
بسم الله الرحمن الرحيم

Vitamins & Minerals

Dr H.A.balou

Vitamin Facts

- Vitamins are essential organic nutrients, required in small amounts.
- They cannot be synthesized by the body. Must be obtained by outside sources like diet, rumen bacteria & sun.
- Required for growth, maintenance, reproduction and lactation.

Classes of Vitamins

Fat Soluble Vitamins:

limited *stored in tissues*

Examples

A

D

E

K

Water Soluble Vitamins:

not stored in tissues, must have constant supply(exept B12 and folate,stored in the liver)

Examples

B, B1, B2, B6 & B12

Niacin

Folic Acid

C

Vitamin A

Function:

- development healthy **skin** and **nerve** tissue.
- Aids in building up resistance to **infection**.
- Functions in **eye**sight and **bone** formation.
- Body require a source of Vitamin A.
- It is important in the ration of pregnant females.

Deficiency signs:

- **retarded** growth in the young,
- **Xerophthalmia**,
- **night blindness**
- reproductive disorders.

Sources:

Carrots,Sweet Potatoes, Cantaloupe, Pink Grapefruit Apricots,Broccoli,Spinach,Pumpkin,whole milk, carotene, animal body oils (cod fish and tuna), legume forages and can be synthetically produced. هویج، سیب زمینی، طالبی، زردآلو گریپ فروت صورتی، کلم بروکلی، اسفناج، کدو تنبل، شیر کامل، کاروتن، روغن های بدن حیوانی (ماهی کاد و تن)، علوفه حبوبات و قابل تولید مصنوعی

Too Much Can Be Toxic!!

(Required: 400mic gr in infant up1200mic gr in pregnant Toxic: >3000 mic gr)

Hypervitaminosis A leads to toxic symptoms:

- ACUTE:

Headaches and fatigue, Dry, itchy skin,Liver damage

- CHRONIC:

Hair loss,Blurred vision,Loss of appetite,Skin coloration

Vitamin E

Function: normal reproduction.

Deficiency signs:

poor **growth**, **axonal** degeneration of the large myelinated axons,**ophtalmoplegia**,pigmented **retipathy**, Muscular **Dystrophy**

Sources:

synthetic for poultry and swine, cereal grains and wheat germ oil, green forages, protein concentrates, oil seeds (peanut and soybean oil).

غلات

و روغن **جوانه گندم**، علوفه سبز، کنسانتره پروتئین، **دانه های روغنی** (روغن بادام زمینی و سویا).

Vitamin E rapidly destroyed in rancid or spoiled fats. Utilization of Vitamin E is dependent on adequate selenium.

VITAMIN E

DRI RECOMMENDED INTAKE:
Adults: 15 mg/day

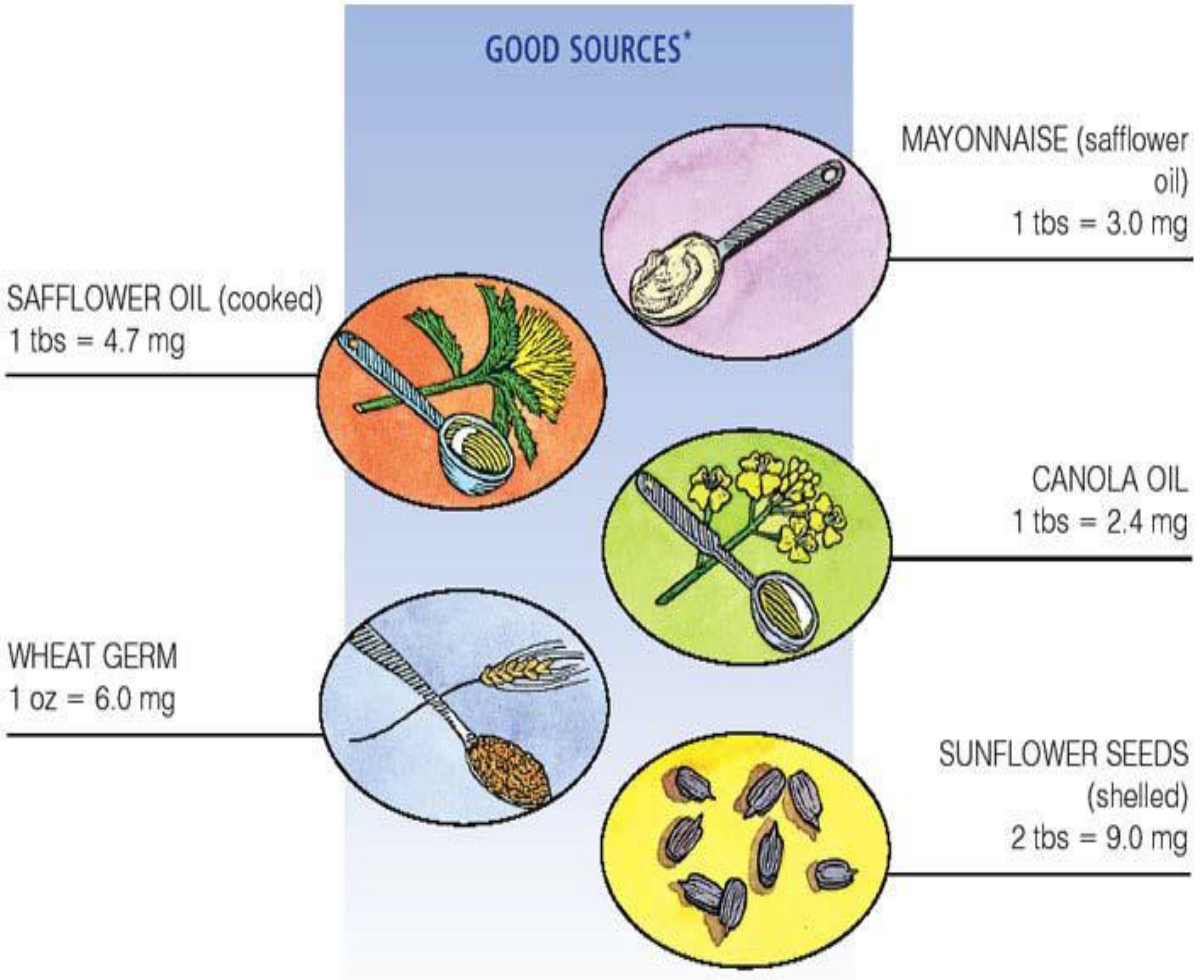
TOLERABLE UPPER INTAKE LEVEL:
Adults: 1,000 mg/day

