



NF-006

Vitamins & Minerals for Life

The Metabolism-U User Guide to Micronutrient Adequacy, Bone, Muscle, Nerve, Immune, Metabolic, and Cardiovascular Health

Rodney C. Curtis, MD

Metabolism-U Nutrition Fundamentals Series

Core message: Vitamins and minerals are needed in small amounts, but their effects are not small. They support bone, muscle, nerve, blood, immune, metabolic, and cardiovascular function. The goal is adequacy—not megadosing: build a nutrient-dense food pattern first, identify genuine gaps or deficiencies, and use supplements selectively when food alone is insufficient or a clinical indication exists.

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Important Medical and AI Disclosures

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Micronutrient needs and laboratory values can be affected by age, sex, diet pattern, body size, pregnancy, gastrointestinal absorption, kidney or liver disease, endocrine disorders, surgery, illness, medications, alcohol use, and other clinical factors. A nutrient level that is appropriate for one person may be inadequate, excessive, or unsafe for another.

High-dose supplements can cause toxicity and drug-nutrient interactions. Examples include vitamin A, vitamin D, vitamin B6, iron, calcium, zinc, selenium, and potassium. Vitamin K can interact importantly with warfarin and related anticoagulation management. Kidney disease can substantially change the safety of potassium, magnesium, phosphorus, and some vitamin preparations.

Currency of information: Scientific evidence, clinical guidelines, product formulations, and nutrition recommendations change over time. This guide reflects information and sources available as of September 30, 2026. Metabolism-U LLC does not undertake an ongoing obligation to revise, update, or republish this guide as evidence or recommendations change.

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How to Use This Guide

The Nutrition Fundamentals webpage describes vitamins and minerals as “small nutrients with essential roles.” This guide is the next layer: enough science to explain what micronutrients do, how needs change with age, where food fits, when laboratory testing may help, and when supplements are useful—or potentially harmful. It is designed primarily for adults over 50 while remaining useful to family members, health professionals, and fitness professionals.

Important distinction: A vitamin or mineral is essential because the body needs it for normal function—not because taking more produces more benefit. Deficiency can be harmful, but excess can also be harmful. “Adequate” and “optimal” should not be confused with “as much as possible.”

What this guide will help you do

- Understand the difference between vitamins and minerals, and between water-soluble and fat-soluble vitamins.
- Recognize the major physiological roles of key micronutrients.
- Use Recommended Dietary Allowances (RDAs), Adequate Intakes (AIs), and Tolerable Upper Intake Levels (ULs) appropriately.
- Identify micronutrients that deserve extra attention after age 50.
- Choose nutrient-dense foods before reaching automatically for supplements.
- Understand when medications, gastrointestinal conditions, kidney disease, or restrictive diets can alter micronutrient status.
- Know which laboratory tests are commonly used to evaluate suspected deficiency and their limitations.
- Use supplements to solve a defined problem rather than as a substitute for dietary quality.

What are micronutrients?

Vitamins are organic compounds required in relatively small amounts for normal metabolism, growth, repair, signaling, and enzyme function. Minerals are inorganic elements that serve structural, electrical, enzymatic, transport, and regulatory roles. Unlike protein, carbohydrate, and fat, micronutrients do not provide meaningful calories—but without them, the body cannot use energy and build or maintain tissues normally [1,2].

Vitamins and Minerals: Not All the Same

The terms “vitamins” and “minerals” cover many chemically different substances. How they are absorbed, stored, transported, excreted, and regulated varies widely.

Category	Examples	Practical meaning
Water-soluble vitamins	Vitamin C and B vitamins	Generally circulate freely and have limited storage compared with fat-soluble vitamins; regular intake matters. Some, especially B12, can still be stored for years.
Fat-soluble vitamins	A, D, E, K	Absorbed with dietary fat and can accumulate in body stores. Excess supplementation can be more consequential.
Major minerals	Calcium, phosphorus, magnesium, sodium, potassium, chloride	Needed in larger amounts and involved in bone structure, fluid balance, nerve transmission, muscle contraction, and metabolism.
Trace minerals	Iron, zinc, copper, selenium, iodine, manganese and others	Required in smaller quantities but essential for oxygen transport, thyroid function, antioxidant enzymes, immunity, and many metabolic pathways.

