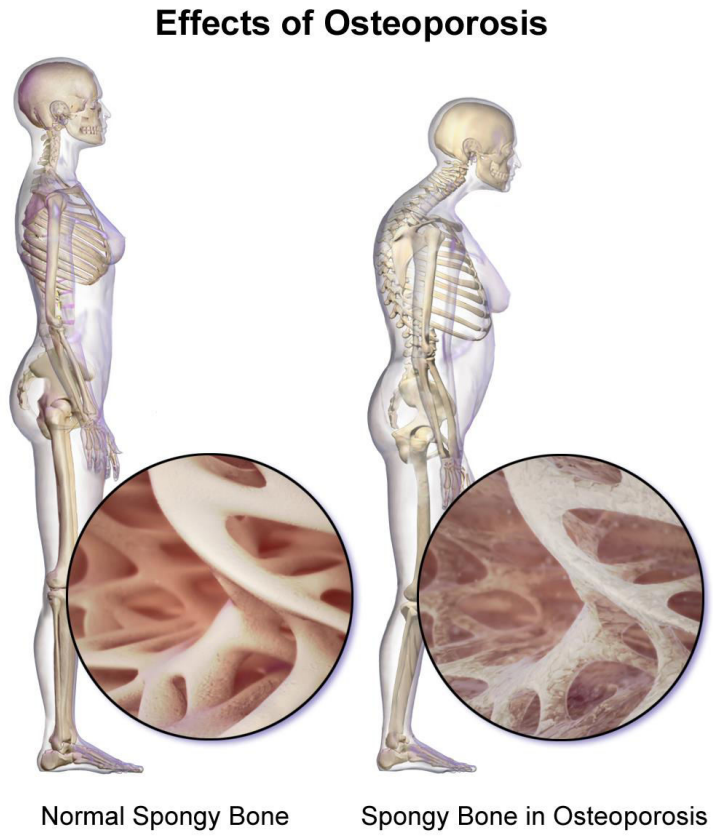
Deficiency

Deficiency disease: **Osteoporosis**

Wide spread **(mainly in women)**

Osteoporosis, or adult bone loss, occurs if a person's stored calcium **is not sufficient.**

A calcium-poor diet during the growing years may prevent someone **from reaching peak bone mass** during the first 30 years of age.



Calcium & Osteoporosis

Dietary Prevention

- A good calcium intake is essential throughout life for healthy bones

Calcium supplements

- May be taken upon prescription along with vitamin D if someone's dietary intake is low and absorption is poor

Phosphorus

Phosphorus is the **second most abundant** mineral in the body.

85% is found combined with **calcium in bones and teeth.**

Function

Mineralization of bones and teeth

Part of every cell (cell membranes)

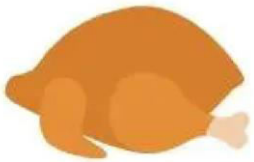
Helps transport lipids in the blood

Assists in energy metabolism

Phosphorus

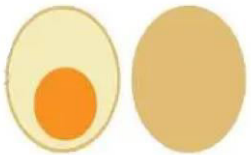
Milk and Dairy

Meat



Poultry

Fish



Eggs

Sources

All animal tissues
(meat, fish, poultry, eggs, milk)

Protein rich foods

Magnesium

More than half of magnesium is found in **bones**, and the rest mostly in **muscles** and **soft tissues**.

Function

Maintains bone health

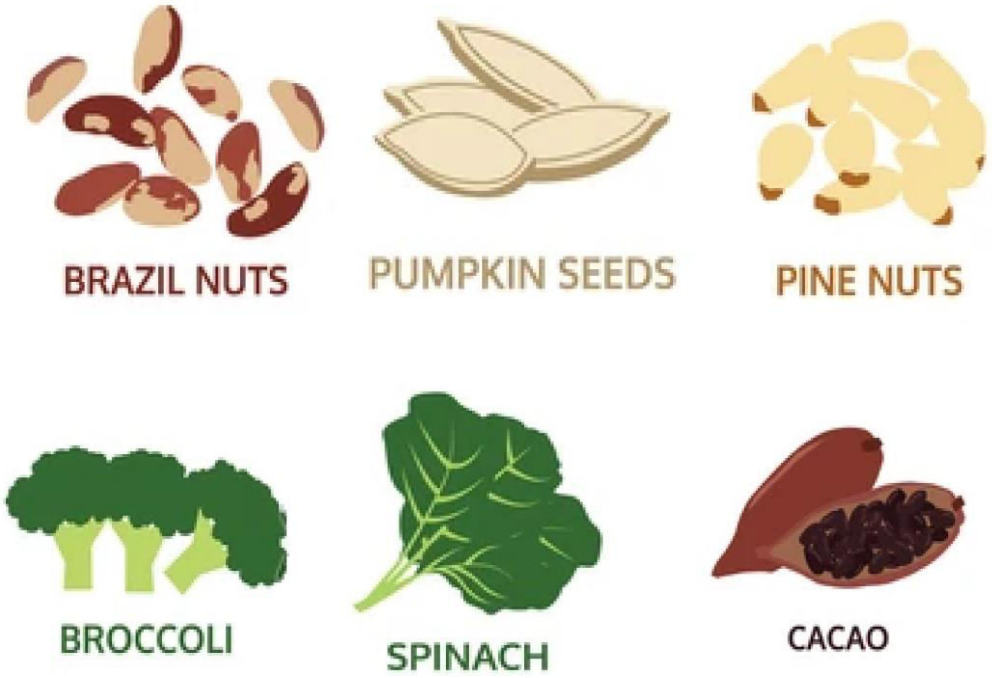
Necessary for energy metabolism

Catalyst in ATP production

Inhibits muscle contraction and blood clotting

Supports normal function of immune system

Magnesium



Sources

Pumpkin seed kernels

Nuts (brazil nuts, almonds, cashews)

Cacao

Spinach

Deficiency

Muscle spasms

Potassium

Potassium is the **main mineral present inside the body's cells** (intracellular action).

