

COMMENTARY

Vitamin D - Not Just a Simple Vitamin

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ABSTRACT:

Vitamin D refers to a group of fat-soluble secosteroids responsible for enhancing intestinal absorption of calcium, iron, magnesium, phosphate and zinc. In humans, the most important compounds in this group are vitamin D₃ and vitamin D₂. Very few foods contain vitamin D. Synthesis of vitamin D (specifically cholecalciferol) in the skin is the major natural source of the vitamin. Dermal synthesis of vitamin D from cholesterol is dependent on sun exposure. Vitamin D deficiency is said to be associated with osteoporosis, type 2 diabetes, rickets, psoriasis, depression, schizophrenia, cancers, obesity etc. Vitamin D deficiency is wide spread in South Asian especially in Pakistani population and is contributing to burden of disease in this region. It is suggested that vitamin D supplementation program may be undertaken by the government on mandatory basis.

Keywords: Vitamin D, Fact, Deficiency, Diseases.

INTRODUCTION:

Vitamin D refers to a group of fat-soluble secosteroids responsible for enhancing intestinal absorption of calcium, iron, magnesium, phosphate and zinc. In humans, the most important compounds in this group are vitamin D₃ (also known as cholecalciferol) and vitamin D₂ (ergocalciferol).¹ They are known collectively as calciferol.² Vitamin D₂ the chemical structure of vitamin D₃ was established and proven to result from the ultraviolet irradiation of 7-dehydrocholesterol. Chemically, the various forms of vitamin D are secosteroids, that is steroids in which one of the bonds in the steroid rings is broken. The structural difference between vitamin D₂ and vitamin D₃ is the side chain of D₂ that contains a double bond between carbons 22 and 23, and a methyl group on carbon 24.³

Cholecalciferol and ergocalciferol can be ingested from the diet and from supplements.^{1,4,5} Very few foods contain vitamin D; synthesis of vitamin D (specifically cholecalciferol) in the skin is the major natural source of the vitamin. Dermal synthesis of vitamin D from cholesterol is dependent on sun exposure (specifically UVB radiation).

American researchers Elmer McCollum and Marguerite Davis in 1914⁶ discovered a substance in cod liver oil which later was called "vitamin A". British doctor Edward Mellanby noticed dogs that were fed cod liver oil did not develop rickets and concluded vitamin A, or a closely associated factor, that could prevent the disease. In 1922, Elmer McCollum tested modified cod liver oil

in which the vitamin A had been destroyed. The modified oil cured the sick dogs, so McCollum concluded the factor in cod liver oil which cured rickets was distinct from vitamin A. He called it vitamin D because it was the fourth vitamin to be named. It was not initially realized that, unlike other vitamins, vitamin D can be synthesized by humans through exposure to UV light. In 1925, it was established that when 7-dehydrocholesterol is irradiated with light, a form of a fat-soluble vitamin is produced (now known as D₃). Alfred Fabian Hess stated, "light equals vitamin D."⁷

Prevalence of Vitamin D Deficiency (VDD) of 92% and 81% in ambulatory patients has also been reported from centers in Karachi and Lahore recently.^{8,9} Reports previously have also demonstrated Vitamin D Deficiency (VDD) from various regions of Pakistan. Unlike many Western countries that have a vitamin D food fortification policy, Pakistan does not have a mandatory Vitamin D fortification policy in place. In this situation the major source of vitamin D is exposure to Ultra Violet B (UVB) rays in sunlight. Vitamin D is perhaps the single most underrated nutrient in the world of nutrition. That's probably because it's free: our body makes it when sunlight touches our skin.^{10,11,12,13}

Vitamin D - Fifteen Facts:

1. Vitamin D is produced by our skin in response to exposure to ultraviolet radiation from natural sunlight.
2. The healing rays of natural sunlight (that generate vitamin D in our skin) cannot penetrate glass. So we don't generate vitamin D when we are sitting in our car or home.
3. It is nearly impossible to get adequate amounts of vitamin D from our diet. Sunlight exposure is the only reliable way to generate vitamin D in our own body.
4. A person would have to drink ten tall glasses of vitamin D fortified milk each day just to get minimum levels of vitamin D into their diet.
5. The further we live from the equator, the longer exposure we need to the sun in order to generate vitamin D. Canada, UK and most US States are far from the equator.
6. People with dark skin pigmentation may need 20-30 times as much exposure to sunlight as fair-skinned people to generate the same amount of vitamin D. That's why prostate cancer is epidemic among

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Received: 06-11-2015

Revised: 15-11-2015

Accepted: 17-11-2015

black men -- it's a simple, but widespread, sunlight deficiency.