RDA, AI, EAR, and UL: four terms worth knowing

Term	Meaning
RDA	Average daily intake sufficient to meet the needs of nearly all (97–98%) healthy people in a life-stage group.
AI	A target used when evidence is insufficient to establish an RDA; assumed to support adequacy.
EAR	Average intake estimated to meet the requirement of 50% of healthy people in a group; useful for population assessment and as one input in individual assessment.
UL	Highest average daily intake unlikely to pose adverse health risk for most people. It is not a target to reach.

The practical point: Micronutrient nutrition is not a contest to “hit 100%” from pills. Build a high-quality food pattern, identify specific risk factors or gaps, and use targeted supplementation when the benefit is reasonably clear.

Micronutrients Across the Body

Micronutrients support nearly every physiological system. Many work together, which is one reason a varied dietary pattern usually outperforms a single-nutrient mindset.

Whole-body role	Examples	Why it matters
Bone and skeletal integrity	Calcium, vitamin D, magnesium, phosphorus, vitamin K	Support mineralization, remodeling, muscle function, and maintenance of skeletal structure.
Muscle and nerve function	Magnesium, potassium, calcium, B vitamins	Support membrane potentials, contraction, nerve transmission, energy metabolism, and neuromuscular function.
Blood and oxygen transport	Iron, folate, vitamin B12, vitamin B6	Required for hemoglobin synthesis, red-cell production, DNA synthesis, and related pathways.
Immune function	Vitamins A, C, D, E; zinc, selenium	Support epithelial barriers, immune-cell function, antioxidant systems, and signaling.
Energy metabolism	Thiamin, riboflavin, niacin, B6, biotin, pantothenate, magnesium	Act as coenzymes or cofactors in pathways that release and use energy from food.
Thyroid and metabolic regulation	Iodine, selenium, iron	Support thyroid hormone synthesis, conversion, and enzyme function.
Cardiovascular and fluid regulation	Potassium, magnesium, sodium, calcium	Influence vascular tone, electrical activity, fluid balance, and blood-pressure regulation.
Vision, skin, connective tissue	Vitamin A, vitamin C, zinc, copper	Support visual pigments, collagen formation, epithelial health, wound healing, and tissue repair.

Unifying idea: Micronutrients rarely work alone. A varied pattern containing vegetables, fruit, legumes, whole grains, dairy or fortified alternatives, nuts, seeds, seafood, eggs, and other nutrient-dense protein foods helps deliver multiple nutrients together rather than one isolated compound at a time.

After 50: Why Micronutrients Deserve More Attention

Aging does not automatically create vitamin or mineral deficiency, but several age-related changes can narrow the margin for error. Lower appetite, reduced dietary variety, gastrointestinal disease, medication use, chronic illness, reduced sun exposure, and changes in absorption or kidney function can all alter micronutrient status.

Common reasons risk can increase

- Vitamin B12 absorption can decline with atrophic gastritis, reduced stomach acid, pernicious anemia, gastrointestinal surgery, and prolonged use of metformin or acid-suppressing medications [3].
- Bone loss accelerates with aging and menopause, increasing the importance of adequate calcium, vitamin D, protein, resistance exercise, and appropriate bone-health evaluation [4,5].
- Lower food intake during weight loss, illness, bereavement, dental problems, swallowing difficulty, or reduced appetite can make nutrient density more important.
- Restrictive dietary patterns can create predictable gaps: vegan diets require reliable B12; low-dairy patterns may need deliberate calcium and vitamin D planning; very low-calorie diets can reduce multiple micronutrients.
- Kidney disease can change handling of potassium, phosphorus, magnesium, calcium, and vitamin D—and can make otherwise routine supplements unsafe.
- Medications can affect absorption, metabolism, or excretion of nutrients; supplements can also alter medication absorption or action.

