Micronutrients Guide

IIN Institute for Integrative Nutrition

Micronutrients Guide

Even though *micro* means “small,” the benefits micronutrients provide the body are anything but! Micronutrients, including vitamins and minerals, are essential for many biological processes. Everything from growth and immune response to hormone regulation and nerve functioning relies on the micronutrients obtained from the diet.

A balanced diet rich in a variety of whole foods, such as fruits and vegetables, usually contains adequate amounts of vitamins and nutrients. However, in certain circumstances, micronutrient insufficiency or deficiency can occur. There are many factors that affect how nutrients are absorbed and used in the body. More specifically, some disease states, medications, and stages of life may increase the demand for certain nutrients. For example, individuals who have had surgery will require additional zinc,[1] while those taking proton pump inhibitors for a long time may need extra iron, magnesium, and vitamin B12.[2] In addition, vitamin D requirements increase for the elderly as their bodies are less effective at synthesizing it.[3] These examples make it clear that we all have bio-individual nutrient needs! This awareness will go a long way toward supporting the health needs of you and your clients.

NUTRITIONAL STATUS

When it comes to vitamin and mineral status, there are a few helpful terms to know:

- **Insufficiency:**
  A subtle vitamin or mineral deficiency not severe enough to cause classic deficiency symptoms[1]
- **Deficiency:**
  Inadequate amounts of a vitamin or mineral due to chronically low intake, low availability of nutrient-dense foods, or poor absorption. Also known as "hidden hunger," this can become detrimental to health and often causes classic nutrient deficiency symptoms.[1] Most deficiencies can be addressed through mindful dietary changes or the addition of a supplement; however, extreme deficiencies may need to be handled in a clinical setting.
- **Toxicity:**
  When too much of certain vitamins and minerals is consumed. Toxicities are less likely to occur through a regular diet and more likely as the result of inappropriate supplementation. Some toxicities can be fatal.

A nutrient analysis test can determine your nutritional status. If interested, ask your healthcare practitioner about available laboratory tests to check your specific micronutrient levels.

VITAMINS

Vitamins are nutrients that support the body's internal regulation and must be obtained through the diet. There are 13 essential vitamins, which can be classified into two types:

1| **Fat-soluble vitamins:** Vitamins A, D, E, and K are fat-soluble. This means they need to be in the presence of fat to be properly absorbed. Unlike water-soluble vitamins, fat-soluble vitamins can be stored in the body's tissue.

2| **Water-soluble vitamins:** Water-soluble vitamins include the B vitamin family and vitamin C. These vitamins can dissolve easily in water. Toxicities in water-soluble vitamins are typically rare because the body eliminates amounts that are not needed.

MINERALS

Minerals must also be obtained from the diet for optimal health. Minerals help with a variety of functions in the body, including everything from providing structure in the bones to supporting a healthy heart. There are three classifications:

1| **Macrominerals:** Nutrient requirements are higher for these, which include calcium, chloride, magnesium, phosphorus, potassium, sodium, and sulfur.

2| **Trace minerals:** Nutrient requirements are lower for these, which include copper, chromium, fluoride, iodine, iron, manganese, selenium, and zinc.

3| **Ultratrace minerals:** Nutrient requirements are considered lowest for these, which include arsenic, boron, cobalt, molybdenum, nickel, silicon, and vanadium. The function of these minerals is less understood.

Read on to learn more about the specific vitamins and minerals your body needs to function at its best and the food sources where you'll find them!

FAT-SOLUBLE VITAMINS

Vitamin A[4]

Vitamin A is essential for growth, cell differentiation, immunity, sexual maturity, and healthy vision. It may also reduce the risk of cancer. Night blindness may occur if there is a deficiency in this vitamin. Vitamin A is found in some foods, but beta-carotene, a red/orange pigment that's more common (found in squash, carrots, and pumpkin), can be converted to vitamin A in the body.

Food sources: butter, egg yolks, liver, milk, tuna

Vitamin D

Vitamin D is necessary for bone health, brain function, cancer prevention, regulation of inflammation, and immunity.[1] Vitamin D can be acquired in two ways: The body is able to synthesize it upon sun exposure and it can be consumed through the diet. Individuals who live in more northern areas of the globe may have a difficult time getting adequate vitamin D due to the limited sun exposure, especially during colder months. Other factors that affect vitamin D synthesis include age, body weight, skin pigmentation, and presence of certain disease states.[5]

Food sources: butter, eggs, fatty fish, fortified milk, liver, some mushrooms (exposed to sunlight)

Vitamin E

Vitamin E functions as an antioxidant in the body. As an antioxidant, it helps prevent or slow cell damage, supporting healthy aging and immunity. Vitamin E may also help reduce the risk of cardiovascular disease.

