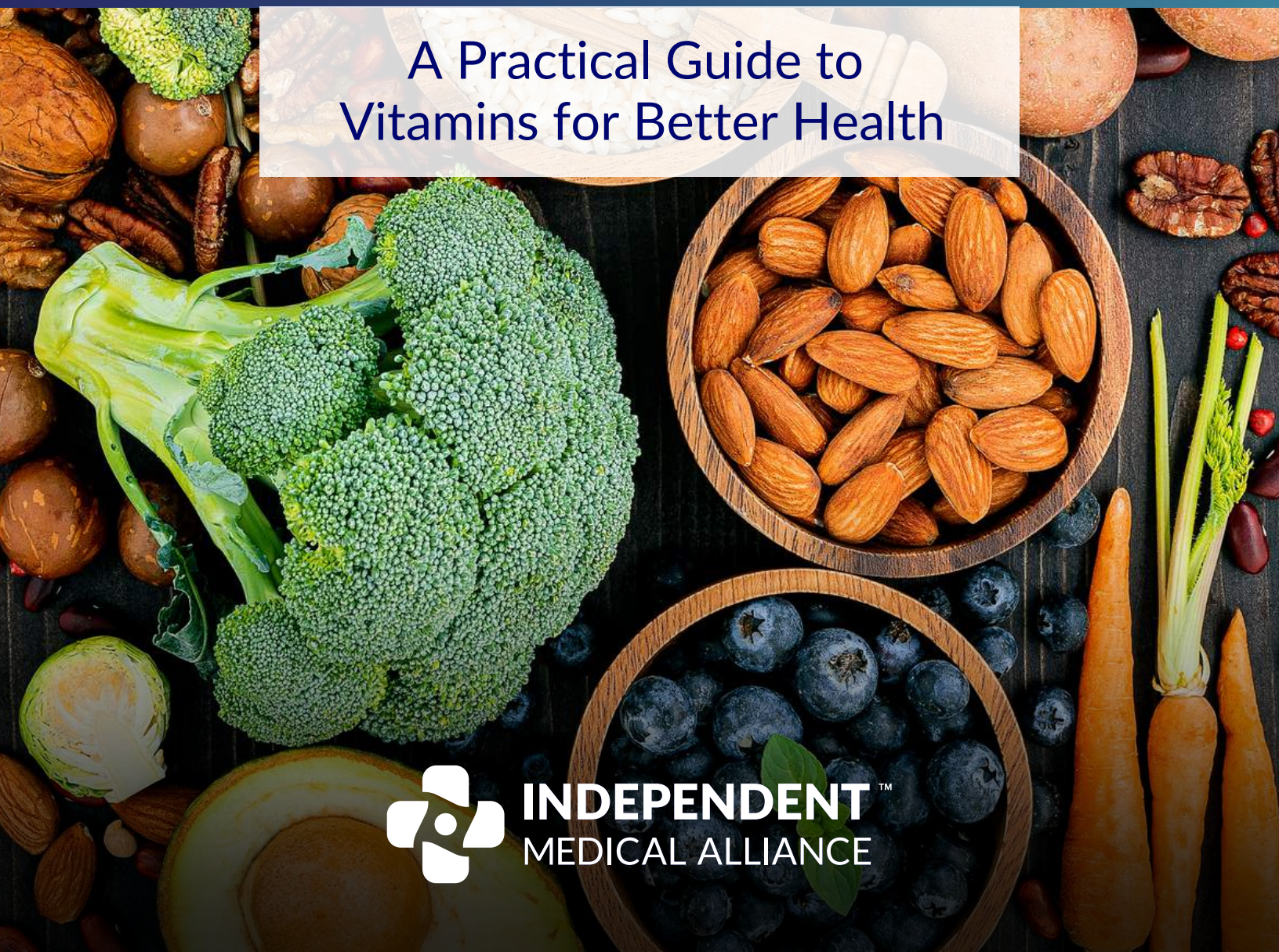
VITAMINS 101

A Practical Guide to Vitamins for Better Health



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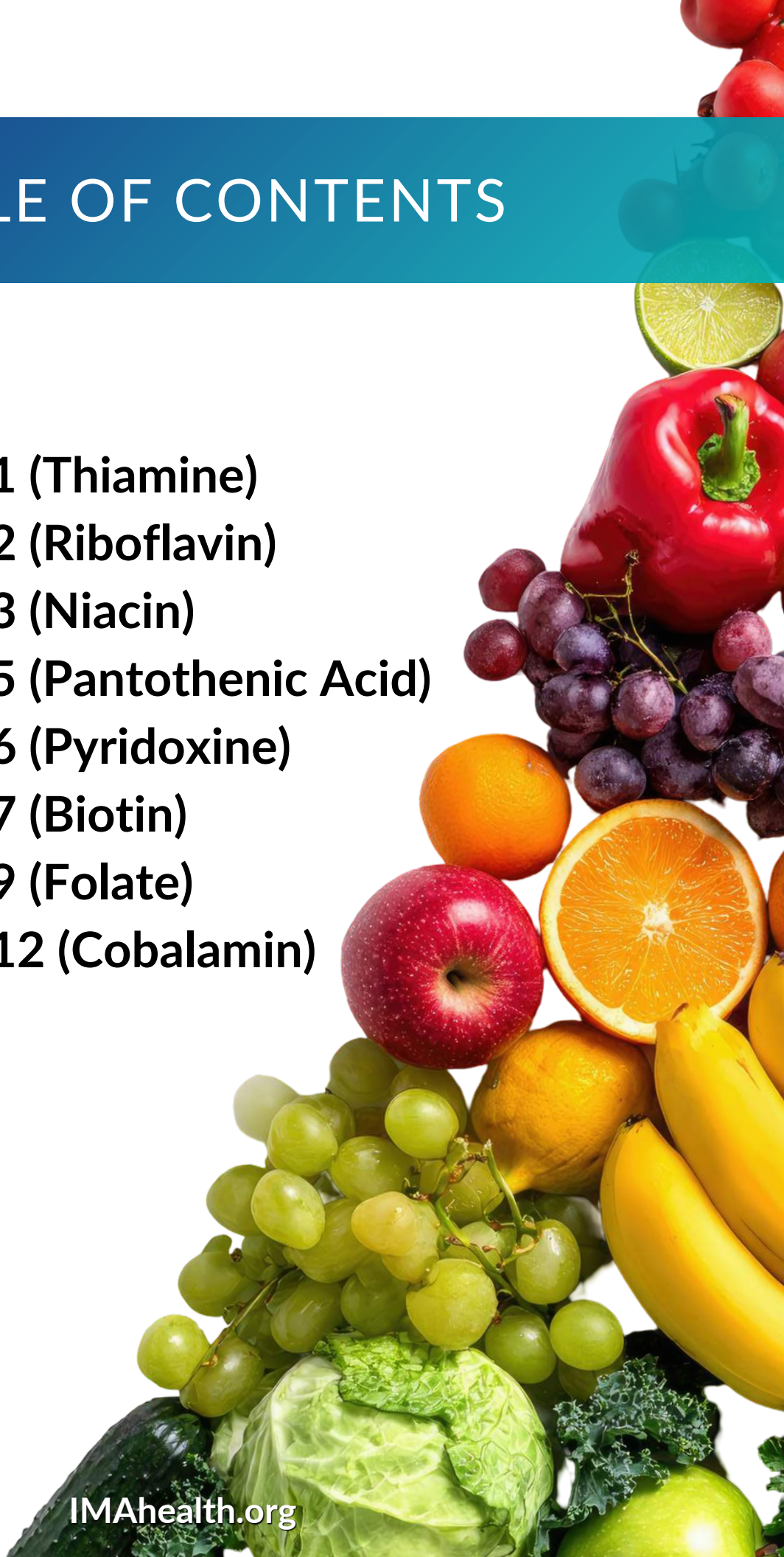

VITAMIN A

Vitamin A is a group of fat-soluble compounds including retinol, retinal, and retinyl esters, as well as provitamin A carotenoids such as beta-carotene found in plant foods. It is one of the most essential nutrients for immune function, vision, skin health, and cellular communication. Vitamin A plays a critical role in gene expression, influencing the development and function of virtually every organ system in the body. It exists in two primary dietary forms: preformed vitamin A from animal sources and provitamin A carotenoids from plant sources, which must be converted by the body—a process that is highly inefficient in many people.