Important: “Over 50” is not a diagnosis. The useful approach is risk-based: identify changes in diet, medications, symptoms, medical conditions, and laboratory findings rather than automatically adding a long list of supplements.

Key Vitamins After 50

The table below highlights vitamins that frequently arise in healthy-aging discussions. Values are general adult reference points; individual needs can differ.

Vitamin	Typical adult reference	Food sources / key point
Vitamin A	700 mcg RAE women; 900 mcg RAE men	Liver, eggs, dairy; orange/dark-green vegetables provide provitamin A carotenoids. Excess preformed vitamin A can be toxic [10].
Vitamin B12	2.4 mcg/day	Fish, meat, eggs, dairy, fortified foods. Absorption problems become more relevant with age; fortified foods or supplements can be useful when needed [3].
Folate	400 mcg DFE/day	Leafy greens, legumes, citrus, fortified grains. Folic acid can correct folate deficiency but high intake may mask the hematologic signs of B12 deficiency [8].
Vitamin C	75 mg women; 90 mg men	Citrus, berries, peppers, broccoli, tomatoes. Supports collagen synthesis and antioxidant function [11].
Vitamin D	600 IU (15 mcg) through age 70; 800 IU (20 mcg) >70	Few natural food sources; fatty fish and fortified foods contribute. Sun exposure also contributes. Routine high-dose use is not automatically beneficial [4,15].
Vitamin E	15 mg/day	Nuts, seeds, vegetable oils. High-dose vitamin E is not recommended for prevention of CVD or cancer [14].
Vitamin K	AI 120 mcg men; 90 mcg women	Leafy greens and some oils. Essential for normal coagulation and bone proteins; warfarin users need consistent intake and clinician guidance [12].

Food-first principle: A colorful, varied diet tends to provide vitamins in biologically useful packages together with fiber, protein, healthy fats, and phytochemicals. Supplements are most defensible when there is a known gap, increased requirement, absorption problem, or clinically meaningful deficiency.

Key Minerals After 50

Mineral	Typical adult reference	Food sources / key point
Calcium	1,000 mg men 51–70; 1,200 mg women 51+ and adults >70	Dairy, fortified alternatives, calcium-set tofu, canned fish with bones, some greens. Serum calcium does not measure dietary adequacy [5].
Magnesium	420 mg men; 320 mg women age 31+	Nuts, seeds, legumes, whole grains, leafy greens. Supplements can cause diarrhea; kidney impairment raises toxicity risk [6].
Potassium	AI 3,400 mg men; 2,600 mg women	Fruit, vegetables, potatoes, legumes, dairy. Kidney disease and certain medications can make high potassium dangerous [13].
Iron	8 mg/day men and women age 51+	Meat, seafood, legumes, fortified grains. Routine iron supplementation after 50 is not appropriate without a reason; deficiency should prompt evaluation for cause [7].
Zinc	11 mg men; 8 mg women	Oysters, meat, dairy, beans, nuts. Chronic high-dose zinc can cause copper deficiency [9].
Selenium	55 mcg/day	Seafood, meat, eggs, Brazil nuts. Excess can cause selenosis; Brazil nuts can contain very high amounts [2].
Iodine	150 mcg/day	Iodized salt, dairy, seafood, eggs. Both deficiency and excess can impair thyroid function.
Sodium	Limit excess; current federal guidance emphasizes lower intake	Sodium is physiologically essential but commonly overconsumed. Needs differ with sweat loss and selected medical conditions.

A useful caution: Mineral supplements deserve the same respect as medications. Calcium, iron, potassium, magnesium, zinc, and selenium can cause adverse effects or interact with drugs when taken inappropriately or at excessive doses.

Vitamin B12: A Special Issue in Older Adults

Vitamin B12 deserves disproportionate attention after age 50 because deficiency can arise even when intake appears adequate. Food-bound B12 must be released by stomach acid and then bind intrinsic factor for absorption. Atrophic gastritis, pernicious anemia, gastrointestinal disease or surgery, metformin, and long-term acid suppression can interfere with this process [3].