Food sources: almonds, avocados, peanuts, spinach, sunflower seeds, vegetable oils, wheat germ

Vitamin K

Vitamin K is essential for blood clotting, so individuals who take certain anticoagulants (blood thinners) may need to be careful about adjusting the amount of vitamin K they get in their diet. Vitamin K can also be produced from the intestinal bacteria as part of the digestive process. This form of vitamin K, known as vitamin K2, is also found in animal fats and fermented foods. Vitamin K2 supports bone health.[6]

Food sources: beet greens, broccoli, cabbage, collards, kale, spinach, Swiss chard, turnip greens

WATER-SOLUBLE VITAMINS

Thiamin (B1)

Thiamin is essential for proper metabolism. More specifically, this B vitamin is necessary for the metabolism of carbohydrates. A deficiency causes beriberi, a condition that can impact muscular function and may cause cardiovascular issues. Deficiencies in thiamin are typically rare, but individuals with an alcohol use disorder are most at risk.

Food sources: brewer's yeast, legumes, nuts, oatmeal, potatoes, pork, seeds, wheat germ, whole grains

Riboflavin (B2)

Riboflavin is also essential for proper metabolism. A deficiency in riboflavin may lead to a condition called photophobia, an increased sensitivity to light. However, deficiencies of this particular vitamin are rare.

Food sources: almonds, beef, brewer's yeast, dairy, eggs

Niacin (B3)

Niacin, another essential vitamin for proper metabolism, is present in both plant and animal foods, though they contain different forms. Typically, niacin is obtained from the diet, but a small amount can actually be synthesized in the body by converting the amino acid tryptophan to a usable form of niacin. A deficiency in niacin will manifest in a condition called pellagra, which can cause skin issues, gastrointestinal tract issues, and confusion – if not treated, it can be fatal.

Food sources: brewer's yeast, chicken, cottage cheese, liver, most fish, mushrooms, pork, potatoes, turkey

Pantothenic Acid

Pantothenic acid is abundant in both plant and animal foods. Its prefix, *pan-*, means "all" – which helps emphasize how many food sources it can be found in. As you might imagine, deficiencies in this vitamin are rare.

Food sources: avocado, beef, broccoli, chicken, egg yolks, legumes, potatoes, tomatoes, whole grains

Vitamin B6

Vitamin B6 is essential for proper metabolism, particularly of protein. It's involved in a variety of enzymatic reactions throughout the body and supports immune function. Vitamin B6 is also used in the process of forming neurotransmitters and hemoglobin.

Food sources: avocado, chicken, chickpeas, liver, navy beans, pistachios, potatoes, salmon, walnuts, wheat bran

Biotin

Biotin is essential for proper metabolism, healthy skin and hair, and gut health (deficiencies have been linked to an imbalance of healthy bacteria in the gut). Biotin can be obtained through food and is also synthesized by bacteria in the large intestine.[7] Although deficiencies are rare, frequently consuming raw eggs can block its absorption.

Food sources: brewer's yeast, egg yolks, legumes, nuts, organ meats, whole grains

Folate

Folate assists with cell turnover, which is why it's especially important for those hoping to become pregnant. Folate deficiencies have been shown to lead to neural tube defects in fetuses. A deficiency is also linked to decreased immunity and a particular form of anemia where blood cells appear enlarged. Folate found in supplements is called folic acid, L-methylfolate, or folinic acid.

Food sources: asparagus, avocado, black-eyed peas, broccoli, edamame, lettuce, liver, okra, spinach, turnip greens

Vitamin B12

Vitamin B12 supports nerve function and healthy blood cells. Proper vitamin B12 absorption relies on intrinsic factor (IF), which is produced in the stomach. As we age, IF production decreases, affecting the proper absorption of vitamin B12. Individuals who follow vegetarian and vegan diets are more likely to be at risk for a deficiency. Vitamin B12 stores can meet the body's demands for a time, but those who avoid animal-based foods should consider a supplement to reduce the deficiency risk.

Food sources: bee pollen, beef, clams, eggs, fortified foods, fortified nutritional yeast, liver, oysters, poultry, salmon, trout, tuna

Vitamin C

Vitamin C acts as a powerful antioxidant in the body. In addition to reducing oxidation and supporting immunity, vitamin C is known to help boost the absorption of iron from plant sources. Deficiencies in vitamin C result in scurvy, which historically affected sailors who had been out to sea for many months without access to foods containing vitamin C.

Food sources: broccoli, Brussels sprouts, cauliflower, citrus fruits, cranberries, kiwi, potatoes, red pepper, rose hips, strawberries

MACROMINERALS

Calcium

Calcium is the most abundant mineral in the body – most of which is located in the bones. In addition to offering structural support through the bones, calcium helps support muscle contraction and pH balance. Calcium absorption is boosted by vitamin D. A deficiency in calcium can lead to osteomalacia, the precondition of osteoporosis.

Food sources: bok choy, cheese, clams, collard greens, kale, milk, sardines, spinach, tofu, yogurt

Chloride

Chloride acts as an electrolyte. The kidneys regulate chloride in the body.