CHIEF FUNCTIONS: Antioxidant (protects cell membranes, regulates oxidation reactions, protects polyunsaturated fatty acids)

DEFICIENCY: Red blood cell breakage, nerve damage

TOXICITY: Augments the effects of anticlotting medication

*These foods provide 10 percent or more of the vitamin E Daily Value in a serving. For a 2,000-calorie diet, the DV is 30 IU or 20 mg/day.



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The role of Vitamin E in global nutrition





Antioxidant Protection

Vitamin E is a potent antioxidant that helps protect cells from oxidative damage by free radicals.



Immune Support

Vitamin E helps regulate immune responses and enhances the body's ability to fight infections.



Cardiovascular Health

Vitamin E helps prevent the oxidation of LDL cholesterol, which is a risk factor for heart disease.



Reproductive Health

Balanced nutrition, including Vitamin E, is essential for family planning and population growth.



Global Malnutrition

In regions where malnutrition is prevalent, ensuring access to Vitamin E-rich foods can help address nutrient deficiencies and improve overall health.



Eye Health

Vitamin E has been associated with a reduced risk of eye conditions like age-related macular degeneration and cataracts.





Child Development

It plays a role in neurological development which is critical for growing children.

Dietary deficiency of vit E occurs in :

- developing countries
- In severe and prolonged malabsobtion disease,
- celiac disease
- Chronic cholestatic liver disease,
- after small intestine resection,
- bariatric surgery

High dose of vit E (>800mg/d):

- Reduce platelet aggregation
- Interfere with vit K metabolism
- Contraindicated in patient taking warfarin,asprin or lopidegrole

Vitamin D

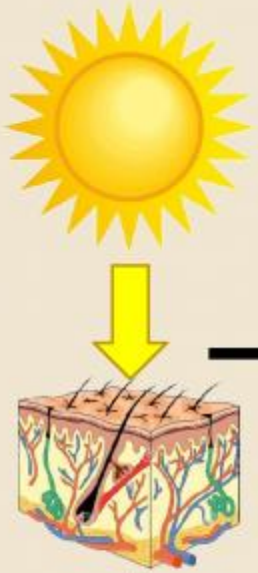
Function: is essential for the **proper utilization** of calcium and phosphorus to produce normal, healthy **bones.**

Deficiency signs: retarded growth, bone pain,weakness,misshapen bones (rickets), lameness and osteoporosis.

Sources: Whole milk, sun-cured hays, forage crops, fish liver oils, irradiated yeast.

شیر کامل، یونجه های آفتاب گرفته، محصولات علوفه ای، روغن کبد ماهی، مخمر پرتودهی شده

The Body Needs All Forms of Vitamin D



Vitamin D3 made in the skin is used by skin cells that cannot rely on vitamin D from the blood

- ↓ DNA Damage Cell Death
- ↑ DNA Repair



VITAMIN D3
(Cholecalciferol)

- Taken directly into cells for local conversion and use
- Most potent form for endothelial stability
- Anti-inflammatory
- Form needed by breastfeeding mothers to transfer to baby through breastmilk
- Must receive daily/semi-daily due to very short half-life of roughly 24 hours



25-hydroxylase

25(OH)D
(Calcifediol)

- Form measured in blood as indicator of vitamin D status
- Taken directly into cells and converted to $1,25(OH)_2D$ for local use
- Used as a signaling molecule in most cells and tissues, including immune, brain, blood vessels, heart, lungs, and many more



1 α hydroxylase

$1,25(OH)_2D$
(Calcitriol)

Hormonal Vitamin D – regulated by parathyroid hormone (PTH) for blood calcium control

- ↑ Calcium absorption in the gut
  Bone turnover
  Calcium in the blood

Chart Date 6/23/2021

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SIGNS OF VITAMIN D DEFICIENCY

In adults, vitamin D deficiency **isn't** obvious.
But you **might** have:



Mood Changes



Bone Loss



Muscle Cramps
(or weakness)



Bone & Joint Pain
(especially in your back)



Fatigue

Cleveland Clinic

Vitamin K

Function: necessary for the maintenance of normal blood coagulation(II/VII/IX/X,Pr c and s).