Symptoms can be subtle—and neurologic symptoms can occur without anemia

- Fatigue, weakness, pallor, glossitis, or megaloblastic anemia.
- Numbness, tingling, balance problems, gait change, cognitive symptoms, or other neurologic findings.
- Symptoms may evolve slowly because body stores can last for years.
- Neurologic injury can become irreversible if a true deficiency is missed and remains untreated.

How B12 is evaluated

Test	What it means
Serum vitamin B12	Common first-line test. Many laboratories consider values below roughly 200–250 pg/mL subnormal, but cutoffs vary [3].
Methylmalonic acid (MMA)	A sensitive functional marker that rises with B12 deficiency. Kidney dysfunction can also raise MMA, especially in older adults [3].
Homocysteine	May rise with B12 or folate deficiency but is less specific and also affected by kidney function and other factors.
CBC / MCV	Can show macrocytic anemia, but a normal CBC does not exclude neurologic B12 deficiency.

Practical message: If B12 is borderline or symptoms/risk factors are present, interpretation should not stop at a single serum number. Clinical context, MMA, blood counts, kidney function, diet, medications, and absorption history may all matter.

Bone Health: Calcium, Vitamin D, and the Bigger Picture

Bone health is not created by one supplement. Calcium and vitamin D are essential, but skeletal health also depends on protein, resistance and impact-loading exercise as appropriate, hormones, genetics, body weight, smoking and alcohol exposure, fall risk, and medical conditions.

Calcium

Calcium provides structural mineral for bone and also supports muscle contraction, nerve transmission, vascular function, and blood clotting. Adults generally need 1,000–1,200 mg/day depending on age and sex [5]. Blood calcium is tightly regulated and is therefore a poor measure of dietary calcium adequacy.

Vitamin D

Vitamin D supports calcium absorption and bone mineral metabolism. The current RDA is 600 IU (15 mcg) through age 70 and 800 IU (20 mcg) after age 70 [4]. The 2024 Endocrine Society guideline suggests that generally healthy adults age 50–74 follow the RDA rather than routinely taking higher empiric doses, and suggests against routine 25-hydroxyvitamin D testing in healthy adults without another indication [15].

Magnesium and vitamin K

Magnesium contributes to bone structure and vitamin D metabolism, while vitamin K is required for gamma-carboxylation of proteins involved in coagulation and bone. Adequacy matters, but evidence does not justify assuming that high-dose magnesium or vitamin K supplements prevent fractures in otherwise well-nourished adults.

Metabolism-U principle: Treat bone health as a system. Adequate calcium and vitamin D matter, but supplementation should complement—not replace—resistance training, adequate protein, fall-risk reduction, and appropriate osteoporosis screening or treatment.

Iron, Folate, and Anemia: Do Not Guess

Anemia is not synonymous with iron deficiency. In adults over 50, low hemoglobin can result from iron deficiency, vitamin B12 or folate deficiency, chronic inflammation, kidney disease, marrow disorders, blood loss, and other causes. Treating presumed iron deficiency without identifying the cause can delay important diagnoses.

Common laboratory tools

Test	What it helps assess
CBC	Hemoglobin, hematocrit, red-cell indices such as MCV, and other blood-cell counts.
Ferritin	Reflects iron stores but also rises with inflammation; a “normal” ferritin may not exclude deficiency in inflammatory states.
Serum iron / TIBC / transferrin saturation	Help characterize circulating iron availability and iron-binding capacity.
Vitamin B12 / MMA	Evaluate B12 status, especially when macrocytosis, neuropathy, or risk factors are present.
Folate	Can help identify folate deficiency in the appropriate clinical setting.
Creatinine / kidney function	Kidney disease can contribute to anemia through reduced erythropoietin and can alter interpretation of several biomarkers.

Important after 50: New iron deficiency—especially in men and postmenopausal women—should generally trigger evaluation for the reason rather than automatic long-term iron supplementation. Gastrointestinal blood loss is one of several possibilities that may need clinical investigation [7].