Food sources: coconut water, olives, salt (sodium chloride), sea vegetables

Magnesium

Magnesium is essential for bone health and muscle relaxation. It plays an important role in a variety of functions, including DNA replication, metabolism, and protein synthesis. Magnesium deficiency has been associated with inflammation, insulin resistance, anxiety, and insomnia.[1] Magnesium deficiencies are becoming more common due to the declining nutritive value of crops (related to poor soil quality and possibly glyphosate use[8]), overall dietary composition, and malabsorption issues.[9]

Food sources: adzuki beans, almonds, black beans, bran cereal, cashews, cocoa, flaxseeds, kidney beans, peas, pumpkin seeds, spinach, Swiss chard, tofu, wheat germ, whole grains

Phosphorus

Phosphorus is another abundant mineral in the body, most of which can be found in the bones. The kidneys regulate circulating phosphorus, so individuals who have kidney disease may need to limit the amount of phosphorus they consume. In addition to supporting bone health, this mineral is also found in cell membranes (providing structure) and helps regulate pH.

Food sources: cheese, eggs, lentils, meat, milk, mushrooms, potatoes, poultry, pumpkin seeds, sardines, sunflower seeds, tempeh, tuna, yogurt

Potassium

Potassium acts as an electrolyte in the body and plays a role in maintaining fluid balance. This mineral is widely available in fruits and vegetables but is notoriously low in the Standard American Diet. Potassium helps reduce the risk of hypertension and cardiovascular disease.

Food sources: bananas, mangoes, milk, oranges, potatoes, squash, tomatoes, yogurt

Sodium

Sodium acts as an electrolyte, and deficiencies are rare – especially in the United States, where sodium is added to most processed foods. Excessive sodium consumption, along with a diet poor in potassium, magnesium, and calcium, has been shown to contribute to hypertension.

Food sources: celery, eggs, ham, milk, processed foods, salt (sodium chloride), seafood

Sulfur

Sulfur is important for supporting DNA and protecting against cell damage. Protein-rich foods are typically a good source of sulfur as it can be found in several amino acids (the building blocks of proteins).

Food sources: beef, eggs, fish, poultry

TRACE MINERALS

Chromium

Chromium is only necessary in small amounts in the diet and has been shown to support insulin sensitivity.

Food sources: broccoli, egg yolks, garlic, ham, potatoes, red wine

Copper

Copper is only necessary in small amounts in the diet. It supports several enzymatic reactions as well as brain cell communication. Copper-zinc balance in the body is important for neurotransmitter function.[1] A deficiency in copper may lead to poor heart health.

Food sources: cashews, prunes, sesame seeds, soybeans, sunflower seeds

Fluoride

Fluoride is essential to the health of bones and teeth and is only necessary in small amounts. To reduce the prevalence of tooth decay, fluoride may be added to the water supply.

Food sources: fluoridated water, gelatin, some seafood, tea

Iodine

Iodine helps support thyroid health and production of its hormones. Those at risk for a deficiency include people following vegan diets, individuals who avoid iodized salt, and athletes who experience significant sweating.[1] A deficiency in this important mineral can lead to an enlargement of the thyroid gland, or goiter. Similar to selenium, iodine content in food is largely dependent on the environment where the food is produced. To help reduce deficiencies, iodine is often added to salt.

Food sources: cod, cottage cheese, eggs, haddock, iodized salt, milk, seaweed, yogurt

Iron

Iron is essential for healthy red blood cells. It's found in both animal (heme form) and plant (non-heme form) sources; iron from animal sources is more easily absorbed. Those who menstruate have a higher recommended intake of iron, due to losses that occur as part of the menstrual cycle. A deficiency in iron can result in anemia.

Food sources: blackstrap molasses, kidney beans, lentils, lima beans, liver, oysters, spinach, soybeans, tofu, white beans

Manganese

Manganese is found in a variety of plant foods and helps support carbohydrate metabolism as well as the formation of cartilage. It's only necessary in small amounts in the diet.

Food sources: almonds, brown rice, lima beans, pineapple, pinto beans spinach

Selenium

Selenium acts as a powerful antioxidant in the body. Selenium content of food is linked to the selenium content present in the soil where it's grown, so it may vary widely in the same foods. Selenium supports immunity and thyroid health and may help reduce the risk of cancer.

Food sources: beef, Brazil nuts, chia seeds, chicken, cottage cheese, crab, couscous, eggs, mushrooms, oysters, pork, salmon, sardines, tofu, yogurt

Zinc

Zinc supports enzymatic reactions necessary for everything from DNA replication to protein digestion. It supports proper growth and development, and therefore recommended intakes are higher for those breastfeeding. Zinc is also an important component of immunity and supports wound healing. A deficiency in zinc can lead to a condition that reduces a person's ability to taste.

Food sources: beef, cashews, chickpeas, cocoa, crab, oysters, lobster, pumpkin seeds, sunflower seeds

FOOTNOTES

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