Deficiency signs: blood loses its power to clot **or** the time needed for clotting is longer **and** serious hemorrhages can result from slight wounds or bruises.

Sources: green leafy forages, fish meal, liver, soybeans, rumen and intestinal synthesis, and the synthetic compounds. علوفه های برگ سبز، پودر ماهی، جگر ، سویا، شکمبه و سنتز روده و ترکیبات مصنوعی

Vitamin C (Ascorbic acid)

Function: has an effect on the metabolism of calcium and vit E in the body, , chollagen Synthesis ,antioxidant , boosts iron absorbtion.

Deficiency signs: Human deficiency: **scurvy** (swollen and painful joints and bleeding gums) and **brittleness** of bones.

Sources: citrus fruits, tomatoes, leafy vegetables and potatoes. مرکبات، گوجه فرنگی، سبزیجات برگ دار و سیب زمینی

VITAMIN C

DRI RECOMMENDED INTAKES:
Men: 90 mg/day
Women: 75 mg/day
Smokers: +35 mg/day

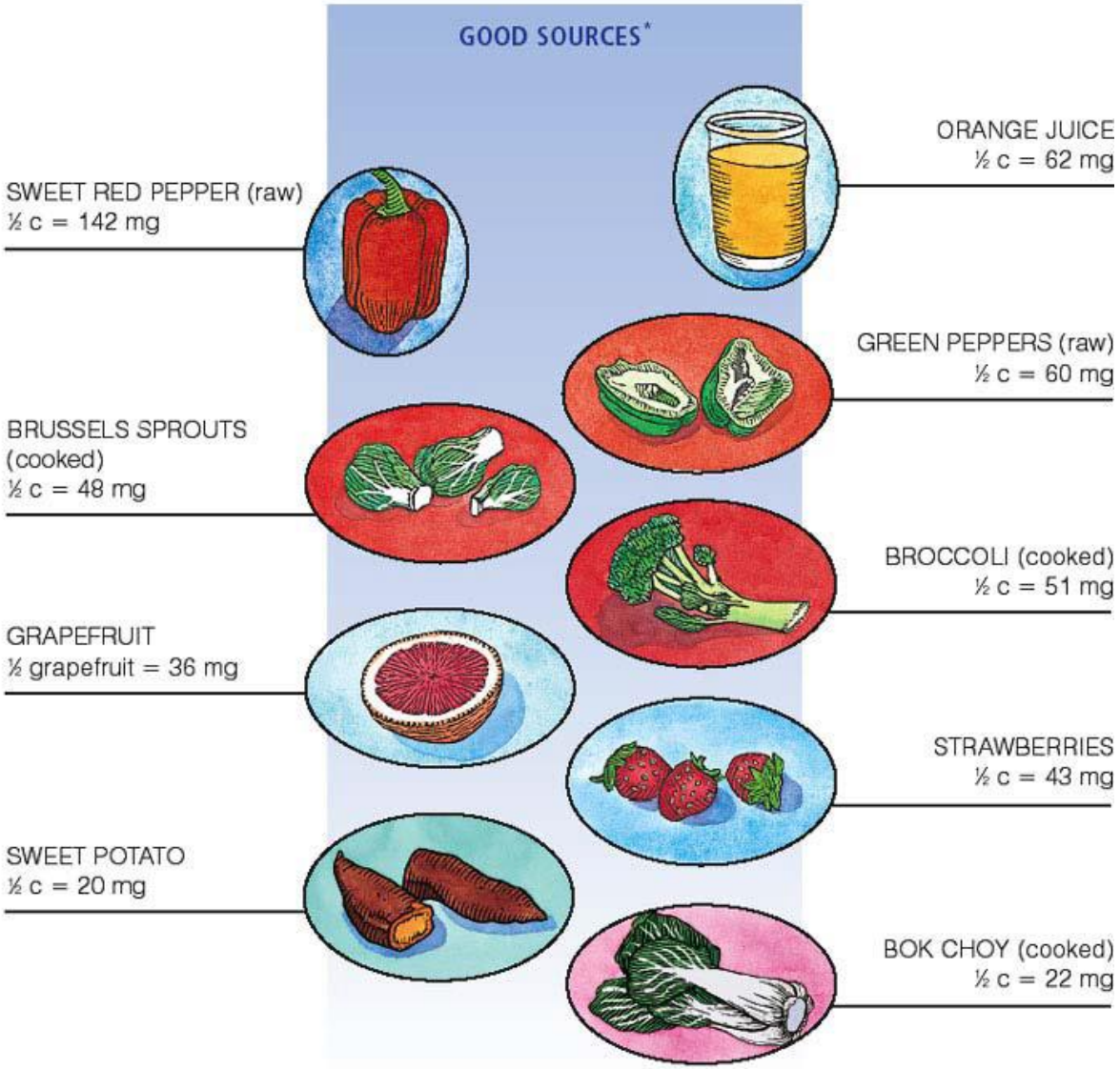
TOLERABLE UPPER INTAKE LEVEL:
Adults: 2,000 mg/day

CHIEF FUNCTIONS: Collagen synthesis (strengthens blood vessel walls, forms scar tissue, provides matrix for bone growth), antioxidant, restores vitamin E to active form, supports immune system, boosts iron absorption

DEFICIENCY: Scurvy, with pinpoint hemmorrhages, fatigue, bleeding gums, bruises; bone fragility, joint pain; poor wound healing, frequent infections

TOXICITY: Nausea, abdominal cramps, diarrhea; rashes; interference with medical tests and drug therapies; in susceptible people, aggravation of gout or kidney stones.