Folate and B12 are metabolically linked. Large doses of folic acid can correct the anemia of B12 deficiency while allowing neurologic injury from B12 deficiency to continue. This is one reason indiscriminate high-dose single-nutrient supplementation can create problems [8].

Supplements: When They Help—and When “More” Backfires

Supplements can be valuable. They can also be unnecessary, ineffective for the intended purpose, or harmful. The best question is not “Should everyone take a multivitamin?” but “What problem am I trying to solve, and is this product likely to solve it safely?”

Situation	Reasonable approach
Documented deficiency	Use a clinician-guided replacement dose and identify the cause when appropriate.
Predictable dietary gap	Examples include B12 in vegan diets or calcium/vitamin D when food and fortified sources are consistently inadequate.
Malabsorption or gastrointestinal surgery	Targeted supplementation may be necessary and sometimes requires higher doses or alternative routes.
Medication-associated risk	Monitor and supplement selectively when medication use creates a recognized nutrient problem.
General disease prevention in well-nourished adults	Evidence does not support assuming that higher-dose vitamin/mineral supplements prevent cardiovascular disease or cancer [14].

Examples of excess that can matter

- Preformed vitamin A: liver toxicity, skeletal effects, and other harms at excessive doses.
- Vitamin D and calcium: excessive intake can cause hypercalcemia; supplemental calcium can contribute to kidney-stone risk in susceptible people.
- Vitamin B6: chronic high-dose use can cause sensory neuropathy.
- Iron: excess is toxic and can accumulate in disorders such as hereditary hemochromatosis.
- Zinc: chronic high intake can impair copper absorption and cause neurologic or hematologic problems.
- Potassium: supplements or salt substitutes can cause dangerous hyperkalemia in kidney disease or with selected medications.

USPSTF perspective: For community-dwelling, nonpregnant adults without known deficiency, the USPSTF recommends against beta-carotene or vitamin E supplements for prevention of cardiovascular disease or cancer and finds insufficient evidence to recommend for or against multivitamins or most other individual nutrient supplements for that purpose [14].

Laboratory Testing: Useful When It Answers a Clinical Question

There is no universal “vitamin panel” that reliably tells a healthy adult whether nutrition is optimal. Testing is most useful when symptoms, diet, medication exposure, disease, surgery, or prior results create a specific question. Reference ranges also differ by laboratory and are not always identical to thresholds for clinical deficiency.

Question	Common tests / interpretation issues
Possible B12 deficiency	Serum B12; MMA when borderline or suspicion remains; CBC/MCV. Kidney dysfunction can elevate MMA [3].
Possible iron deficiency	CBC, ferritin, serum iron, TIBC/transferrin saturation. Ferritin rises with inflammation [7].
Vitamin D status when indicated	Serum 25-hydroxyvitamin D [25(OH)D] is the standard status test. Routine screening of healthy adults is not recommended by the 2024 Endocrine Society guideline [15].
Calcium disorders	Serum total calcium, albumin, sometimes ionized calcium and parathyroid hormone. Serum calcium does not measure dietary calcium adequacy [5].
Magnesium problems	Serum magnesium is commonly used but represents a small fraction of total body magnesium; clinical context matters [6].
Electrolyte / kidney concerns	Basic or comprehensive metabolic panel may include sodium, potassium, calcium, creatinine, and other markers. Results can reflect disease and medications as well as diet.

Do not treat the laboratory report in isolation: A value near a cutoff is not automatically a diagnosis, and a value inside a reference range does not always exclude a clinically relevant problem. Symptoms, repeat testing, medications, kidney function, inflammation, and the pretest probability of deficiency all influence interpretation.

Micronutrient-Dense Food Choices

The most efficient way to improve micronutrient adequacy is usually to improve the food pattern. Different food groups fill different micronutrient roles.