How it helps:

- Supports healthy vision — particularly night vision and low-light adaptation
- Essential for immune system development and function
- Promotes healthy skin and mucous membrane integrity
- Supports healthy reproductive system in both men and women
- Essential for fetal development during pregnancy
- Supports bone health and growth
- Promotes healthy gene expression and cellular differentiation
- Powerful antioxidant via carotenoid forms
- Supports healthy thyroid function
- Supports lung and respiratory health

Vitamin A-rich foods:

- Beef liver (richest source by far)
- Cod liver oil
- Salmon and fatty fish
- Eggs
- Dairy products
- Sweet potato (beta-carotene)
- Carrots (beta-carotene)
- Leafy greens (beta-carotene)
- Red bell peppers (beta-carotene)
- Mango and cantaloupe (beta-carotene)

Signs of deficiency:

- Night blindness and poor low-light vision
- Dry eyes and Bitot's spots
- Dry, rough, or acne-prone skin
- Frequent infections and weakened immunity
- Hair loss and poor hair health
- Infertility and reproductive issues
- Poor wound healing
- Respiratory infections
- Growth delays in children

Optimal Dosages:

- Maintenance: 3,000–5,000 IU
- Immune/skin: 5,000–10,000 IU
- Therapeutic: up to 25,000 IU — short-term, supervised
- Use preformed retinol (animal sources / cod liver oil) — not beta-carotene
- Fat-soluble — take with fat; pairs with D and K2
- Cap at 10,000 IU/day long-term without testing (same in pregnancy — teratogenic at high doses)
- Those with liver conditions should use caution and consult a practitioner

VITAMIN B1 (THIAMINE)

Thiamine is a water-soluble B vitamin essential for converting carbohydrates into energy. It plays a critical role in nerve function and is required by virtually every cell in the body. Because the body cannot store it well, consistent dietary intake is essential.

How it helps:

- Converts food into usable energy
- Supports healthy nerve function
- Promotes healthy brain function
- Supports cardiovascular health
- Essential for muscle function

Thiamine-rich Foods:

- Whole grains
- Pork
- Legumes (black beans, lentils)
- Sunflower seeds
- Trout
- Mussels
- Nutritional yeast
- Asparagus
- Brussels sprouts

Signs of deficiency:

- Fatigue and weakness
- Nerve damage (tingling/numbness)
- Memory problems and confusion
- Irritability
- Poor appetite
- In severe cases: Beriberi or Wernicke's encephalopathy

Optimal Dosages:

- General health: 50–100 mg daily
- Neurological support: 100–300 mg daily
- Best taken as benfotiamine (fat-soluble form) for superior absorption, especially for nerve and metabolic support
- Take with food; works best alongside the full B vitamin family

VITAMIN B2 (RIBOFLAVIN)

Riboflavin is a water-soluble vitamin that acts as a precursor to two major coenzymes—FAD and FMN—which are critical for energy metabolism, cellular function, and the metabolism of fats, drugs, and steroids. It also plays a key role in converting other B vitamins into their active forms.