Major part of **fluid** and **electrolyte balance.**

Function

Helps maintain fluid and electrolyte balance

Helps maintain cell integrity

Aids in nerve impulse transmission and muscle contraction

Potassium

Sources

Fresh foods

All whole foods: meats, milks, fruits, vegetables, grains, legumes

Deficiency

Irregular heartbeat, muscular weakness, glucose intolerance

Sodium

Sodium is the **main mineral present outside the body's cells** (extracellular action).

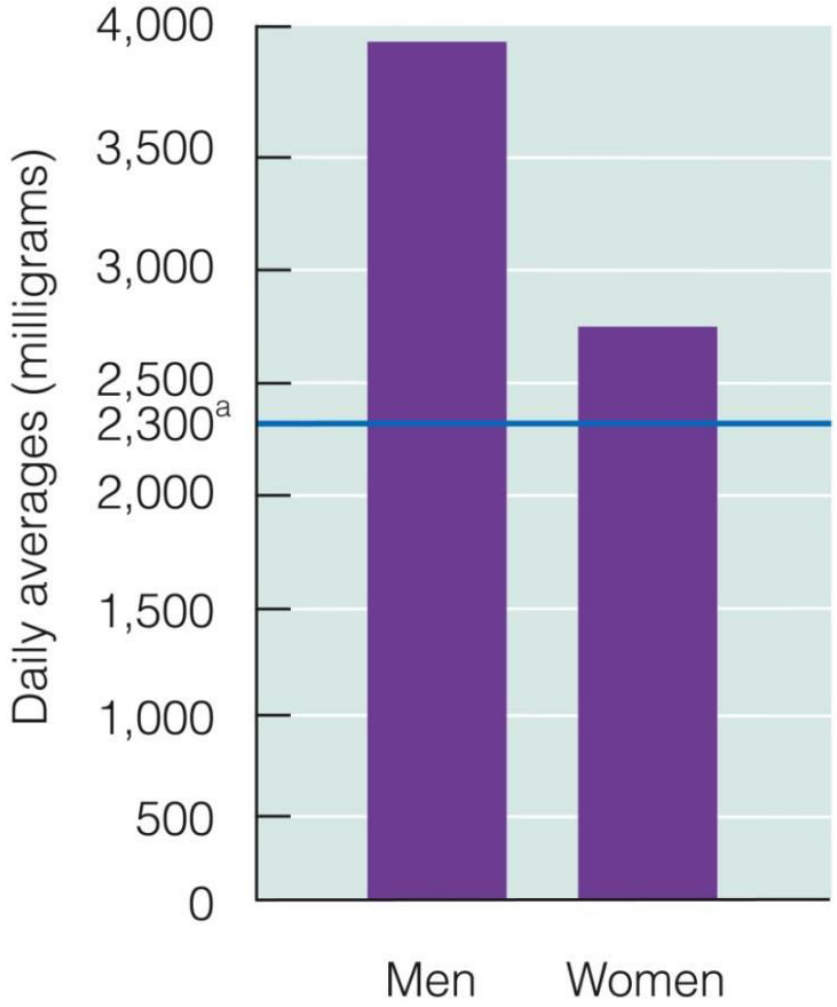
Major part of **fluid** and **electrolyte balance.**

Recommendations are less than the actual intakes.

Sodium deficiency is harmful, but few diets lack sodium.

Usually, the problem with salt is too much of it!