Food group	Micronutrients commonly contributed	Practical examples
Vegetables and fruit	Vitamins A precursors, C, K, folate, potassium, magnesium	Leafy greens, peppers, berries, citrus, tomatoes, squash, broccoli.
Dairy / fortified alternatives	Calcium, B12, riboflavin; often vitamin D when fortified	Milk, yogurt, kefir, fortified soy beverages.
Seafood	B12, selenium, iodine, vitamin D in fatty fish; iron and zinc vary	Salmon, sardines, trout, shellfish.
Meat / poultry / eggs	B12, iron, zinc, selenium, choline and several B vitamins	Lean meats, poultry, eggs; liver is extremely nutrient-dense but high in preformed vitamin A.
Legumes	Folate, iron, magnesium, potassium, zinc	Lentils, beans, chickpeas, peas.
Nuts and seeds	Magnesium, vitamin E, zinc, selenium (especially Brazil nuts)	Almonds, pumpkin seeds, sunflower seeds, walnuts.
Whole grains	Magnesium, iron, B vitamins; fortified grains add folic acid and other nutrients	Oats, whole wheat, brown rice, quinoa.

Variety beats perfection: No single “superfood” covers every micronutrient. A repeatable pattern that rotates food groups and colors is more useful than chasing isolated foods or supplements with impressive marketing claims.

Vitamins & Minerals in Common Real-World Situations

Plant-based or vegan eating

Vitamin B12 requires deliberate planning because unfortified plant foods do not provide reliable B12. Calcium, vitamin D, iodine, iron, zinc, and selenium may also require attention depending on food choices and fortification [3,5,7,9].

Metformin or long-term acid suppression

Metformin and prolonged use of proton-pump inhibitors or other acid-suppressing therapies are recognized risk factors for B12 inadequacy. Testing is most useful when exposure is prolonged and symptoms or other risk factors are present [3].

Kidney disease

Chronic kidney disease changes the handling of potassium, phosphorus, magnesium, calcium, vitamin D, and other nutrients. Over-the-counter supplements and salt substitutes can become unsafe. Nutrition and supplementation should be coordinated with the treating clinician.

Anticoagulation with warfarin

Vitamin K intake does not need to be eliminated. The key is consistency: abrupt changes in vitamin K intake can change anticoagulant effect. Patients should coordinate dietary changes and supplements with the anticoagulation team [12].

Bariatric or gastrointestinal surgery

Anatomic changes can reduce absorption of B12, iron, calcium, vitamin D, folate, thiamin, and other nutrients. Long-term monitoring and procedure-specific supplementation may be necessary.

Weight loss or very-low-calorie intake

When calories fall, nutrient density must rise. Large energy deficits, limited food variety, or prolonged restrictive diets can make micronutrient gaps more likely even when protein intake is adequate.

Common Micronutrient Mistakes

- Assuming a supplement can compensate for a poor food pattern.
- Treating RDAs as minimums to exceed by as much as possible.
- Using high-dose “immune,” “energy,” or “anti-aging” formulas without a defined indication.
- Taking iron routinely without confirming need or investigating the cause of deficiency.
- Using serum calcium as a measure of calcium intake or skeletal calcium status.
- Ignoring drug-nutrient interactions—for example, vitamin K with warfarin or minerals that interfere with absorption of certain medications.
- Ordering broad micronutrient panels without a clinical question and then treating borderline numbers rather than the person.
- Forgetting that supplements can contain overlapping ingredients, causing unintentional high total doses.

The Metabolism-U Vitamins & Minerals Action Plan

1. Build a nutrient-dense base: vegetables, fruit, legumes, whole grains, high-quality protein foods, dairy or fortified alternatives, nuts, seeds, and seafood as appropriate.
2. Compare several typical days of intake—not one unusually good day—with age- and sex-appropriate reference values.
3. Identify predictable gaps created by diet pattern, medications, gastrointestinal conditions, surgery, or chronic disease.
4. Use laboratory testing when there is a specific clinical question rather than as a substitute for good dietary assessment.
5. Correct a documented deficiency and look for the cause when appropriate.
6. Check supplement labels for duplicate ingredients and doses near or above ULs.
7. Review supplements with a clinician or pharmacist when prescription medications, kidney disease, anticoagulation, or major illness are present.
8. Reassess as diet, medications, health status, and aging change.

