

**VITAMIN D DEFICIENCY: MYTH OR REALITY**

**Vitamin D Deficiency: Myth or Reality**

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### **Abstract**

Vitamin D Deficiency is a complex issue that is widely known as a severe and degenerative syndrome. This condition has spread in many developing countries and has become a known reality due to its continuous growth as an epidemic. Research as well as several studies from health care professionals has revealed other diseases that this deficiency can be associated with. These studies also elaborate on the effects of the deficiency which can sometimes be detrimental to individuals with the condition. The detrimental aspects of this deficiency include developing impaired bone mineralization, increased bone fragility (Osteomalacia & Osteoporosis) as well as retarded and deformed growth of bones (Rickets). The focus of this research paper includes identifying the etiology of the disease as well as other factors associated with the disease. Different types of Vitamin D are discussed in this review to better explain the link between their roles and the effects that their inadequacies can have on individuals. Vitamin D Deficiency is generally considered to be the precursor for some other degenerative diseases.

### **Vitamin D Deficiency: Myth or Reality**

Vitamin D deficiency, a condition that consists of lack of sufficient amount of vitamin D has become an increasingly critical issue worldwide today. The condition occurs mainly as a result of inadequate concentrations of different types of Vitamin D supply in the body. Vitamin D, a fat soluble vitamin that is found in dietary products such as fortified milks and eggs is essential for promoting adequate calcium and phosphate concentrations that lead to healthy bone mineralization.<sup>4</sup> Lack of sufficient Vitamin D supply over time is considered to be the antecedent for many other diseases. Consistency of this deficiency in infants and adults can lead to other conditions and diseases such as Rickets, Osteoporosis and Osteomalacia. Numerous studies have proven the link between the deficiency and the complications that they can create for individuals in the long run. Health care professionals and researchers have deemed it necessary to address this deficiency as an important issue in order to eliminate the possible calamities that it can create for individuals. Vitamin D deficiency is an actuality simply because it accounts for various diseases that many individuals suffer from today.

Exposure to the sun plays a major role in preventing Vitamin D deficiency; it is one of the major sources of Vitamin D. Vitamin D is produced when UV rays from the sun make contact with the skin and initiate Vitamin D synthesis.<sup>1,4</sup> Other sources of Vitamin D include food and dietary sources including dairy products such as milk and cheese. Fortified foods are considered to provide most of the vitamin D concentrations for individuals. These foods are usually what constitute part of well balanced meals for individuals. According to the Adequate Intakes (AI) from the Daily Reference Intakes (DRI) committee, an average adult is required to have at least 5mcg/day. This Adequate Intake for Vitamin D is said to be sufficient enough to maintain bone health, normal calcium concentrations and metabolism for healthy people.<sup>6</sup> Dietary supplements

are also another well known source for increasing Vitamin D intakes. These are essential for individuals who do not get sufficient amount of Vitamin D intake; who are more susceptible to other diseases and disorders associated with the deficiency. Vitamin D sources that come from supplements are usually available in two forms; D<sup>2</sup> (Ergocalciferol) and D<sup>3</sup> (Cholecalciferol).<sup>4, 8</sup> These two sources are said to elevate Serum 25 (OH) D levels (Calcidiol levels used to detect Vitamin D deficiency); however research and evidence has proven that they are metabolized differently.<sup>4</sup> A Serum 25 (OH) D level is considered to be the best determinant for the presence of deficiency in Vitamin D. Depicted below is a table illustrating different serum levels and diagnosis associated with each. This table further explains in detail the different levels as well as ranges for concentrations and their relation to individuals' health.

**Table 1: Serum 25-Hydroxyvitamin D [25(OH) D] Concentrations and Health\***

<b>ng/mL**</b>	<b>nmol/L**</b>	<b>Health status</b>
<10-11	<25-27.5	Associated with vitamin D deficiency, leading to rickets in infants and children and osteomalacia in adults
<10-15	<25-37.5	Generally considered inadequate for bone and overall health in healthy individuals
≥15	≥37.5	Generally considered adequate for bone and overall health in healthy individuals
Consistently >200	Consistently >500	Considered potentially toxic, leading to hypercalcemia and hyperphosphatemia, although human data are limited. In an animal model, concentrations ≤400 ng/mL (≤1,000 nmol/L) demonstrated no toxicity

\* Serum concentrations of 25(OH)D are reported in both nanograms per milliliter (ng/mL) and nanomoles per liter (nmol/L).