*These foods provide 10 percent or more of the vitamin C Daily Value in a serving. For a 2,000-calorie diet, the DV is 60 mg/day.



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Vitamin B_1 (Thiamin)

Function: required for the normal metabolism of carbohydrates.

Deficiency signs: loss of appetite, muscular weakness, severe nervous disorders, general weakness and wasting (BeriBeri).

Sources: raw, whole grains and especially their seed coats and embryos; fresh green forage; and yeast, milk and rumen synthesis.

Vitamin B_2 (Riboflavin)

Function: necessary for normal embryo development, important in the metabolism of amino acids and carbohydrates.

Deficiency signs: poor reproduction characterized by small litters and deformed young (cleft palate and club-footedness) curly toe paralysis in chicks, digestive disturbances, general weakness and eye abnormalities.

Sources: milk and dairy by-products, yeast, green forages, well cured hay (especially alfalfa), whole grains, wheat bran and synthetic riboflavin rumen synthesis.

Vitamin B_6

Roles:

- Conversion of amino acids to other amino acids

Ex.: Tryptophan to niacin

- Synthesis of hemoglobin and neurotransmitters
- Release of glucose from glycogen
- Immune function
- Promotes steroid hormone activity
- Development of nervous system

VITAMIN B_6

DRI RECOMMENDED INTAKE:
Adults (19–50 yr): 1.3 mg/day

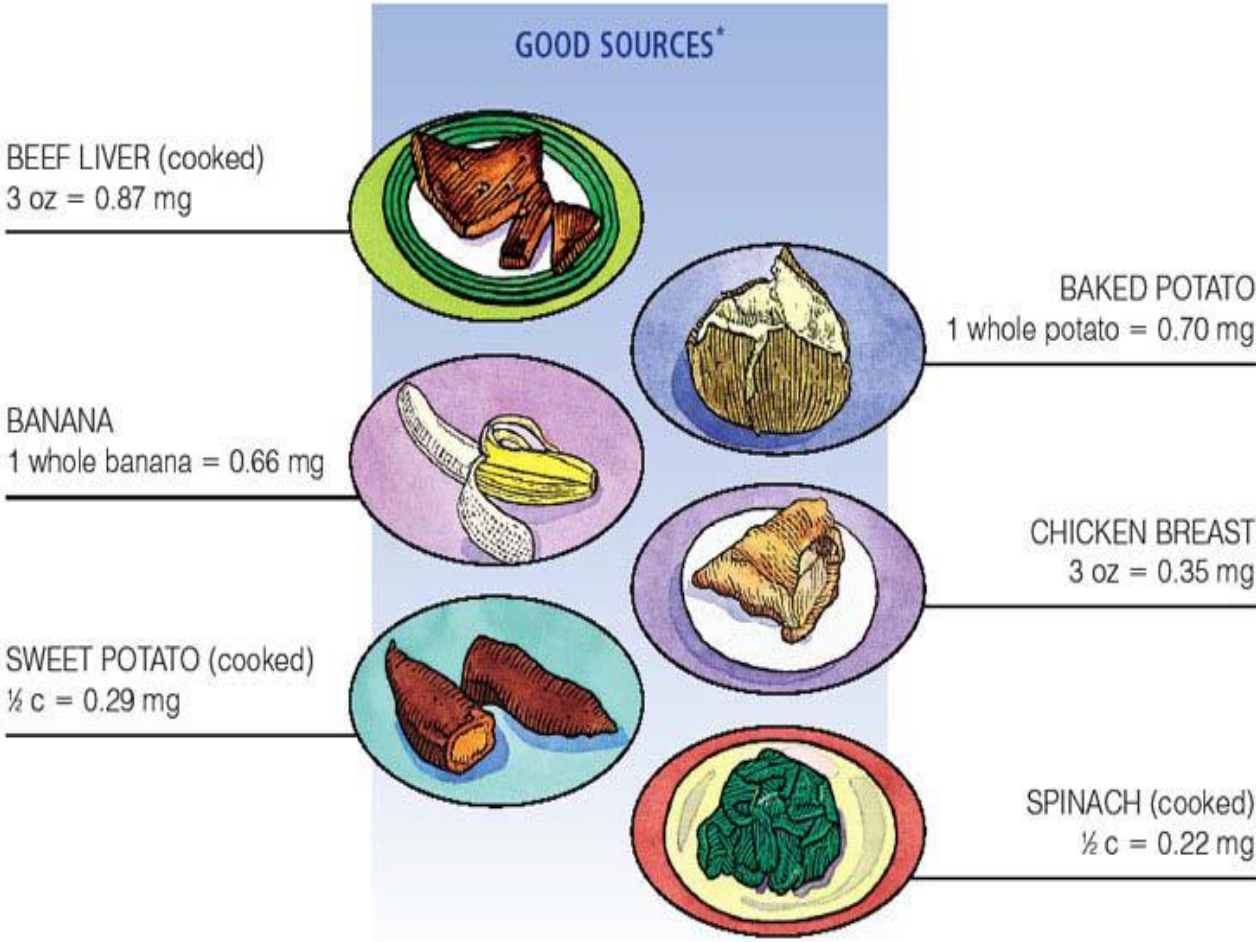
TOLERABLE UPPER INTAKE LEVEL:
Adults: 100 mg/day

