

The Role of Vitamins and Minerals in Immune Deficiencies and Autoimmune Disorders



Can taking vitamin and mineral supplements benefit those with compromised and overactive immune systems? Here's what the research shows.

By Mindy Hermann, MBA, RDN

ADMITTEDLY, VITAMINS and minerals are extremely popular in the United States. The 2017 Council for Responsible Nutrition Annual Survey on Dietary Supplements shows a majority of American adults takes supplements and three-quarters report taking a vitamin and mineral supplement at least once in the prior year.

The benefits of vitamin and mineral supplements, however, are being challenged. A widely publicized systematic review in the May 28, 2018, issue of the *Journal of the American College of Cardiology* concluded multivitamin supplements, as well as single supplements of vitamin D, calcium or vitamin C alone, did not help prevent heart disease, heart attack, stroke or death at a young age. But, they did not cause harm either. Numerous other vitamin and mineral supplements likewise had no positive or negative effects, with the exception of folic acid (positive) and niacin and antioxidants (potentially negative).

Because certain vitamins and minerals are required for a healthy immune system and deficiencies of these nutrients can weaken the immune response, is it possible vitamins and minerals can help people with immunodeficiency diseases and autoimmune disorders?

Several Vitamins and Minerals Support Everyday Immune Health

Vitamin A and compounds related to vitamin A take part in both innate and adaptive immunity. This vitamin helps protect the health of cells in the skin, eye, lungs, gastrointestinal tract and urinary tract. They also help block infections. In addition, vitamin A is required for healthy function of natural killer cells, macrophages and neutrophils that are part of the body's innate response. On an adaptive level, T and B lymphocytes and the body's antibody response need vitamin A.

People who have a vitamin A deficiency are more likely to contract infections that affect the eye and respiratory, urinary and gastrointestinal tracts since the cells in these locations rely on vitamin A for normal function. Deficiency also affects the functioning of B and T cells.

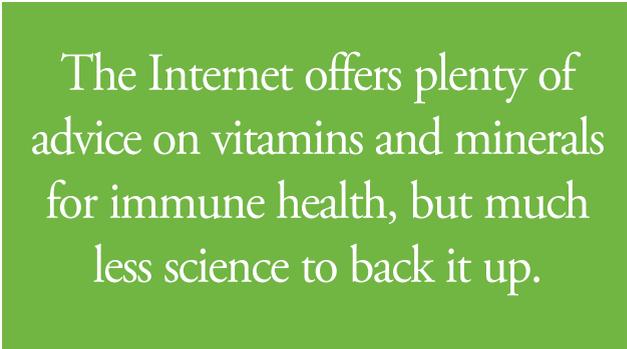
Since vitamin A is a fat-soluble vitamin, it is stored in the body and can be toxic in high doses, so supplementation generally is not recommended unless a deficiency has been proven.

Vitamin B6 takes part in biochemical reactions related to protein amino acid production and immune system functioning. Deficiency of this vitamin adversely affects the immune system, and correction of a deficiency helps restore affected functions.

Vitamin C functions as an antioxidant that protects cells from damage by immune system activity against harmful bacteria and viruses. It stimulates production of several types of white blood cells, and it builds up in these cells to help them withstand damage caused by reactive forms of oxygen that form when the body fights off pathogens.

Vitamin D, in the form of 1,25-dihydroxyvitamin D3, helps to regulate several types of cells in the immune system, including monocytes, macrophages, dendritic cells and activated T cells, and it helps prevent autoimmune responses. It also protects against infection by helping to regulate proteins that kill harmful bacteria. Adequate vitamin D through diet and exposure to sunlight is thought to help prevent and treat autoimmune diseases such as insulin-dependent diabetes, multiple sclerosis, systemic lupus erythematosus and rheumatoid arthritis. In studies, people with low blood levels of a form of vitamin D show increased disease activity. Adequate vitamin D intake through food and supplements is recommended for overall health, bone strength and other health benefits.

Vitamin E is an antioxidant that protects cells from attack by highly reactive compounds in the body. Deficiency affects immunity, and supplementation may help protect against infections.



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Selenium, a mineral, is a component of several enzyme reactions related to normal immune functions. One reaction, for example, neutralizes potentially damaging oxygen compounds that can affect immune response and can also increase the risk of cancer. Selenium deficiency adversely affects innate and adaptive immunity and can lead to more severe reactions to viral infections. Low selenium levels have been associated with autoimmune thyroid diseases such as Graves' and Hashimoto's. A selenium supplement may help improve immune response in individuals who are deficient in the mineral.

Zinc, a mineral, aids the development and function of immune system cells. It is not stored in the body and must be supplied regularly in the diet. Zinc deficiency affects the immune system in many ways, including reducing immune cell production and activity.

Studies on Supplementation for Immune Deficiency Are Limited

The Internet offers plenty of advice on vitamins and minerals for immune health, but much less science to back it up. The most promising studies pertain to vitamin D and selenium.