Sodium



Function

Maintains normal fluid and electrolyte balance

Is **essential to muscle contraction** and **nerve transmission**

Sodium

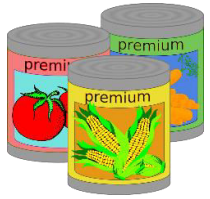
Table Salt

Soy Sauce

Milk and Dairy

Fast and Processed Food

Bread



Canned Food

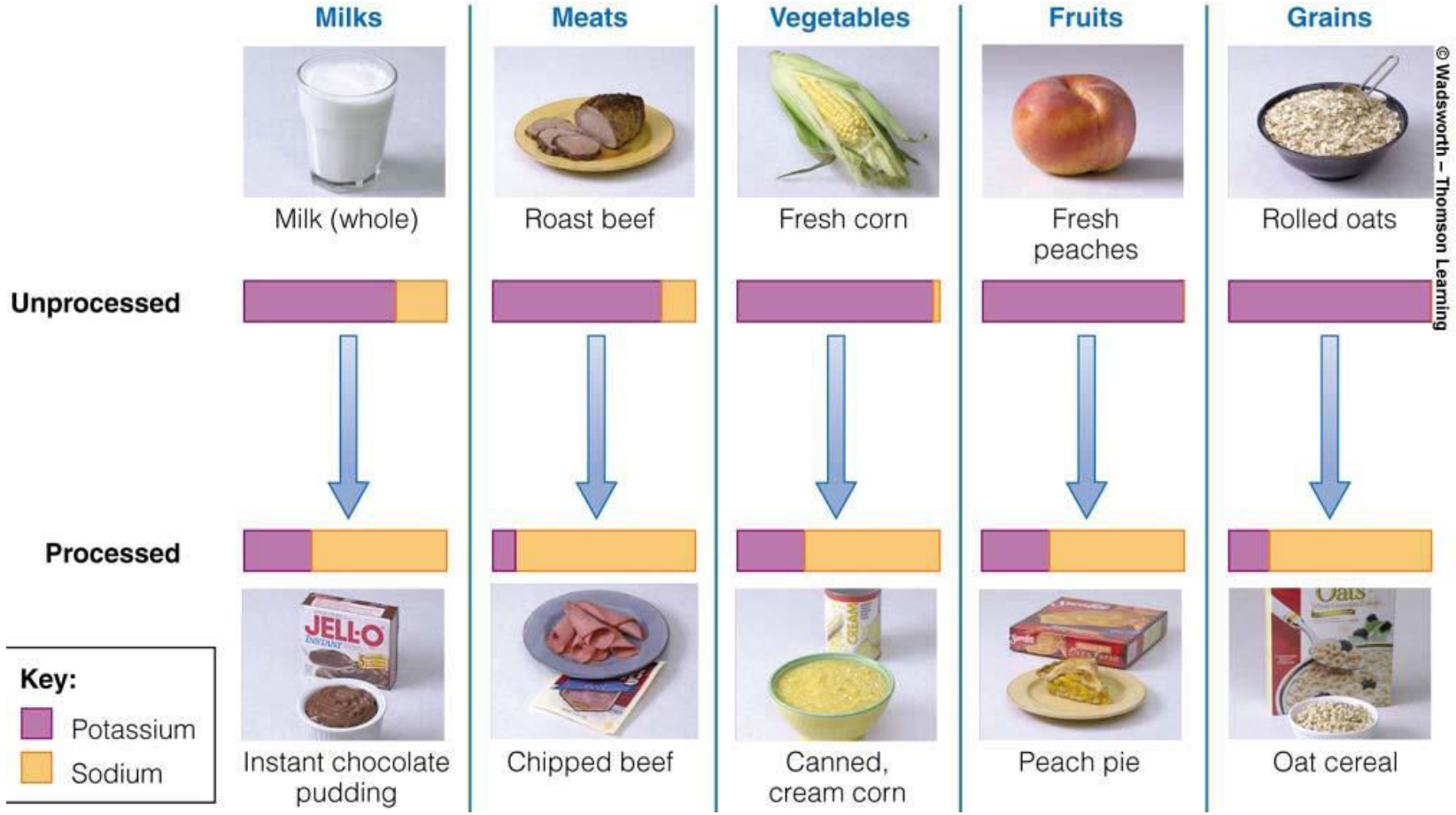
Sources

Major source :Table salt

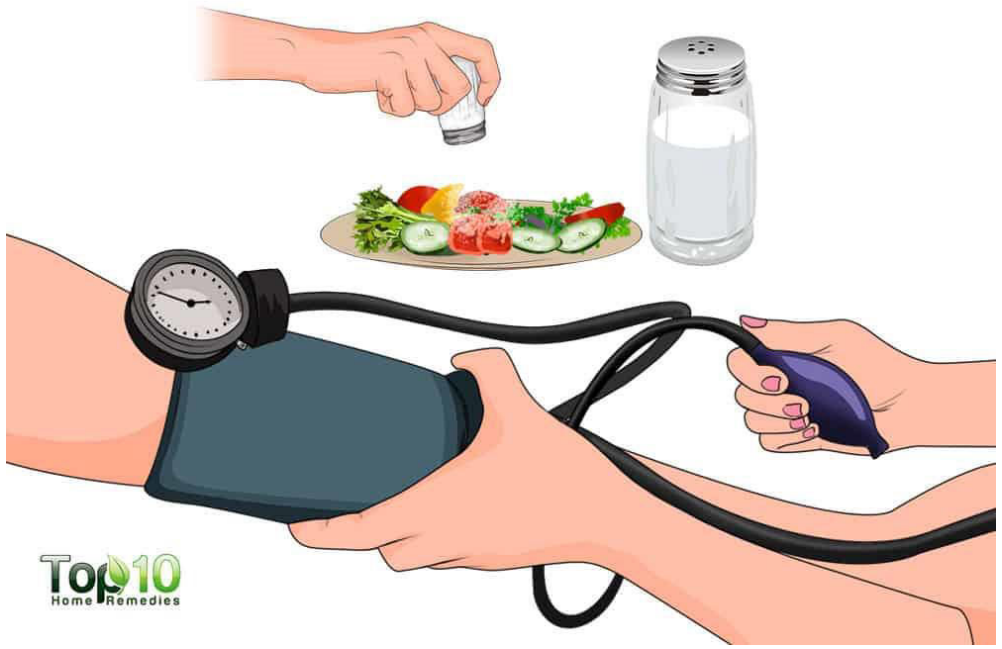
Large amounts in processed foods, Soy sauce canned foods, fast foods and yellow cheeses