CHIEF FUNCTIONS: Part of a coenzyme needed in amino acid and fatty acid metabolism; helps to convert tryptophan to niacin and to serotonin; helps to make hemoglobin for red blood cells

DEFICIENCY: Anemia, depression, confusion, abnormal brain wave pattern, convulsions; greasy, scaly dermatitis

TOXICITY: Depression, fatigue, impaired memory, irritability, headaches, nerve damage causing numbness and muscle weakness progressing to an inability to walk and convulsions; skin lesions

*These foods provide 10 percent or more of the vitamin B_6 Daily Value in a serving. For a 2,000-calorie diet, the DV is 2 mg/day.



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Vitamin B12

(requires intrinsic factor for absorption)

Roles:

- works with folate, part of insulating sheath around nerves.

Deficiencies

- Pernicious anemia
- Paralysis
- Nerve damage in fetus

VITAMIN B_{12}

DRI RECOMMENDED INTAKE:
Adults: 2.4 µg/day

CHIEF FUNCTIONS: Part of coenzymes needed in new cell synthesis; helps to maintain nerve cells

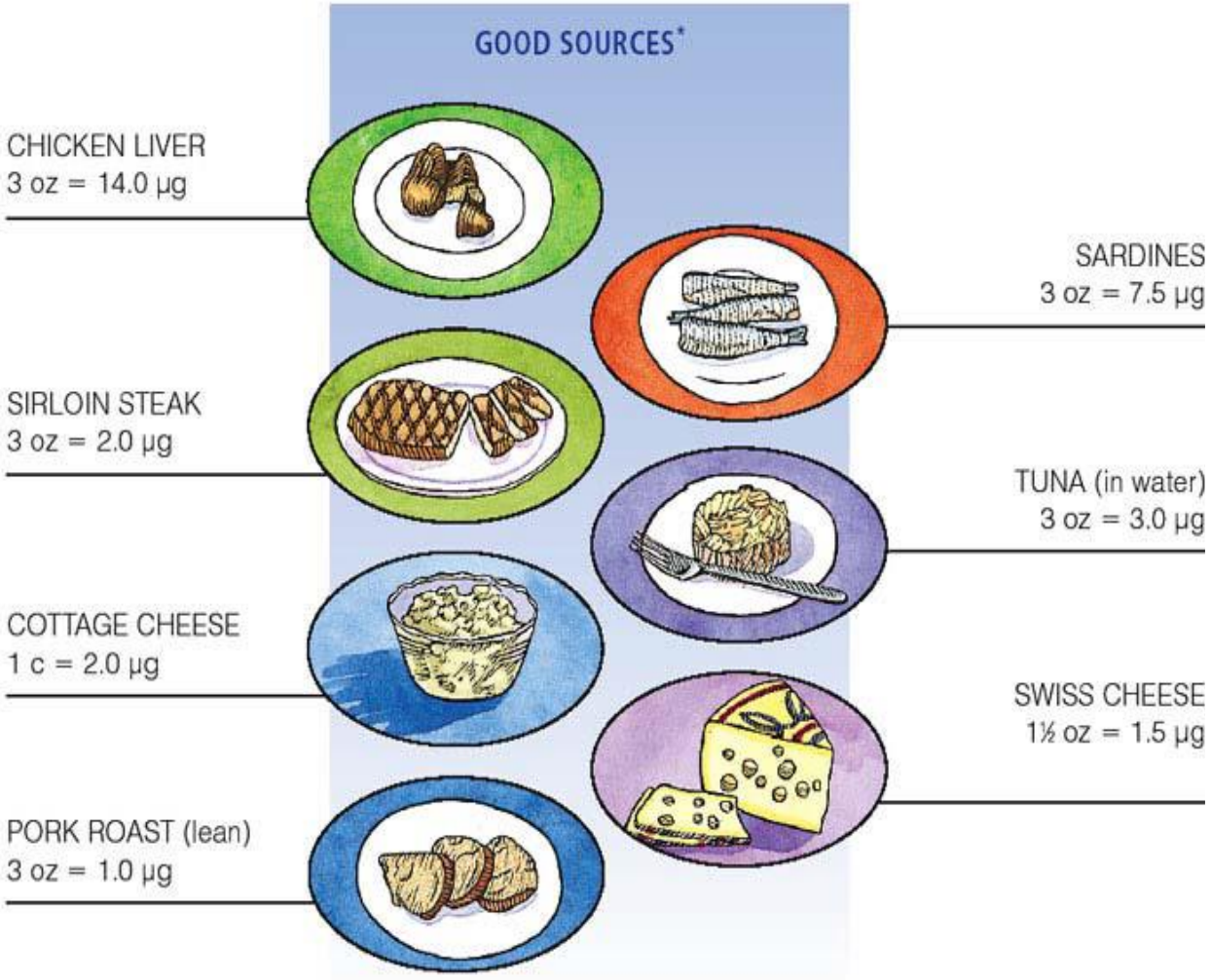
DEFICIENCY: Pernicious anemia;[a] anemia (large-cell type);[b] smooth tongue; tingling or numbness; fatigue, memory loss, disorientation, degeneration of nerves progressing to paralysis

