Healthy Heart Newsletter

Decrease heart disease with vitamin D

Vitamin D benefits go beyond bone health

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Cardiovascular Disease

Coronary heart disease is the single leading cause of death in the United States. According to a study conducted by the American Heart Association, over 451,000 lives were claimed by this disease in the year 2004. Over 80,700,000 people are living with one or more forms of cardiovascular disease (CVD)[2]. There are many types of diseases that fall under the umbrella term of "cardiovascular disease". These are diseases that can damage arteries, the heart muscle, and may cause pain, blockage, or even death. Some of these diseases include coronary artery disease, heart attack, high blood pressure and stroke[1]. There are many risk factors for cardiovascular disease. Some of these risk factors can't be changed like increasing age, heredity and being male. However, there are many risk factors, such as quitting smoking, lowering cholesterol, being physically active, decreasing blood pressure, and losing weight that can be controlled, modified, or treated by lifestyle changes to reduce the risk of developing cardiovascular disease[6].

What is vitamin D?

Vitamin D is a fat-soluble vitamin that exists naturally in very few foods, and can also be produced when skin is exposed to the ultraviolet rays from the sun. The primary role of vitamin D in the human body is to support bone health by activating calcium absorption in the gut and by maintaining sufficient levels of serum calcium and phosphate concentrations. Vitamin D status is best indicated by measuring serum concentration of 25-OH D, which represents vitamin D obtained from food sources as well as produced in the skin. However, measuring serum 25-OH D levels does not account for the amount of vitamin D stored in other parts of the body. Foods that naturally contain vitamin D include fish such as salmon and tuna, fish liver oils, egg yolks, and cheese[3]. Vitamin D may also be obtained from dietary supplements and sun exposure. Current recommendations for vitamin D intake are 400 IU per day, although recent findings suggest that increasing vitamin D intake to 700 to 1,000 IU per day may have additional health benefits[7].

Data from the 2000-2004 NHANES indicates that serum levels of 25-OH D are generally higher in males than females and higher in younger people than in older people[3]. Vitamin D deficiency is caused when intake or sun exposure is inadequate, or when activation or absorption is impaired. Those most likely to suffer from a vitamin D deficiency are breast-fed infants, people with limited sun exposure or darker skin, older adults, obese people and people with fat malabsorption problems. Recent studies indicate that adequate vitamin D intake may help to avoid the development of osteoperosis and certain cancers.

How vitamin D might decrease CVD

Vitamin D is widely known for its ability to regulate calcium levels in the blood and promote bone health. However, new research suggests that vitamin D may do more than just help prevent osteoporosis. Vitamin D receptors are found on vascular smooth muscle, endothelium and heart cells.

Activated 1,25-OH D directly suppresses renin gene expression. Without activated vitamin D, there's up-regulation of the renin-angiotensin system which causes hypertension and enlargement of the left ventricle. The renin-angiotensin system regulates blood pressure and fluid balance. Low blood pressure causes the kidneys to secrete renin which stimulates the production of angiotensin. Angiotensin causes blood vessels to constrict in order to increase blood pressure. If this system is too active, blood pressure will be too high. Thus, vitamin D has the ability to suppress this system, decreasing the chance of developing high blood pressure[5,8].

In addition to decreasing blood pressure, vitamin D also has the ability to decrease inflammation and thrombosis. Activated 1,25-OH D regulates the growth and proliferation of smooth muscle cells that compose blood vessel walls and heart cells. They can convert circulating 25-OH D to the active form 1,25-OH D thus decreasing inflammation and blood clot formation. Activated vitamin D can also down-regulate the production of pro-inflammatory cytokines. In a vitamin D deficiency, secondary hyperparathyroidism may develop and the heart may enlarge. Parathyroid hormone has a pro-inflammatory effect by stimulating the release of cytokines by vascular smooth muscle cells. Thus, by decreasing these pro-inflammatory cytokines (via activated vitamin D) there's less inflammation in the body leading to a decreased risk of CVD[5,8].

What do studies say?

A recent study published in the *Journal of the American Heart Association* entitled "Vitamin D Deficiency and Risk of Cardiovascular Disease" attempted to show a correlation between low vitamin D intake/exposure and cardiovascular disease[8]. The study included 1,739 Framingham Offspring Study participants who didn't have any prior cardiovascular disease. All of the participants were white with 55% being female and 45% being male. The mean age of the participants was 59 years old. Serum vitamin D levels were assessed by measuring 25-OH D using a radioimmunoassay. Participants with hypertension were identified at the beginning of the study during the clinical evaluation and were placed into their own subgroup for analysis.

Even though 1,25-OH D is the biologically active hormonal form of vitamin D, serum 25-OH D is regarded as the best indicator of vitamin D status because it has a longer half-life and circulates in much higher concentrations in the blood than 1,25-OHD does.

