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Vitamin D and Your Heart

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Heart disease remains the leading cause of mortality for men and women in the U.S. and worldwide. Originally known for its crucial role in maintenance of bone health, vitamin D has emerged as a potential therapeutic target in the prevention of cardiovascular disease. A growing body of evidence suggests an association between vitamin D deficiency and increased cardiovascular disease morbidity and mortality; however, optimal levels of vitamin D for heart health remain undefined.

Vitamin D is a hormone precursor that can be obtained from natural or fortified foods, dietary supplements, or from exposure of the skin to sunlight's ultraviolet rays. It is uniquely different from all other vitamins due to our body's own ability to produce it in adequate quantities from exposure to ultraviolet-B light, which initiates the skin synthesis of vitamin D₃ (cholecalciferol). Vitamin D₃ then undergoes modification by the liver to 25(OH) D, the best indicator of vitamin D exposure and easily measured in the blood. Vitamin D ultimately undergoes final hydroxylation by our kidneys to its biologically active form, 1, 25(OH)₂ D. As a result, vitamin D deficiency can arise from several mechanisms including minimal sunlight exposure, inadequate dietary intake, and severe liver and/or kidney dysfunction.

Beyond the Bones

Vitamin D receptors are present in many different cells and tissues in the body and account for vitamin D's influence on a variety of physiologic functions. Low vitamin D levels have been associated with an increased risk of hypertension, diabetes, coronary artery disease, and stroke. Although it remains unknown if there is a cause-and-effect relationship, potential cardioprotective mechanisms of vitamin D include anti-inflammatory effects, inhibition of

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smooth muscle proliferation, and improved glucose tolerance, all factors known to reduce the development of cardiovascular disease and/or diabetes. However, the vast majority of available data regarding the cardiovascular effects of vitamin D has been drawn from observational studies that are not able to fully control for confounding factors, such as outdoor physical activity (increased sunlight exposure), general nutritional status, or medical conditions that affect the absorption or metabolism of vitamin D.

Are You at Risk?

The best method to determine vitamin D status is through measurement of 25(OH) D levels in the blood. Vitamin D insufficiency is generally defined as a 25(OH)D level of less than 20 ng/mL. Epidemiological studies have estimated that at least 30% of the U.S. adult population has insufficient levels. The Institute of Medicine (IOM) and U.S. Preventive Services Task Force (USPSTF) do not currently recommend widespread population screening for vitamin D except for patients who are considered at increased risk for deficiency. Risk factors for developing vitamin D deficiency include malabsorption disorders such as inflammatory bowel disease, celiac disease, or gastric bypass, older age, obesity, darker skin pigmentation, and severe liver or kidney disease. Individuals with osteoporosis, other bone health disorders, or those using certain medications (such as glucocorticoids, anti-seizure and anti-retroviral medications) that interfere with vitamin D metabolism may have increased requirements for vitamin D.

More is Not Necessarily Better

The IOM has recommended dietary reference intakes for vitamin D for all adults (see Table 1). Due to the paucity of data on nonskeletal outcomes in randomized clinical trials of vitamin D supplementation, the IOM's recommendations are based on the requirements needed for the prevention of bone disease only and assume minimal to no sun exposure. Increasing sun exposure is not currently recommended as a means to raise vitamin D levels due to the associated risks of skin cancer. Given the limited dietary sources rich in vitamin D (see Table 2), dietary supplements in the form of both vitamin D₂ and D₃ are also widely used and available to meet daily requirements. In addition, a tolerable upper intake level for vitamin D has been defined as 4000 IU daily or a 25(OH)D level of 50 ng/mL due to research linking both low and high levels of vitamin D to adverse health outcomes. Excess intake of vitamin D should be avoided given the potential risks, including gastrointestinal side effects, high calcium levels in the urine and blood, kidney stones, and calcium deposits in the arteries.

Ongoing Research

To date, there are no completed large-scale trials specifically designed to study the effectiveness of vitamin D supplementation on the prevention of heart disease, however, there are several trials ongoing worldwide. VITAL (the *VIT*amin D and *OmegA*-3 *TriaL*), the largest ongoing randomized clinical trial of vitamin D in the U.S., is specifically designed to assess any differences in heart disease and cancer outcomes through the study of 2000 IU of daily vitamin D supplementation among a diverse group of 25,874 participants. Until further data become available, the IOM's recommendations provide guidance to

patients and clinicians for shared decision-making based on individual clinical assessments. As we face the expansion of an aging population at heightened risk for cardiovascular disease, the promising role of vitamin D in cardiovascular disease prevention warrants ongoing investigation.

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Additional Resources

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Table 1

Vitamin D Dietary Reference Intake for Adults by Age (males and females)	RDA (IU/d)	Serum 25(OH)D level* (ng/mL)	Tolerable Upper Intake Level (IU/d)
<i>19–50 yr</i>	600	20	4,000
<i>51–70 yr</i>	600	20	4,000
<i>71+ yr</i>	800	20	4,000

* Level corresponding to the RDA (Recommended Dietary Allowance), the intake that meets the requirement of 97.5% of population.

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Table 2

Dietary Sources of Vitamin D	IU (International Units) per serving
<i>Natural</i>	
Salmon (3 oz., cooked)	600–1000
Tuna (3.6 oz, canned)	200
Cod liver oil (1 tsp)	400–1000
Egg yolk	20
Mushrooms (wild, sun-dried)	400
<i>Fortified</i>	
Milk (8 oz.)	100
Yogurt (6 oz.)	100
Breakfast cereals (1 cup)	100
Cheeses (3oz.)	100
<i>Supplements</i>	
Multivitamin	Varies widely: generally 400–1000
Vitamin D ₂	50,000 capsule weekly, 8,000 liquid supplements
Vitamin D ₃	Varies widely: 400, 800, 1000, or 2,000 capsules

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