\*\* 1 ng/mL = 2.5 nmol/L

Maryland. National Institute of Health. “*Dietary Supplement Fact Sheet: Vitamin D.*” Office of Dietary Supplements. 2009 < <http://ods.od.nih.gov/factsheets/vitamind.asp>>

There are three main forms of Vitamin D; one of them being the most effective determinant for Vitamin D deficiency. Cholecalciferol, is the inactive form of Vitamin D<sub>3</sub> which is usually made when the skin comes in contact with sunlight. As mentioned earlier, it is also in the form of a Vitamin D supplement. The second is Calcidiol (25 (OH) D<sub>3</sub>) which is made from Cholecalciferol. This form of Vitamin D is usually used to measure the concentrations levels of Vitamin D in infants, adults and elderly and is proven to be the most effective. It is also known as the Serum 25 (OH) D which is the major circulating metabolite of Vitamin D that's demonstrates Vitamin D inputs from dietary intakes.<sup>4,8</sup> The last form, Calcitriol (1, 25 (OH)<sub>2</sub> D<sub>3</sub>) is an active form of Vitamin D found in the body. It is derived from Calcidiol in the kidneys and tissues; it is the most powerful steroid hormone made from Cholecalciferol.<sup>8</sup> This form unlike Calcidiol is not a good indicator Vitamin D level measurement simply because the serum concentrations are controlled by parathyroid hormones, calcium and phosphate.<sup>4</sup>

Inadequate amount of Vitamin D supply in the body is generally considered to be the main contributing factor to the deficiency. In addition to that, other factors contribute immensely towards individuals chances of having the deficiency. Hypocalcaemia, for one which is a condition that consists of low serum calcium levels in the blood is considered to be another known contributing factor. This can be associated with the deficiency because similar to Vitamin D, calcium plays an important role in the formation of healthy bones. Since Vitamin D is said to help absorb calcium in the body, individuals who are have Hypocalcaemia tend to sometimes have the Vitamin D deficiency as well. Studies have shown that when individuals gets older, their kidneys are less able to convert Vitamin D to its active form thereby increasing their chances for getting other diseases associated with the deficiency. This inability can be a contributing factor because the kidneys play a major role in Vitamin D synthesis. The kidneys

have to be fully active so that they can promote the metabolism of Vitamin D. An abnormality in the kidney such as a kidney disease can interrupt conversion of Vitamin D into active metabolites.<sup>8</sup>

The effects of the deficiency can sometimes be detrimental for individuals including infants and adults. The detrimental aspects include developing Rickets; a condition where there is a deformity in the bones. This disease usually occurs in infants and children when there are severe low levels of Vitamin D. The presence of limited Vitamin D supply causes interruption for maturation of Chondrocytes as well as normal mineralization of the bones.<sup>5</sup> In adults, Osteomalacia can occur where there is pronounced bone and muscle weakness. Another condition, Osteoporosis which is most common amongst the elderly can occur as a result of the effects of the deficiency as well. Osteoporosis is considered to be a metabolic disease of the bones where generally there is a low bone mass and deterioration of bone tissue.<sup>5,6</sup> Unlike Rickets and Osteomalacia, this disease is considered to be the actual long term effect of calcium and Vitamin D deficiency.<sup>6</sup>