How it helps:

- Supports cellular energy production
- Activates B6, folate, and B12
- Powerful antioxidant properties
- Supports healthy skin and eyes
- Promotes growth and development
- May reduce frequency of migraines

Riboflavin-rich foods:

- Beef liver
- Beef
- Clams
- Salmon
- Milk and dairy products
- Eggs
- Almonds
- Mushrooms
- Spinach
- Fortified cereals

Signs of deficiency:

- Cracked lips and mouth sores
- Sore or swollen throat
- Skin rashes
- Hair loss
- Fatigue
- Sensitivity to light
- Bloodshot or itchy eyes

Optimal Dosages:

- General health: 25–50 mg daily
- Migraine prevention: 400 mg daily (well-supported in clinical literature)
- Look for riboflavin-5-phosphate (active form) for better bioavailability
- Note: may cause bright yellow urine — this is harmless

VITAMIN B3 (NIACIN)

Niacin exists in two primary forms—nicotinic acid and niacinamide—and is essential for over 400 enzymatic reactions in the body. It is a key player in energy metabolism, DNA repair, and cell signaling. Niacin also has well-established cardiovascular benefits, particularly in supporting healthy cholesterol levels.

How it helps:

- Supports energy metabolism
- Promotes healthy cholesterol levels
- Supports DNA repair and cell signaling
- Improves skin health
- Supports brain function and mental clarity
- May reduce inflammation

Niacin-rich foods:

- Beef liver
- Chicken breast
- Tuna and salmon
- Turkey
- Pork
- Peanuts
- Avocado
- Brown rice
- Mushrooms
- Fortified cereals

Signs of deficiency:

- Pellagra (dermatitis, diarrhea, dementia)
- Fatigue and weakness
- Depression and anxiety
- Headaches
- Memory loss
- Skin rashes especially in sun-exposed areas
- Digestive issues

Optimal Dosages:

- General health: 25–50 mg daily as niacinamide (no flush)
- Cholesterol support: 500–2,000 mg daily as nicotinic acid (causes flushing — start low)
- NAD+ support/longevity: consider NMN or NR as alternative niacin precursors
- High doses should be taken under practitioner guidance due to liver considerations

VITAMIN B5 (PANTOTHENIC ACID)

Pantothenic acid is found in nearly every food, yet deficiency is more common than expected due to food processing. It is essential for synthesizing coenzyme A (CoA), which is central to energy metabolism and the production of hormones, red blood cells, and neurotransmitters. Its name comes from the Greek word "pantothen," meaning "from everywhere."

How it helps:

- Essential for energy metabolism via CoA
- Supports adrenal hormone production
- Promotes healthy skin and wound healing
- Supports synthesis of neurotransmitters
- Helps reduce stress response
- Supports healthy cholesterol levels

Vitamin B5-rich foods:

- Beef liver
- Sunflower seeds
- Chicken
- Tuna
- Avocado
- Mushrooms
- Sweet potato
- Lentils
- Eggs
- Milk and yogurt

Signs of deficiency:

- Fatigue and irritability
- Insomnia
- Stomach pain and nausea
- Numbness or burning in hands and feet
- Muscle cramps
- Headaches
- "Burning feet" syndrome

- **Optimal Dosages:**
- General health: 250–500 mg daily
- Adrenal and stress support: 500–1,000 mg daily
- Acne/skin support: 1,000–2,000 mg daily (divided doses)
- Best taken as pantethine for enhanced bioavailability and cholesterol benefits
- Take with meals to reduce any digestive sensitivity

VITAMIN B6 (PYRIDOXINE)

Vitamin B6 is one of the most versatile B vitamins, serving as a cofactor in over 100 enzyme reactions—primarily involving amino acid metabolism. It is essential for the production of neurotransmitters like serotonin, dopamine, and GABA, making it deeply tied to mood regulation, sleep, and cognitive function.

How it helps:

- Supports production of serotonin, dopamine & GABA
- Promotes healthy mood and sleep
- Supports immune function
- Reduces homocysteine levels (heart health)
- Essential for hemoglobin production
- Supports brain health and development

Vitamin B6-rich foods:

- Chickpeas
- Beef liver
- Tuna and salmon
- Chicken and turkey
- Potatoes
- Bananas
- Fortified cereals
- Pistachios
- Avocado
- Spinach

Signs of deficiency:

- Depression, anxiety, and irritability
- Confusion and poor concentration
- Weakened immune function
- Anemia
- Cracked lips and mouth sores
- Skin rashes (seborrheic dermatitis)
- Nerve pain or numbness