Moderate amounts in meats, milks and breads

Sodium Versus Potassium In Foods



Sodium

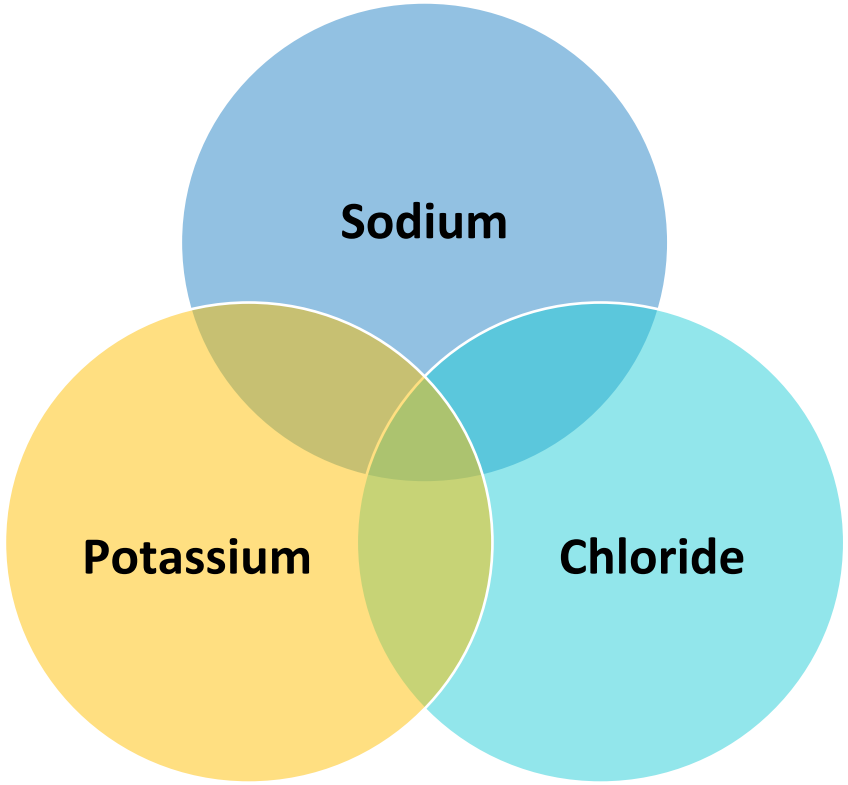


Toxicity

Sodium intake **increases blood pressure** (for salt sensitive people).

Increased amounts of salt correlate with **increased frequency of hypertension.**

Three Minerals Closely Related In The Body And Have Some Common Functions



Maintenance of water-balance: Na, K and Cl are electrolytes.

Distribution of water in the body is related to their distribution.

Assists in **nerve impulse transmission** and **muscle contractions** (heartbeat).

Trace Minerals

Iron

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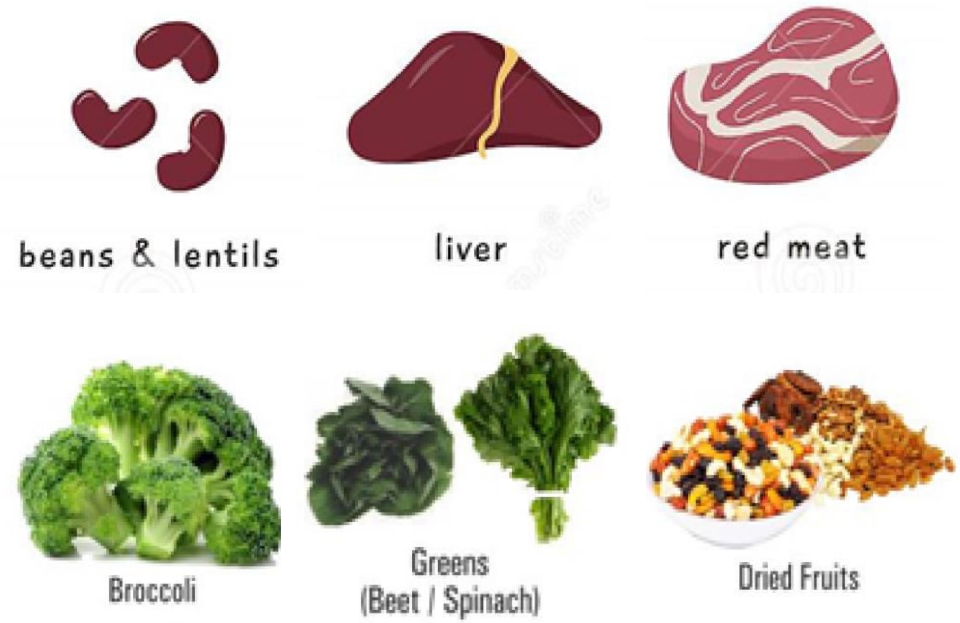
Function

It is part of the **hemoglobin** (RBC) and **transports oxygen** to all cells

It is essential for **building healthy muscles** and maintaining **healthy blood**

Its deficiency causes **anemia**

Iron



Sources

Meats (especially red meat)

Organ meat and liver

Dried fruits (raisins)

Legumes (lentils, beans)

Green leafy vegetables (spinach)

Iron

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Heme-iron

Animal sources (beef, liver,..)