7. Sufficient levels of vitamin D are crucial for calcium absorption in our intestines. Without sufficient vitamin D, our body cannot absorb calcium, rendering calcium supplements useless.
8. Chronic vitamin D deficiency cannot be reversed overnight: it takes months of vitamin D supplementation and sunlight exposure to rebuild the body's bones and nervous system.
9. Even weak sunscreens (SPF=8) block our body's ability to generate vitamin D by 95%. This is how sunscreen products actually cause disease by creating a critical vitamin deficiency in the body.
10. It is impossible to generate too much vitamin D in our body from sunlight exposure: our body will self-regulate and only generate what it needs.
11. If it hurts to press firmly on our sternum, we may be suffering from chronic vitamin D deficiency right now.
12. Vitamin D is "activated" in our body by the kidneys and liver before it can be used.
13. Having kidney disease or liver damage can greatly impair our body's ability to activate circulating vitamin D.
14. The sunscreen industry doesn't want us to know that our body actually needs sunlight exposure because that realization would mean lower sales of sunscreen products.
15. Even though vitamin D is one of the most powerful healing chemicals in our body, our body makes it absolutely free. No prescription is required.¹⁴

Diseases and conditions caused by vitamin D deficiency:

- a. Osteoporosis is commonly caused by a lack of vitamin D, which greatly impairs calcium absorption.
- b. Sufficient vitamin D prevents prostate cancer, breast cancer, ovarian cancer, depression, colon cancer and schizophrenia.
- c. "Rickets" is the name of a bone-wasting disease caused by vitamin D deficiency.
- d. Vitamin D deficiency may exacerbate type 2 diabetes and impair insulin production in the pancreas.
- e. Obesity impairs vitamin D utilization in the body, meaning obese people need twice as much vitamin D.
- f. Vitamin D is used around the world to treat Psoriasis.
- g. Vitamin D deficiency can cause schizophrenia.
- h. Seasonal Affective Disorder is caused by a melatonin imbalance initiated by lack of exposure to sunlight.
- i. Chronic vitamin D deficiency is often misdiagnosed as fibromyalgia because its symptoms are so similar: muscle weakness, aches and pains.
- j. Your risk of developing serious diseases like diabetes and cancer is reduced 50% - 80% through simple, sensible exposure to natural sunlight 2-3 times each week.
- k. Infants who receive vitamin D supplementation (2000 units daily) have an 80% reduced risk of de-

veloping type 1 diabetes over the next twenty years.¹⁵

Sources of vitamin D:

Food: Very few foods in nature contain vitamin D. The flesh of fatty fish (such as salmon, tuna, and mackerel) and fish liver oils are among the best sources. Small amounts of vitamin D are found in beef liver, cheese, and egg yolks. Vitamin D in these foods is primarily in the form of vitamin D₃ and its metabolite 25(OH) D₃. Some mushrooms provide vitamin D₂ in variable amounts. Mushrooms with enhanced levels of vitamin D₂ from being exposed to ultraviolet light under controlled conditions are also available. Fortified foods provide most of the vitamin D in the American diet. For example, almost all of the U.S. milk supply is voluntarily fortified with 100 IU/cup.

Table: 1
Recommended Dietary Allowances (RDAs) for Vitamin D

Age	Male	Female	Pregnancy	Lactation
0-12 months*	400 IU (10 mcg)	400 IU (10 mcg)		
1-13 years	600 IU (15 mcg)	600 IU (15 mcg)		
14-18 years	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)
19-50 years	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)
51-70 years	600 IU (15 mcg)	600 IU (15 mcg)		
>70 years	800 IU (20 mcg)	800 IU (20 mcg)		

* Adequate Intake (AI)

Sunlight: It has been suggested by some vitamin D researchers, for example, that approximately 5-30 minutes of sun exposure between 10 AM and 3 PM at least twice a week to the face, arms, legs, or back without sunscreen usually lead to sufficient vitamin D synthesis. Individuals with limited sun exposure need to include good sources of vitamin D in their diet or take a supplement to achieve recommended levels of intake.¹⁶

Interactions with Medications:

Vitamin D supplements have the potential to interact with several types of medications. Corticosteroid medications such as prednisone, often prescribed to reduce inflammation, can reduce calcium absorption and impair vitamin D metabolism.¹⁷ These effects can further contribute to the loss of bone and the development of osteoporosis associated with their long-term use. *Other medications* like weight-loss drug orlistat and the cholesterol-lowering drug cholestyramine can reduce absorption of vitamin D and other fat-soluble vitamins.^{18,19} Both phenobarbital and phenytoin, used to prevent and control epileptic seizures, increase the hepatic metabolism

of vitamin D to inactive compounds and reduce calcium absorption.²⁰

It is surprising to see so much of vitamin D deficiency in a country like Pakistan, with ample sunshine where one would assume it to be non-existent. Increased pigmentation due to which more prolonged exposure to sun is required, use of sun block, purdah observation and possibly the reason that women in general do not go outside the home may be responsible for Vitamin D Deficiency(VDD). However, to note even this cannot explain the existence of vitamin D deficiency in many sun-drenched areas such as South America, where clothing style is such that sunlight activity may not be hindered, vitamin D deficiency is still becoming a major public health problem.⁸

Thus Vitamin D deficiency is wide spread in South Asian especially in Pakistani population and is contributing to burden of disease in this region. It is suggested that a national program on the supplementation of vitamin D and public awareness through electronic and print media should be undertaken by the government.

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