Optimal Dosages:

- General health: 25–50 mg daily
- Mood, PMS, and hormone support: 50–100 mg daily
- Always use pyridoxal-5-phosphate (P5P), the active form; standard pyridoxine HCl at high doses long-term has been linked to nerve toxicity
- Do not exceed 200 mg daily long-term without practitioner supervision

VITAMIN B7 (BIOTIN)

Biotin is a water-soluble B vitamin that serves as an essential cofactor for five carboxylase enzymes involved in critical metabolic processes including fatty acid synthesis, amino acid metabolism, and glucose production. Often called the "beauty vitamin," biotin is widely recognized for its role in hair, skin, and nail health—but its metabolic and neurological functions are equally important and frequently overlooked.

How it helps:

- Supports healthy hair, skin, and nails
- Essential for fat, carbohydrate, and protein metabolism
- Supports healthy blood sugar regulation
- Promotes healthy nerve function
- Supports thyroid and adrenal function
- Important during pregnancy for fetal development
- May support MS and other neurological conditions

Biotin-rich foods:

- Beef liver
- Egg yolk (cooked)
- Salmon
- Sardines
- Sunflower seeds
- Sweet potato
- Almonds
- Spinach
- Broccoli
- Dairy products

Signs of deficiency:

- Hair thinning or loss
- Brittle nails
- Skin rashes, particularly around the face
- Fatigue and lethargy
- Depression and mood changes
- Numbness or tingling in extremities
- Muscle pain and cramps
- Cognitive impairment

Optimal Dosages:

- General health & metabolism: 1,000–2,500 mcg daily
- Hair, skin & nail support: 2,500–5,000 mcg daily
- Blood sugar regulation: 2,000–8,000 mcg daily (often combined with chromium)
- Note: Raw egg whites contain avidin, a protein that blocks biotin absorption—avoid regularly consuming raw eggs
- High-dose biotin can interfere with certain thyroid and cardiac lab tests —inform your doctor before testing

FOLATE (VITAMIN B9)

Folate (vitamin B9) occurs naturally in many foods. Folic acid is the synthetic form of folate that some food manufacturers add to fortify foods. Some people with certain MTHFR gene variants may have reduced ability to convert folic acid efficiently.

How it helps:

- Helps your body produce red blood cells
- Needed to make and repair DNA
- Supports healthy growth and development during pregnancy
- Improves cognition

Vitamin B9-rich foods:

- Leafy greens
- Asparagus
- Brussels sprouts
- Beans
- Broccoli
- Avocado
- Orange
- Mango
- Eggs

Signs of deficiency:

- Anemia
- Fatigue
- Trouble concentrating
- Depression
- Mouth ulcers
- Sore and red tongue
- Birth defects
- Fertility issues

Optimal Dosages:

- General health: 400–800 mcg daily
- Pregnancy/preconception: 800–1,000 mcg daily (critical for neural tube development)
- Cardiovascular/homocysteine support: 800–2,000 mcg daily
- Always choose methylfolate (5-MTHF), the active form. Standard folic acid is synthetic and cannot be properly converted by those with the common MTHFR gene mutation (estimated to affect up to 40% of the population)
- Works synergistically with B12 and B6. These three should ideally be taken together for homocysteine management
- Do not supplement high-dose folate in isolation without adequate B12

VITAMIN B12

Vitamin B12, also known as cobalamin, is mostly found in animal sources of food. So, for vegans or those who eat a plant-based diet, a B12 supplement is a wise move.