Very efficiently absorbed

Non-heme iron

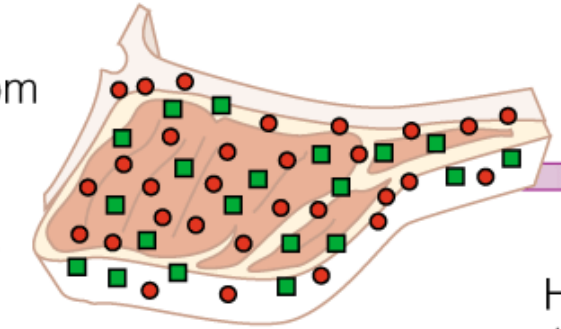
Plant sources (dark green vegetables, legumes)

Animal sources

Less efficiently absorbed

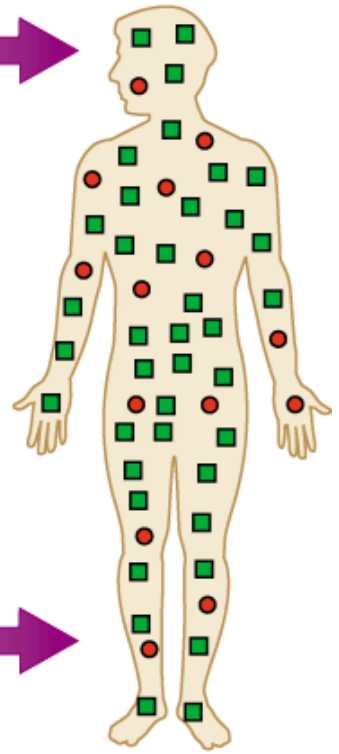
Iron

Only foods derived from animal flesh provide heme, but they also contain nonheme iron.



Key:
- Heme
- Nonheme

Heme accounts for about 10% of the average daily iron intake, but it is well absorbed (about 25%). Nonheme iron accounts for the remaining 90% but it is less well absorbed (about 17%).



All the iron in foods derived from plants is nonheme iron.

Iron

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Enhance non-heme absorption

Animal protein

HCl (hydrochloric acid) in stomach

Vitamin C

Inhibit non-heme absorption

Phytates and oxalates (found in some vegetables)

Fibers

Tannic acid (tea, beer, soft drinks)