TOXICITY: None reported

*These foods provide 10 percent or more of the vitamin B_{12} Daily Value in a serving. For a 2,000-calorie diet, the DV is 6 µg/day.

[a]The name *pernicious anemia* refers to the vitamin B_{12} deficiency caused by a lack of stomach intrinsic factor, but not to anemia from inadequate dietary intake.

[b]Large cell-type anemia is known as either *macrocytic* or *megaloblastic anemia*.



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Folate

Role:

required for synthesis of DNA -***pregnancy

Deficiencies:(drug interactions, smoking)

- Anemia
- Decreased immunity
- Decreased digestive and cardiovascular function
- Colon and cervical cancers
- Neural tube defects, ?other birth defects

FOLATE

DRI RECOMMENDED INTAKE:
Adults: 400 µg/day[a]

TOLERABLE UPPER INTAKE LEVEL:
Adults: 1,000 µg/day

CHIEF FUNCTIONS: Part of a coenzyme needed for new cell synthesis

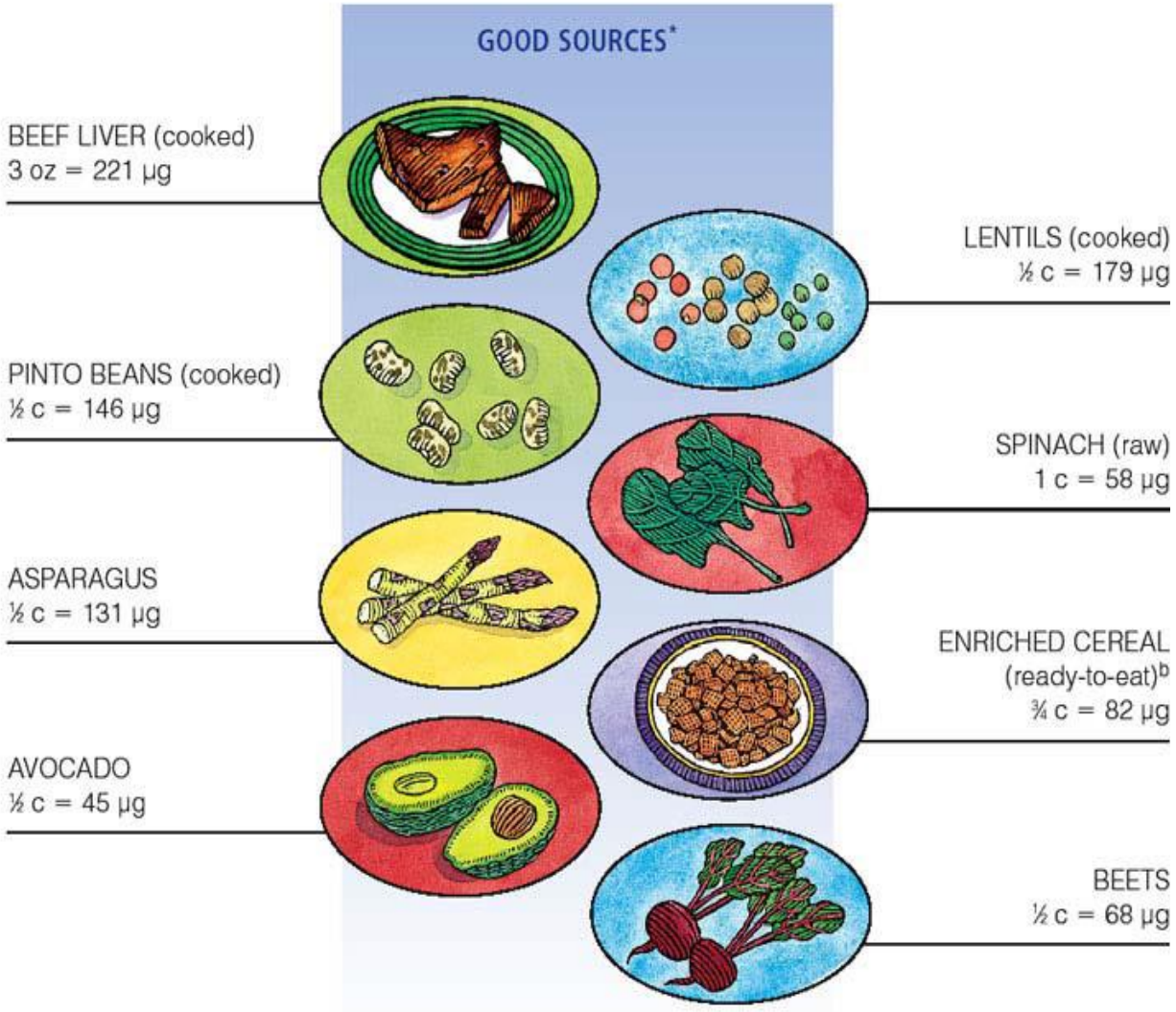
DEFICIENCY: Anemia, smooth, red tongue; depression, mental confusion, weakness, fatigue, irritability, headache; a low intake increases the risk of neural tube birth defects

TOXICITY: Masks vitamin B_{12}–deficiency symptoms

*These foods provide 10 percent or more of the folate Daily Value in a serving. For a 2,000-calorie diet, the DV is 400 µg/day.