At the beginning of the study, 28% of participants had vitamin D levels <15 ng/mL and 9% had levels <10 ng/mL (which was considered severe vitamin D deficiency). The mean 25-OH D concentration was 19.7 ng/mL. During a mean follow-up of 5.4 years, 120 individuals (57 women) developed a first cardiovascular event. Events included 65 fatal or nonfatal coronary heart disease events like heart attack or angina, 28 fatal or nonfatal cerebrovascular events like a stroke, 8 occurrences of claudication (or poor circulation of blood that can cause cramping) and 19 occurrences of heart failure.

The development of cardiovascular disease after five years was statistically twice as common in those with 25-OH D <15 ng/mL as in those with 25-OH D >15 ng/mL.

Dividing 25-OH D status into three categories (>15, 10 to <15, and <10ng/mL) a stepwise increase in cardiovascular risk was seen across categories. Those with hypertension who also had a vitamin D deficiency with levels less than <15 ng/mL were associated with a 2-fold risk of cardiovascular events.

Since this was a non-controlled cohort study, diet and sun exposure were not measured.

In order to further investigate the relationship between vitamin D intake and various cardiovascular disease risk factors, a recent study published by the Archives of Internal Medicine was conducted in order to identify the correlation between low serum levels of 25-OH D and risk for cardiovascular disease.

The study was a case-control investigation titled "Prevalence of Cardiovascular Risk Factors and the Serum Levels of 25-Hydroxyvitamin D in the United States" that used data from the NHANES III survey[4]. The NHANES III is a national probability survey that was conducted by the National Center for Health Statistics at 89 survey locations between January 1988 and December 1994.

The study participants consisted of 7,186 men and 7,902 women over the age of 20. The group included an oversampling of people age 60 and older, non-Hispanic black and Mexican American people to accurately represent the prevalence of CVD in these groups.

The study began by first determining which participants already suffered from the conditions of diabetes mellitus or hypertension. Weight and height were measured for each participant, and their BMIs were calculated. Total serum cholesterol, serum albumin, and serum 25-OH D levels were also measured, the latter being measured via the radioimmunoassay method.

Once the initial data from participants was collected, it was statistically analyzed using the NHANES III. This data was organized by age, race/ethnicity, sex, BP level, history of hypertension, blood glucose level, history of diabetes mellitus, body mass index, triglyceride level, total cholesterol level, non-high density lipoprotein cholesterol level, serum albumin level, and albuminuria. Between these groups, the mean levels of serum 25-OH D was calculated and compared using the 2-tailed *t* test and analysis of variance when needed.

The presence of serum levels of 25-OH D under 30 ng/ml was more prevalent in women, racial/ethnic minorities, elderly people, and those with CVD risk factors such as obesity, hypertension, diabetes mellitus, hypertriglyceridemia, and hypercholesterolemia.

It was found that while there was a significant inverse relationship between serum 25-OH D levels and obesity, hypertension, and diabetes mellitus in the overall population, total cholesterol had no relation to serum 25-OH D levels. Low serum albumin levels were associated with low serum 25-OH D levels, but it did not affect the association with risk factors for CVD.

The conclusion reached by this study is that there is a significant association between low vitamin D levels and risk for CVD in this sample of participants that is representative of the population of the United States. The researchers in this study found that the data collected presents enough evidence for the relationship between CVD and serum vitamin D levels that prospective studies are warranted to assess the benefit of vitamin D supplementation on CVD risk factors.

Strengths and weaknesses of studies

The first study mentioned was a non-controlled cohort study, which is a type of research that is useful for observing multiple outcomes and is fairly quick and inexpensive to conduct. The study used direct, objective measures of vitamin D status rather than relying on self-reported vitamin D intake or sunlight exposure. However, cohort studies are not perfect because the researcher has no control over exposure or outcome assessment, and it is often difficult to compare the exposed participants with the non-exposed participants. A limitation specific to this study is that the participants were all white. A more ethnically diverse sample of participants would better represent vitamin D deficiency in the United States.

The next study was a case-controlled study, which is another type of research that is used to investigate rare diseases and/or multiple exposures. This type of study is also relatively quick and inexpensive to conduct. A strength of this study was that the number of participants was large and was demographically representative of the United States population. On the other hand, the blood sample collections were taken at random times throughout the year, so it was difficult to determine the impact of seasonal sunlight variations on vitamin D levels. Case-controlled studies cannot be perfectly accurate because they rely on recall or historical data for exposure. These types of studies also make it difficult to compare cases and controls.

The bottom line

There seems to be a strong correlation showing that vitamin D deficiency is a risk factor for developing CVD, but further clinical and experimental studies are needed to validate the current findings.

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