Other nutrients: zinc, calcium

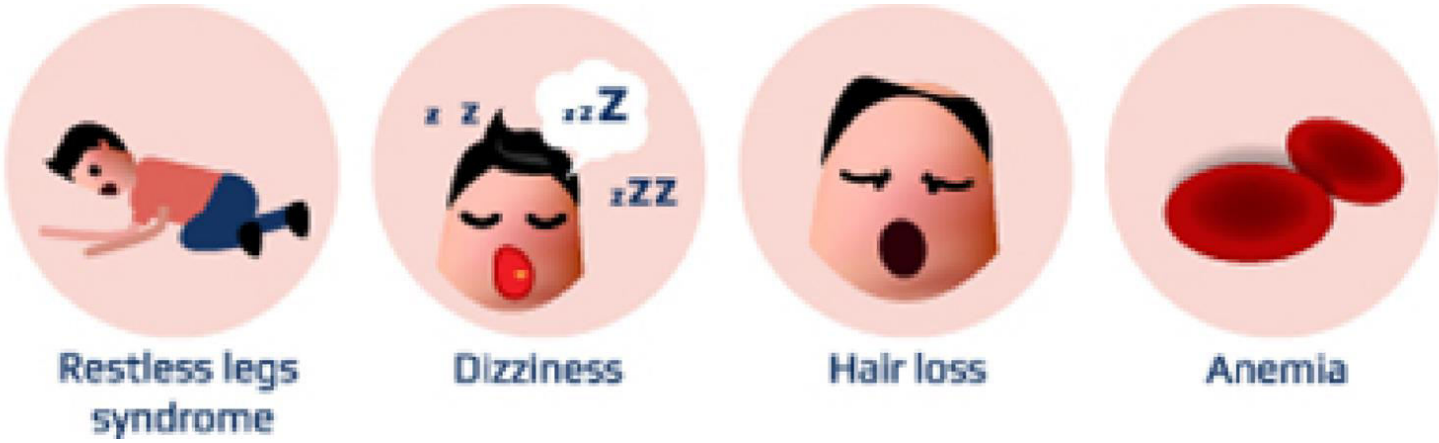
Iron

Deficiency

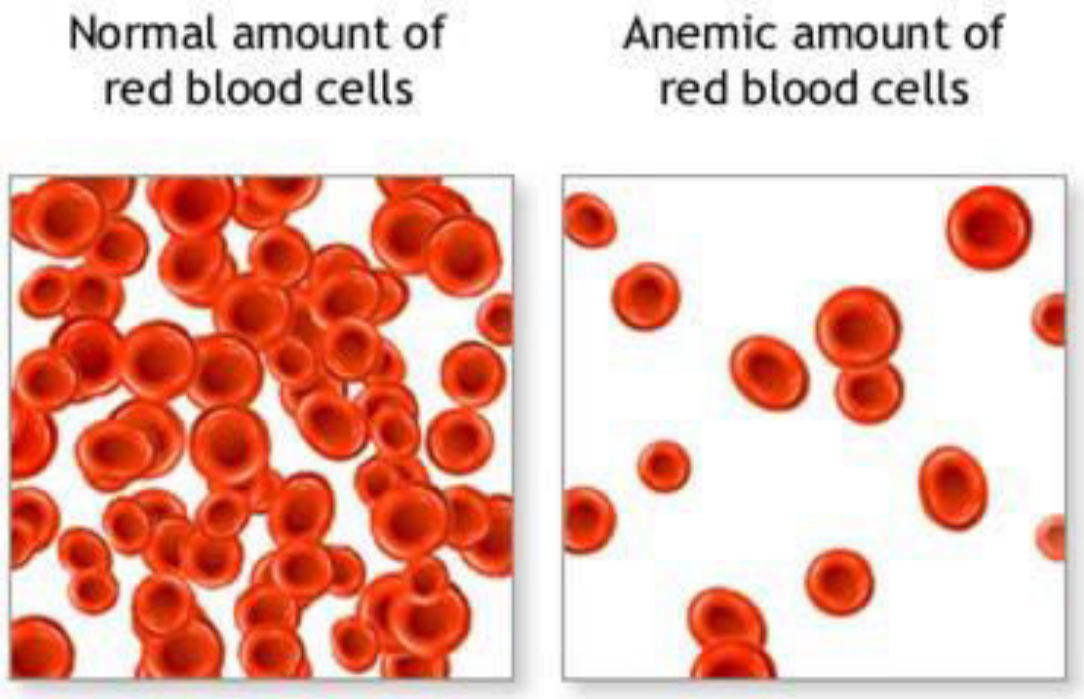
Most common nutrient deficiency worldwide.

Symptoms include: anemia, fatigue, decreased performance.

Iron deficiency anemia means anemia due to **severe deficiency in iron stores**.



Anemia



Anemia is a condition characterized by a **reduction in the hemoglobin** and/or in red blood cells.

Hemoglobin (Hb) is the oxygen-carrying protein inside red blood cells. It gives the red color to blood cells.

Anemia

Anemia affects more than **30 percent of the world's population**, it is one of the most important deficiencies in both developing and developed countries.

All age groups might be at risk.

Most affected groups:

Infants

Preschoolers

School aged children

Adolescents

Pregnant women

Elderly

Anemia

Main Causes of Anemia

Iron Deficiency Anemia	**Megaloblastic Anemias** Deficiency of Vitamin B12 or Folate (folic acid)	**Anemia of chronic disease** Malaria, Tuberculosis, HIV

Other Causes of Anemia

Excess blood loss (ex: from menstruation in women)
Ingestion of toxic (poisonous) **substances**, such as lead and other compounds
Genetic (heredity) **abnormalities**

Anemia

Main Causes of Anemia

Iron deficiency Anemia

- Insufficient iron available for the normal production of hemoglobin
- Small and pale cells are produced (Microcytic hypochromic anemia)

Megaloblastic Anemias

- Results from an imbalance between supply of vitamins necessary for DNA synthesis
- The cells are not matured and larger in size
- Deficiency of Vitamin B12 or Folate (folic acid)