[a]Folate recommendations are expressed in dietary folate equivalents (DFE). Note that for natural folate sources, 1 µg = 1 DFE; for enrichment sources, 1 µg = 1.7 DFE.

[b]Some highly enriched cereals may provide 400 or more micrograms in a serving.



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Mineral Facts

- Essential inorganic nutrients, required in small amounts.
- As many as 20 minerals may be required!
- Required for growth, maintenance, reproduction and lactation.

- Term **mineral → elements other than C, H, O, and N** → present in foods.
- Four non mineral elements (C, H, O, and N) → present in organic molecules and water → constitute 99% → total number of atoms in living systems.
- Minerals → remain as ash → combustion of plant and animal tissues.
- Present → relatively low conc in foods → key functional roles .

Three classes:

MAIN ELEMENTS:

human beings in amounts **> 50 mg/day**

e.g., Ca, Cl, K, Mg, Na, P, S .

TRACE ELEMENTS:

concentrations **< 50 mg/day**

e.g.,Fe, F, Co, Cu, Cr, I, Zn, Se, Mn, Mo, Ni.

ULTRA-TRACE ELEMENTS:

vital elements

e.g.,Al, As, B, Ba, Bi, Br, Cs, Cd, Ge, Hg, Li, Pb, Rb, Si, Sn, Sb, Sr, Ti, W.

NUTRITIONAL AND FUNCTIONAL ROLES

Minerals have important nutritional and physiological functions .

MAIN ELEMENTS

Sodium:

- Sodium absorption is rapid.
- activates → some enzymes, such as amylase.
- excessive intake → hypertension.
- low intake of sodium → a non-salty diet or by using diet salt (common salt substitutes).

Potassium:

- regulates osmotic pressure within the cell.
- involved in cell membrane transport.
- deficiency ← potassium-deficient foods, e.g., white bread, fat or oil.
- Potatoes and molasses → sources

Magnesium:

- constituent and activator → many enzymes.
- associated → conversion of energy-rich phosphate compounds
- Stabilizer → plasma membranes, intracellular membranes, and nucleic acids

Calcium:

- skeleton and in some body tissues.

- controls essential processes → activity of brain cells and cell growth, blood clotting, muscle contraction (heartbeat).
- **source** → milk and milk products, fruit and vegetables, cereal products, meat, fish and eggs.

Chloride:

- serves as counter ion for sodium in extracellular fluid and
- for hydrogen ions in gastric juice.

- absorption is as rapid as its excretion → urine.

Phosphorus:

- essential nutrient.

- in the form of phosphate, free or bound as an ester or present as an anhydride, plays imp role → metabolism

TRACE ELEMENTS

Iron:

- essential ingredient of daily diet
- present → hemoglobin (blood) and myoglobin (muscle tissue) pigments.
- present → enzymes (peroxidase, catalase, hydroxylases and flavine enzymes)
- Two **food processing problems** → iron fortification :

  1. increased probability → oxidation
  2. wheat flour → decreased baking quality.

- **undesirable** element → food processing
- catalyzes oxidation of **fat / oil**,
- increases turbidity of **wine**,
- supports growth of iron-requiring **bacteria**

Copper:

- component of oxidoreductase enzymes (amine oxidase, cytochrome oxidase, superoxide dismutase, tyrosinase, uricase).
- less desirable than iron → food processing and storage → catalyzes many **unwanted reactions.**
- Cu2+-Ions are taste bearing.
- Threshold value 2.4 – 3.8mg/l was determined with aqueous solutions of CuSO4 or CuCl2

Zinc:

- component → enzymes (e.g., alcohol dehydrogenase, carbonic anhydrase, carboxypeptidases A and B, glutamate dehydrogenase, lactate dehydrogenase and malate dehydrogenase,,).

- Other enzymes, e.g., alkaline phosphatase, dipeptidases, enolase and lecithinase are activated by zinc.

- **deficiency** in animals → serious disorders.

- **high zinc** intake → toxic

Manganese:

- metal activator for **pyruvate carboxylase** .
- activates various enzymes → alkaline phosphatase, amino peptidase, arginase, lecithinase or enolase.
- even in higher amounts → relatively **nontoxic**

Fluorine:

- Addition → drinking water **0.5–1.5 ppm** fluorine in the form of **NaF** → **inhibits** tooth decay.

- beneficial effect → retarding solubilization of tooth enamel and inhibiting the enzymes involved → development of **caries**.

- **Toxic** effects → at a level of 2 ppm.