How it helps:

- Helps your body form red blood cells to prevent anemia
- Supports healthy bones
- Promotes a healthy nervous system
- Helps your body produce energy
- Plays a role in DNA formation

Vitamin B12-rich foods:

- Beef
- Chicken
- Salmon
- Sardines
- Tuna
- Clams
- Eggs
- Milk
- Nutritional Yeast

Signs of deficiency:

- Fatigue
- Weakness
- Tingling in fingers and toes
- Anemia
- Poor memory
- Depression
- Shortness of breath
- Pale skin

Optimal Dosages:

- General health: 500–1,000 mcg daily
- Neurological support/deficiency recovery: 1,000–5,000 mcg daily
- Seniors & absorption issues: 1,000 mcg daily sublingual or higher
- Always choose methylcobalamin or adenosylcobalamin, the active forms. Avoid cyanocobalamin, the cheap synthetic form found in most grocery store supplements
- Vegans and vegetarians are at particularly high risk of deficiency, as B12 is found almost exclusively in animal products
- Those on Metformin or proton pump inhibitors (PPIs) are at significantly elevated risk of depletion and should supplement regularly
- Sublingual delivery bypasses absorption issues in the gut

VITAMIN E

Vitamin E is a fat-soluble antioxidant that exists in eight chemical forms, with alpha-tocopherol being the most active in humans. It protects cell membranes from oxidative damage, supports immune function, and plays an important role in skin health and cardiovascular protection. It works synergistically with vitamin C and selenium.

How it helps:

- Powerful antioxidant — protects cells from oxidative damage
- Supports immune function
- Promotes healthy skin and wound healing
- Supports cardiovascular health
- Protects eye health
- Works synergistically with Vitamin C and selenium
- Supports healthy brain aging

Vitamin E-rich foods:

- Wheat germ oil
- Sunflower seeds
- Almonds
- Hazelnuts
- Peanut butter
- Avocado
- Spinach and leafy greens
- Butternut squash
- Olive oil
- Salmon

Signs of deficiency:

- Muscle weakness
- Nerve damage (peripheral neuropathy)
- Vision problems
- Weakened immune response
- Difficulty with coordination and walking
- Dry or damaged skin
- Fatigue

Optimal Dosages:

- General health: 200–400 IU daily
- Therapeutic/antioxidant support: 400–800 IU daily
- Always choose mixed tocopherols (full spectrum); avoid synthetic dl-alpha-tocopherol
- Take with a fat-containing meal for optimal absorption
- Those on blood thinners should consult a practitioner before supplementing

VITAMIN K

Vitamin K is a fat-soluble vitamin that exists in two primary forms with distinct roles and sources—K1 (phylloquinone) found in leafy green vegetables and primarily involved in blood clotting and K2 (menaquinone) found in fermented foods and animal products, which plays the critical role of directing calcium to bones and away from soft tissues and arteries. K2 is the form that has generated the most excitement in modern nutritional research, with profound implications for cardiovascular health, bone density, and cancer prevention. Despite eating plenty of leafy greens, most people are significantly deficient in vitamin K2, the form that matters most beyond basic clotting function.

How it helps:

- K1: essential for healthy blood clotting
- K2: directs calcium into bones — supports bone density and prevents osteoporosis
- K2: prevents arterial calcification — protects cardiovascular health
- K2: activates osteocalcin — the protein that binds calcium into bone matrix
- K2: activates Matrix GLA Protein (MGP) — the most potent inhibitor of arterial calcification
- Works synergistically with vitamin D3 and calcium for bone health
- Supports healthy brain function — K2 supports myelin sheath integrity
- Emerging research in cancer prevention
- Supports healthy insulin sensitivity
- Supports kidney health — prevents soft tissue calcification

Vitamin K-rich foods:

K1 sources:

- Kale and collard greens
- Spinach
- Broccoli
- Brussels sprouts
- Parsley

K2 sources:

- Natto (fermented soybeans — richest K2 source by far)
- Hard and soft aged cheeses
- Egg yolks (pasture-raised)
- Butter and ghee (grass-fed)
- Chicken liver
- Beef liver
- Fatty fish

Signs of deficiency:

- Easy bruising and poor wound clotting (K1)
- Poor bone density and increased fracture risk (K2)
- Arterial calcification and cardiovascular stiffness (K2)
- Dental decay and poor dental mineralization
- Elevated cardiovascular disease risk
- Varicose veins
- Brain fog and poor cognitive function
- Kidney stones (calcium deposited incorrectly)
- Joint calcification and stiffness

Optimal Dosages:

- K1: 100–200 mcg — usually covered by leafy greens
- K2 MK-4: 1,000–5,000 mcg — short-acting, multiple doses needed
- K2 MK-7: 100–360 mcg — preferred form; once-daily dosing effective
- Always pair K2 with D3 — D3 without K2 may increase soft-tissue calcification
- Fat-soluble — take with a fat-containing meal
- Stacks with calcium, magnesium, and D3 for bone/cardiovascular protocols
- Warfarin or other anticoagulants: consult your doctor first — K1 affects INR directly; K2 less so but caution still warranted
- MK-7 is the most bioavailable and longest-acting form strongly preferred over MK-4

VITAMIN C

Vitamin C (ascorbic acid) is perhaps the most widely recognized vitamin in the world, yet its full therapeutic potential is dramatically underappreciated. It is a water-soluble vitamin and one of the most powerful antioxidants in the body, essential for collagen synthesis, immune function, neurotransmitter production, iron absorption, and adrenal hormone synthesis. Unlike most mammals, humans have lost the ability to synthesize vitamin C endogenously. Therefore, adequate dietary and supplemental intake is critical. Under conditions of stress, illness, or oxidative burden, requirements increase dramatically beyond what diet alone can realistically provide.

How it helps:

- Powerful antioxidant — protects cells from oxidative damage
- Essential for collagen synthesis — skin, joints, gut, and blood vessels
- Supports and enhances immune function at multiple levels
- Enhances non-heme iron absorption from plant foods
- Supports adrenal hormone synthesis — depleted rapidly under stress
- Supports healthy neurotransmitter production — dopamine, norepinephrine
- Regenerates vitamin E after it neutralizes free radicals
- Supports cardiovascular health and healthy blood pressure
- Supports healthy eye health — reduces cataract and macular degeneration risk
- Supports liver detoxification and phase I reactions

Signs of deficiency:

- Frequent infections and slow recovery from illness
- Fatigue and low energy
- Poor wound healing
- Easy bruising
- Bleeding gums and poor dental health
- Joint pain and poor connective tissue integrity
- Dry and rough skin
- Irritability and depression
- In severe deficiency, scurvy (rare in developed countries, but subclinical deficiency is widespread)
- Anemia (via reduced iron absorption)

Vitamin C-rich foods:

- Kakadu plum (highest known food source)
- Camu camu
- Acerola cherry
- Guava
- Red and yellow bell peppers
- Kiwi fruit
- Broccoli and Brussels sprouts
- Strawberries
- Citrus fruits
- Papaya

Optimal Dosages:

- General health and antioxidant support: 500–1,000 mg daily
- Immune maintenance: 1,000–2,000 mg daily
- Active infection or illness: 3,000–8,000 mg daily in divided doses — bowel tolerance dosing
- Therapeutic and high oxidative stress: titrate to bowel tolerance — the dose just below which loose stools occur; this varies from 4 g to over 20g daily depending on health status
- Always use divided doses throughout the day — vitamin C has a short half-life of 30 minutes in plasma
- Liposomal vitamin C offers significantly enhanced bioavailability and allows higher effective doses without digestive side effects
- Sodium ascorbate or calcium ascorbate (buffered forms) are gentler on digestion than pure ascorbic acid
- Those with a history of kidney stones (calcium oxalate) should use caution at high doses and stay well hydrated
- Pairs powerfully with zinc, quercetin, and glutathione for immune and antioxidant synergy

VITAMIN D

Vitamin D is technically a fat-soluble prohormone rather than a true vitamin—the body synthesizes it from cholesterol upon exposure to UVB sunlight, and it acts on receptors found in virtually every tissue and cell in the body. Vitamin D deficiency is the most prevalent nutritional deficiency in the world, affecting an estimated 1 billion people globally, driven by indoor lifestyles, sunscreen use, geographical latitude, skin pigmentation, and aging. Its effects extend far beyond bone health—vitamin D is deeply involved in immune regulation, mood, cardiovascular function, metabolic health, and cancer prevention.