Vitamin D:

- Low vitamin D levels are associated with several autoimmune diseases, including rheumatoid arthritis, systemic lupus erythematosus, systemic sclerosis, type 1 diabetes mellitus, multiple sclerosis, inflammatory bowel diseases, autoimmune thyroid diseases (i.e., Hashimoto's thyroiditis and Graves' disease) and autoimmune gastritis. Data are inconclusive, however, regarding the role of vitamin D in autoimmune thyroid diseases. Additional

studies are needed to show a relationship between vitamin D and the cause, prevention or treatment of autoimmune thyroid diseases.¹

- The optimal blood concentration of vitamin D to prevent or treat autoimmune diseases is being evaluated. Experimental studies suggest vitamin D supplementation could reduce the severity of the diseases.²

- A review of studies on vitamin D and systemic lupus erythematosus shows while vitamin D insufficiency is common, vitamin D levels do not correlate with disease activity, and benefits of supplementation are not clear.³

- The role of vitamin D in preventing and treating rheumatoid arthritis is not clear.⁴

- It has been suggested low vitamin D levels might be caused by autoimmune disease, and supplementation could make symptoms worse rather than better.

Selenium:

- Results from studies looking at selenium supplementation for thyroid diseases have been inconclusive and inconsistent, without evidence of a benefit for autoimmune thyroid

Table 1. Dietary Guidelines for Americans, Recommended Amounts of Food from Each Food Group, 2,000 Calories/Day

Food Group	Healthy U.S.-Style Eating Pattern	Healthy Mediterranean-Style Eating Pattern	Healthy Vegetarian Eating Pattern
Vegetables	2½ c-eq/day	2½ c-eq/day	2½ c-eq/day
Dark green	1 ½ c-eq/week	1 ½ c-eq/week	1 ½ c-eq/week
Red and orange	5 ½ c-eq/week	5 ½ c-eq/week	5 ½ c-eq/week
Legumes (dry peas, beans)	1 ½ c-eq/week	1 ½ c-eq/week	1 ½ c-eq/week
Starchy	5 c-eq/week	5 c-eq/week	5 c-eq/week
Other	4 c-eq/week	4 c-eq/week	4 c-eq/week
Fruits	2 c-eq/day	2 ½ c-eq/day	2 c-eq/day
Grains	6 oz-eq/day	6 oz-eq/day	6 ½ oz-eq/day
Whole	3 oz-eq/day	3 oz-eq/day	3 ½ oz-eq/day
Refined	3 oz-eq/day	3 oz-eq/day	3 oz-eq/day
Dairy	3 c-eq/day	2 c-eq/day	3 c-eq/day
Protein Foods	5 ½ oz-eq/day	6 ½ oz-eq/day	3 ½ oz-eq/day
Seafood	8 oz-eq/week	16 oz-eq/week	Eggs 3 oz-eq/week
Meat, poultry, eggs	26 oz-eq/week	26 oz-eq/week	Legumes 6 oz-eq/week
Nuts, seeds, soy products	5 oz-eq/week	5 oz-eq/week	Soy products 8 oz-eq/week Nuts, seeds 7 oz-eq/week
Oils	27 g	27 g	27 g

(The terms c-eq and oz-eq refer to cup- and ounce-equivalents; these incorporate foods that can substitute for each other in different amounts.)

inflammation.⁵ While the benefits of routine supplementation have not been proven, correction of a selenium deficiency may benefit the treatment of autoimmune thyroid diseases.⁶

- In groups of individuals with autoimmune thyroid diseases, supplementation with selenium plus myo-inositol, a vitamin-like compound, improved thyroid function after six months of treatment.^{7,8}

- Selenium supplementation in study subjects with chronic autoimmune thyroiditis reduced thyroid autoantibody levels, but benefits for alleviating symptoms and treating the disease are not known.⁹

Lack of Evidence for Supplementation Means a Sensible Diet Is Best

Research has not yet identified a clear relationship between key vitamins and minerals and the cause, prevention and treatment of autoimmune diseases. For this reason, a sensible diet is more advisable than supplementation, particularly of vitamins and minerals that may also pose a health risk. The Dietary Guidelines for Americans 2015-2020, coordinated by the U.S. Department of Agriculture and U.S. Department of Health and Human Services, suggests dietary patterns that are associated with health and can be customized based on calories and food preferences. These include foods rich in vitamins and minerals that help support the immune system:

- Vitamin A: liver, milk, eggs, leafy greens, carrots and other orange and red-orange vegetables, tomato products
- Vitamin B6: fish, beef liver and other organ meats, potatoes and other starchy vegetables, fortified breakfast cereals
- Vitamin C: citrus fruits and their juices, bell peppers, kiwifruit, broccoli, potatoes, tomatoes

- Vitamin D: higher-fat fish such as salmon, trout and swordfish; fortified dairy products; fortified breakfast cereals; eggs

- Vitamin E: vegetable oils, nuts and seeds, leafy greens, broccoli

Research has not yet identified a clear relationship between key vitamins and minerals and the cause, prevention and treatment of autoimmune diseases.

- Selenium: Brazil nuts, fish and seafood, organ meats, poultry, grains, eggs

- Zinc: red meat, poultry, seafood, fortified breakfast cereals, beans, nuts, whole grains

The sample diet patterns in the Dietary Guidelines for Americans (Table 1) list recommended amounts from each food group in terms of daily and weekly totals. Following one of the recommended patterns and choosing a variety of foods from each category will provide adequate amounts of nutrients important to immune and overall health. ■

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Resources

- Cleveland Clinic Health Essentials
3 Vitamins That Are Best for Boosting Your Immunity
health.clevelandclinic.org/3-vitamins-best-boosting-immunity
- Linus Pauling Institute
Immunity in Depth
lpi.oregonstate.edu/mic-eq/health-disease/immunity
- *Dietary Guidelines for Americans 2015-2020, 8th Ed.*
health.gov/dietaryguidelines/2015/guidelines/introduction/dietary-guidelines-for-americans

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