- beneficial effects of fluoridating drinking water → **disputed** by some and → **controversial** topic of mineral nutrition

Iodine:

- absorption → **as iodide** .
- **utilized** in thyroid gland → biosynthesis of → hormone **thyroxine** (tetraiodothyronine) and its less iodized form, **triiodothyronine**.
- **deficiency** → enlargement of the thyroid gland (iodine-deficiency induced goiter).
- most food → little iodine.
- **Good sources** → milk, eggs and seafood.
- Drinking water → little iodine supply.
- To avoid deficiency diseases → **iodization of common salt** is done in which **potassium iodate**, with 100 μg iodine added to 1–10 g NaCl..
- Higher amounts of iodine → **toxic**.

Water soluble
B-1: ham, soymilk, watermelon, acorn squash
B-2: milk, yogurt, cheese, whole and enriched grains and cereals
B-3: meat, poultry, fish, fortified and whole grains, mushrooms, potatoes
B-5: chicken, whole grains, broccoli, avocados, mushrooms
B-6: meat, fish, poultry, legumes, tofu and other soy products, bananas
B-7: Whole grains, eggs, soybeans, fish
B-9: Fortified grains and cereals, asparagus, spinach, broccoli, legumes (black-eyed peas and chickpeas), orange juice
B-12: Meat, poultry, fish, milk, cheese, fortified soymilk and cereals
Vitamin C: Citrus fruit, potatoes, broccoli, bell peppers, spinach, strawberries, tomatoes, Brussels sprouts
Fat soluble
Vitamin A: beef, liver, eggs, shrimp, fish, fortified milk, sweet potatoes, carrots, pumpkins, spinach, mangoes
Vitamin D: Fortified milk and cereals, fatty fish
Vitamin E: vegetables oils, leafy green vegetables, whole grains, nuts
Vitamin K: Cabbage, eggs, milk, spinach, broccoli, kale
Minerals
Major
Calcium: yogurt, cheese, milk, salmon, leafy green vegetables
Chloride: salt
Magnesium: Spinach, broccoli, legumes, seeds, whole-wheat bread
Potassium: meat, milk, fruits, vegetables, grains, legumes
Sodium: salt, soy sauce, vegetables
Trace
Chromium: meat, poultry, fish, nuts, cheese
Copper: shellfish, nuts, seeds, whole-grain products, beans, prunes
Fluoride: fish, teas
Iodine: Iodized salt, seafood
Iron: red meat, poultry, eggs, fruits, green vegetables, fortified bread
Manganese: nuts, legumes, whole grains, tea
Selenium: Organ meat, seafood, walnuts
Zinc: meat, shellfish, legumes, whole grains

منابع ویتامین
محلول در آب

- B-1: ژامبون، شیر سویا، هندوانه، کدو بلوط
- B-2 شیر، ماست، پنیر، غلات کامل و غنی شده و غلات
- B-3: گوشت، مرغ، ماهی، غلات غنی شده و کامل، قارچ، سیب زمینی
- B-5: مرغ، غلات کامل، بروکلی، آووکادو، قارچ
- B-6: گوشت، ماهی، مرغ، حبوبات، توفو و سایر محصولات سویا، موز
- B-7: غلات کامل، تخم مرغ، سویا، ماهی
- B-9: غلات و غلات غنی شده، مارچوبه، اسفناج، کلم بروکلی، حبوبات (نخود و نخود چشم سیاه)، آب پرتقال
- B-12: گوشت، مرغ، ماهی، شیر، پنیر، شیر سویا غنی شده و غلات
- C: ویتامین مرکبات، سیب زمینی، کلم بروکلی، فلفل دلمه ای، اسفناج، توت فرنگی، گوجه فرنگی، کلم بروکسل

محلول در چربی

- A: گوشت گاو، جگر، تخم مرغ، میگو، ماهی، شیر غنی شده، سیب زمینی شیرین، هویج، کدو تنبل، اسفناج، انبه
- D: شیر و غلات غنی شده، ماهی چرب
- E: روغن های گیاهی، سبزیجات سبز برگ، غلات کامل، آجیل
- K: کلم، تخم مرغ، شیر، اسفناج، کلم بروکلی، کلم پیچ

مواد معدنی

ماژور:

کلسیم: ماست، پنیر، شیر، سالمون، سبزیجات سبز برگ

کلرید: نمک

منیزیم: اسفناج، کلم بروکلی، حبوبات، دانه ها، نان سبوس دار

پتاسیم: گوشت، شیر، میوه ها، سبزیجات، غلات، حبوبات

سدیم: نمک، سس سویا، سبزیجات

trace:

کروم: گوشت، مرغ، ماهی، آجیل، پنیر

مس: صدف، آجیل، دانه ها، محصولات غلات کامل، لوبیا، آلو

فلورایید: ماهی، چای

ید: نمک یددار، غذاهای دریایی

آهن: گوشت قرمز، مرغ، تخم مرغ، میوه ها، سبزیجات سبز، نان غنی شده

منگنز: آجیل، حبوبات، غلات کامل، چای

سلنیوم: گوشت اندام، غذاهای دریایی، گردو

روی: گوشت، صدف، حبوبات، غلات کامل