How it helps:

- Essential for calcium absorption and bone mineralization
- Regulates immune function — both innate and adaptive immunity
- Supports healthy mood and reduces risk of depression and seasonal affective disorder
- Supports cardiovascular health and healthy blood pressure
- Supports healthy blood sugar and insulin sensitivity
- Supports healthy muscle function and reduces fall risk in older adults
- Supports healthy brain function and cognitive aging
- Reduces risk of autoimmune conditions
- Supports healthy respiratory function
- Emerging research in cancer prevention and mortality reduction

Signs of deficiency:

- Fatigue and low energy
- Bone pain and poor bone density
- Muscle weakness and aches
- Frequent infections and poor immune response
- Depression and seasonal mood changes
- Brain fog and poor cognitive function
- Hair loss
- Poor wound healing
- Gut dysfunction — vitamin D receptors throughout the gut lining
- Increased autoimmune activity

Vitamin D-rich foods:

- Cod liver oil (richest food source)
- Wild caught salmon
- Mackerel and sardines
- Herring
- Tuna
- Egg yolks (pasture-raised)
- Beef liver
- Mushrooms exposed to UV light
- Fortified dairy and plant milks
- Fortified cereals

Optimal Dosages:

- General health maintenance: 2,000–4,000 IU daily
- Correcting deficiency: 5,000–10,000 IU daily until levels are restored
- Maintenance at optimal blood levels: 4,000–6,000 IU daily for most adults
- Target blood level: 60–80 ng/mL (150–200 nmol/L)—significantly higher than the conventional sufficiency threshold of 20 ng/mL
- Always take vitamin D3 (cholecalciferol)—not D2 (ergocalciferol), which is significantly less effective
- Always pair with vitamin K2 (MK-7)—directs calcium into bones and away from arteries; critical safety cofactor
- Take with magnesium—essential for vitamin D conversion and activation; magnesium deficiency renders vitamin D supplementation ineffective
- Take with a fat-containing meal for optimal absorption
- Test 25(OH)D blood levels before and during supplementation to guide dosing
- Those with granulomatous conditions (sarcoidosis, TB) should consult a practitioner before supplementing

A NOTE ON CONTRAINDICATIONS

The information contained in this guide is intended for educational purposes only and should never replace the personalized guidance of a qualified healthcare practitioner. While every vitamin featured in this guide has a well-established safety profile at the doses outlined, there are important considerations to be aware of before beginning any new supplement protocol.

Medications and supplement interactions to be aware of:

- Blood thinners (warfarin, aspirin, heparin): Vitamins E and K can affect clotting. Always consult your doctor before supplementing if you are on anticoagulant therapy.
- Chemotherapy and immunosuppressants: High-dose immune-stimulating supplements may interfere with certain cancer treatments. Always work closely with your oncologist.
- Proton pump inhibitors (PPIs): Significantly deplete B12. If you are on long-term PPI therapy, targeted supplementation is strongly advisable under guidance.
- Oral contraceptives: Deplete B6, B12, and other minerals. Women on the pill should pay particular attention to these nutrients.
- Metformin: Significantly depletes vitamin B12 and CoQ10. Supplementation of both is strongly advisable for anyone on long-term metformin therapy.

Special populations requiring extra caution:

- Pregnancy and breastfeeding: Always work with a qualified practitioner before supplementing during pregnancy. Vitamin A (preformed retinol) in particular must not exceed 10,000 IU daily during pregnancy.
- Children and adolescents: Doses throughout this guide are intended for adults. Always seek professional guidance for supplementing children.
- Kidney disease: Impaired kidney function affects the metabolism and excretion of many nutrients, including fat-soluble vitamins, potassium, magnesium, and phosphorus. Always consult a nephrologist before supplementing.
- Liver disease: Fat-soluble vitamins and high-dose supplements are metabolized by the liver. Consult a practitioner before supplementing if you have compromised liver function.
- Autoimmune conditions: Immune-stimulating supplements such as high-dose vitamin D, elderberry, and echinacea should be used with caution and under supervision in autoimmune disease.

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