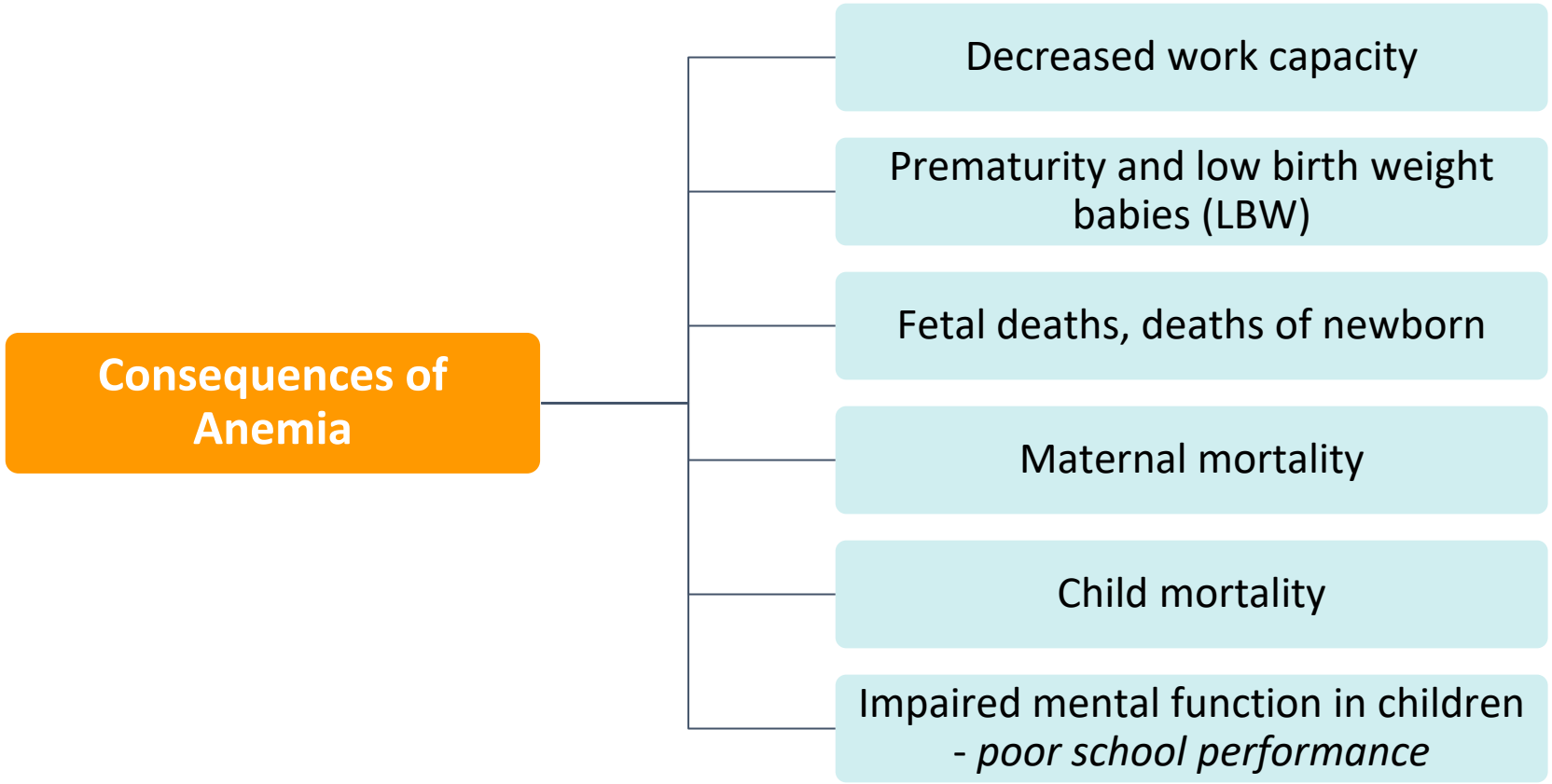
Anemia

Clinical Signs and Symptoms of Anemia

Most commonly, people with anemia report:

- Feeling of weakness or fatigue in general or during exercise, general discomfort (**malaise**)
- Poor mental concentration
- Severe cases often report shortness of breath (**dyspnea**) on exertion, rapid heart rate (**palpitations**) and sweating
- Pale (**pallor**) of skin, mucosal linings and nail beds
- Cracking of lips and spoon shaped nails
- Craving for consumption of non-food items (**pica**) such as dirt, paper, wax, grass, ice, and hair, may be a symptom of iron deficiency
- **Behavioral disturbances** in children as a direct result of impaired neurological development in infants, and reduced scholastic performance in children of school age

Anemia


Consequences of Anemia
Decreased work capacity
Prematurity and low birth weight babies (LBW)
Fetal deaths, deaths of newborn
Maternal mortality
Child mortality
Impaired mental function in children - poor school performance

Anemia

Prevention and Treatment

Increase intake of iron rich food and fortified foods with iron (foods with added iron)

Iron supplementation (medication)

Increased intake of other vitamins such as vitamin A, folic acid and vitamin B12 (Megaloblastic anemia)

Control of parasitic infections

Zinc

Function

Part of enzymes involved in CHO, lipid, protein and nucleic acid metabolism

Necessary for growth

Helps in the production of enzymes

Helps building a healthy immune system

Maintains your senses of smell and taste

Deficiency

Vegetarians are at greater risk of deficiency

Symptoms include short stature

Iodine

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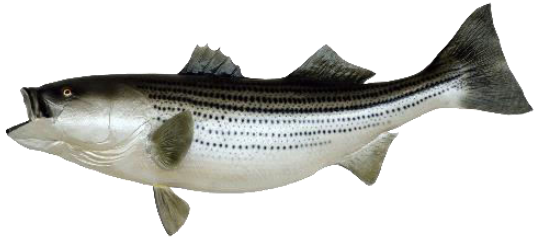
Function

Part of the thyroid hormones, which control the rate of cell metabolism

Iodine

Iodized Salt



Seafood

Sources

Content of animal and plant foods depends on amount of iodine in the soil or water where they are grown

Best sources are iodized salts and sea foods

Iodine

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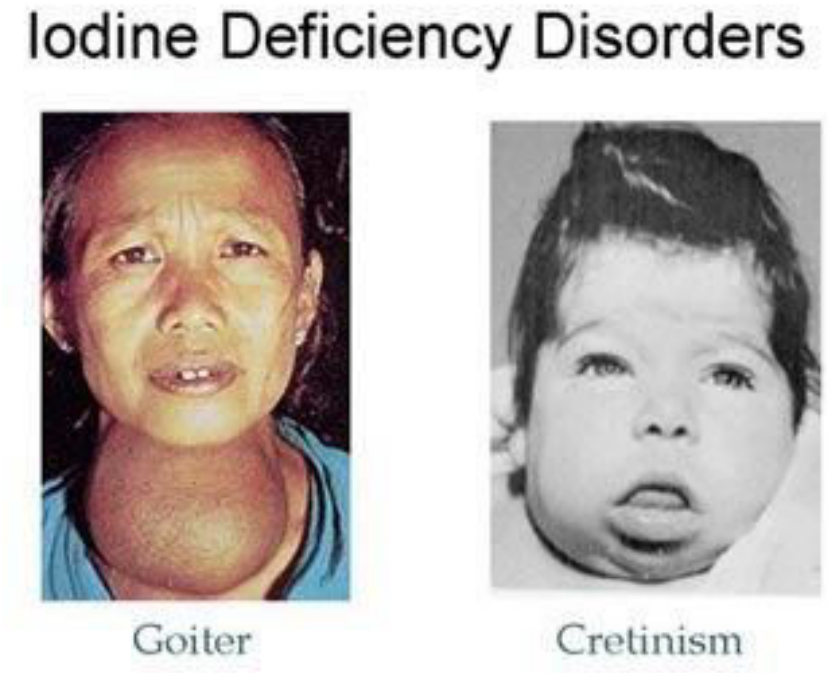
Deficiency