One-Day Micronutrient-Dense Pattern: An Illustration

This example demonstrates food variety and nutrient density; it is not a universal meal plan. Portions should be adjusted for energy needs, medical conditions, preferences, allergies, and training.

Eating occasion	Example	Micronutrient emphasis
Breakfast	Greek yogurt or fortified soy yogurt with berries, oats, chia, and walnuts	Calcium, B12/fortified nutrients, magnesium, manganese, vitamin C and other plant compounds.
Lunch	Large salad with leafy greens, lentils or chicken, colorful vegetables, whole grain, olive-oil dressing	Folate, vitamin K, potassium, magnesium, iron, zinc and vitamin C.
Snack	Fruit with nuts or seeds; or milk/fortified beverage	Vitamin C, vitamin E, magnesium, calcium and potassium.
Dinner	Salmon or tofu, roasted vegetables, potato or whole grain	Vitamin D/B12/selenium from fish or calcium from calcium-set tofu; potassium and magnesium from vegetables/starch.

Key Takeaways

- Vitamins and minerals are essential micronutrients: small required amounts, large physiological roles.
- Food quality and variety should provide the foundation; supplements are tools, not substitutes for diet.
- After 50, B12 absorption, bone health, medication use, restrictive diets, and chronic disease deserve particular attention.
- Deficiency and excess can both be harmful. The UL is a safety boundary, not a target.
- Vitamin B12 deficiency can produce neurologic symptoms even without anemia and may require MMA or other context for interpretation [3].
- Calcium and vitamin D matter for bone, but bone health also depends on protein, exercise, fall prevention, hormones, and appropriate osteoporosis care.
- For primary prevention of cardiovascular disease or cancer in community-dwelling, nonpregnant adults, the USPSTF recommends against beta-carotene or vitamin E supplements and finds insufficient evidence to determine the balance of benefits and harms for multivitamins or most other single or paired nutrient supplements [14].
- Use testing selectively, interpret it clinically, and correct the problem that is actually present.

Above all: Build a food pattern that reliably supplies the micronutrients needed to stay strong, neurologically capable, metabolically healthy, and independent—and use targeted supplementation when evidence, diet, or clinical circumstances justify it.

Evidence Notes and References

The numerical, comparative, and clinical statements in this guide were reviewed against National Academies Dietary Reference Intakes, current federal dietary guidance, NIH Office of Dietary Supplements professional fact sheets, major clinical guidance, and peer-reviewed evidence. Bracketed numbers in the text correspond to the sources below. Evidence and guidelines evolve; recommendations should be revisited as newer guidance becomes available.

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Final Medical and AI Disclosures

Educational use only: This guide provides general educational information. It is not medical advice and is not a substitute for individualized evaluation, diagnosis, treatment, laboratory interpretation, or nutrition counseling. Seek guidance from your personal licensed healthcare professional before incorporating any supplement, high-dose nutrient, therapeutic diet, or laboratory-testing strategy from this publication into your lifestyle.

Micronutrient requirements and safe upper limits vary with age, sex, pregnancy, kidney and liver function, gastrointestinal absorption, medications, surgery, illness, and other factors. A suspected deficiency should be evaluated in clinical context; in some cases the underlying cause is more important than simply replacing the nutrient.

Dietary supplements can interact with prescription medications and can cause toxicity. People with kidney disease, anticoagulant use, gastrointestinal surgery, malabsorption, endocrine disease, anemia of uncertain cause, or major chronic illness should obtain individualized guidance before making substantial supplement changes.

Currency of information: This publication reflects scientific evidence and guidance available as of September 30, 2026. Evidence, reference values, clinical recommendations, supplement formulations, and regulatory information can change. Metabolism-U LLC does not undertake an ongoing obligation to revise, update, or republish this guide as information changes.

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