Goiter: enlargement of the thyroid gland, weight gain, defect in regulation of body temperature

Cretinism: in children of iodine deficient mother: mental retardation, impaired physical development



Fluoride

Present in Bones and Teeth

Function

Make teeth resistant against cavities

Sources

Best sources are fluoridated water

Deficiency

Fluorosis

Increased incidence of dental cavities

Water

Water

Water constitutes majority of body weight: **60%** of an adult's body weight.

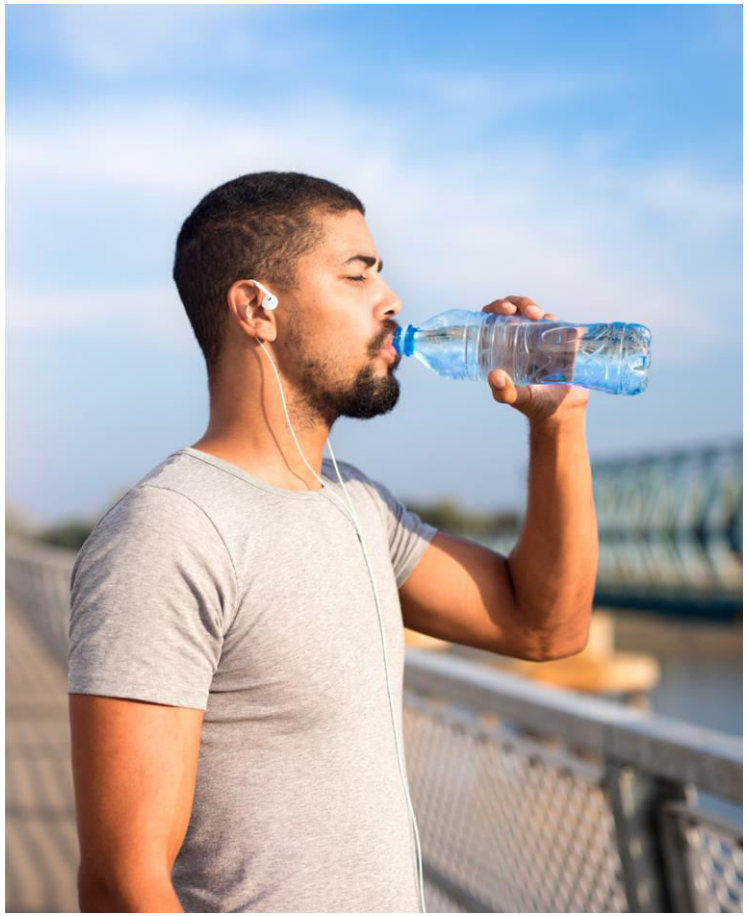
The body needs *more water per day* than any other nutrient.

Water is found in: blood vessels, cells (and chemical structure of cells), tissues, organs.

Influenced by body composition: water makes up 75% of the weight of lean tissues and less than 25% of weight of fat.

Because of their proportion of lean tissues, the proportion of water is smaller in: Females, Obese people, Elderly.

Water in the Body



- Carries nutrients and waste products
- Maintains structure of large molecules
- Participates in metabolic reactions
- Serves as a solvent
- Acts as a lubricant and cushion
- Aids in regulation of body temperature
- Maintains blood volume

Water Sources

Water

Beverages

Foods

Recommended Water Intake

Needs vary depending on diet, activity, environment and humidity.

An average of 8-10 cups per day of water is recommended.

Your body also obtains some water from foods.

In warm weather, extra water is required.

People who are more prone to dehydration and need to drink more are the elderly and children.

Under normal conditions, adults need between 1 and 1.5 liters of water from all sources for each calorie spent in the day.

Information For Your Interest

Effects of Mild and Severe Dehydration

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Mild Dehydration (Loss of <5% Body Weight)	Severe Dehydration (Loss of >5% Body Weight)	Chronic Low Fluid Intake May Increase the Likelihood of:[a]
Thirst	Pale skin	Cardiac arrest (heart attack) and other heart problems
Sudden weight loss	Bluish lips and fingertips	Constipation
Rough, dry skin	Confusion; disorientation	Dental disease
Dry mouth, throat, body linings	Rapid, shallow breathing	Gallstones
Rapid pulse	Weak, rapid, irregular pulse	Glaucoma (elevated pressure in the eye)
Low blood pressure	Thickening of blood	Hypertension
Lack of energy; weakness	Shock; seizures	Kidney stones
Impaired kidney function	Coma; death	Pregnancy/childbirth problems
Reduced quantity of urine; concentrated urine		Stroke
Decreased mental functioning		Urinary tract infections
Decreased muscular work and athletic performance		
Fever or increased internal temperature		
Fainting		