**Table 1 Worldwide prevalence of rickets.**

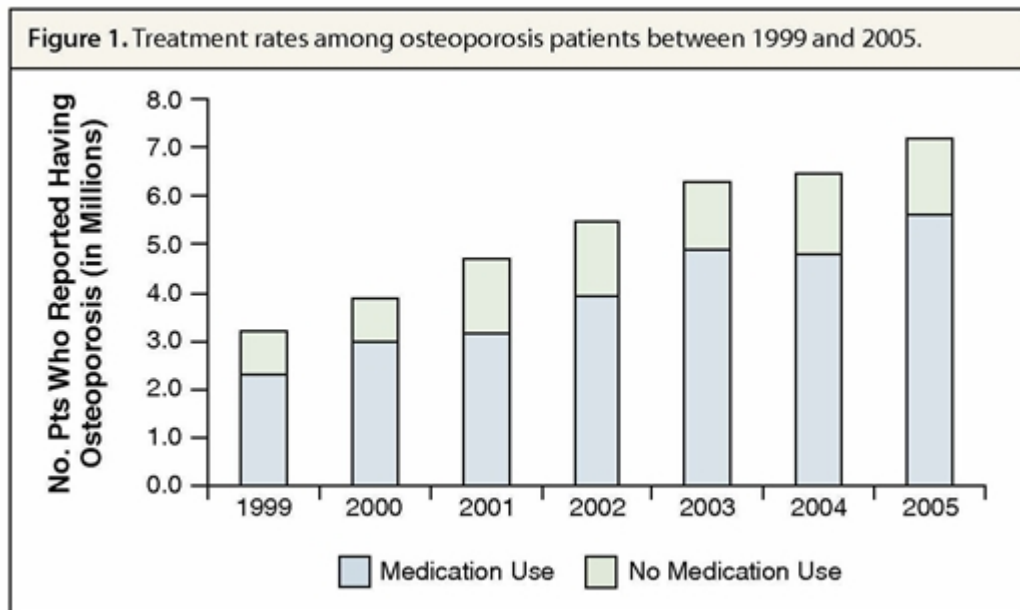
Country	Year	Percentage
Asia, Middle East, and Africa		
Mongolia	1998	70
Tibet	1994	66
Ethiopia	1997	42
Yemen	1987	27
Turkey	1994	10
Nigeria	1998	9
Europe		
The Netherlands – macrobiotics	1990	55
UK – Manchester, minorities*	2002	1.6

\* Ethnic minorities, 77% were of SE Asian origin (predominantly Pakistani).

Prevalence of clinical or radiological rickets in children not suffering from other diseases reported within the last 20 years.<sup>1,7-10</sup>

Ann Prentice. "Vitamin D Deficiency: a global perspective." 2008. Nutrition Reviews Vol. 66 (Suppl. 2): S153-S164

The statistics below were derived based on an annual count of people with Osteoporosis in the U.S population. Approximately 3.2 million patients were reported with the disease; this number rose to about 7.2million by the year 2005. More than half of the populations with the disease were reported using some form of medication to control the disease.



Joel F. Farley et al. "Trends and Determinants of Prescription Medication use for treatment of Osteoporosis." 2009. Am J health-Syst Pharm Vol 66:1191-1201

Treatment for the deficiency relates back to its causes. As mentioned already some of the contributing factors to the deficiency include not enough exposure to sunlight, absence of Vitamin D and calcium supply as well as dietary supplements in the body. Obviously individuals who have developed diseases related to the deficiency will have to receive care from a health professional or health institution, but they can also manage the disease or condition following the treatments mentioned above. In the earlier stages, some of these diseases like Osteomalacia may not have any apparent symptoms, however after the condition worsen, individuals may begin to experience certain symptoms related to bone pain and muscle weakness.<sup>5,6</sup> It is imperative that

individuals report this to their physician or health care facility to get testing such as x-rays, urine tests and biopsies done so that effective measures can be carried out immediately to manage the condition. Other conditions such as Rickets for instance can be easily corrected by encouraging a diet rich in calcium and Vitamin D for children that are affected. Sufficient intake of calcium and Vitamin D in children is critical for maintaining and developing strong bones. Elevated vitamin D and calcium intake levels can potentially eliminate the effect of rickets completely. <sup>6</sup>

It is evident that Vitamin D deficiency is indeed more of an actuality than a myth. The effects of the deficiency can be linked to many other complications and disorders that exist extensively today and this is simply the main reason that makes it more of a reality. Some of these disorders or diseases can occur in either infants in the form of rickets or in adults in form of Osteoporosis. Although disorders like Rickets are not prevalent here in the United States, they are generally considered to be predominant in other developing countries. This therefore makes it a critical issue that has to be addressed appropriately. Osteoporosis however is more common here in the United States; studies are showing that the incidence rates are increasing which is depicted in the graph demonstrated in the body of this review. Preventive measures are one of the most effective ways of preventing these disorders. Some of these measures include getting adequate exposure to sunlight and eating meals that are sufficient with vitamin D and calcium supply. These measures are also considered to be effective for people who have some of the diseases caused by the effects of the deficiency. Therefore, it is imperative that individuals who are at risk or not conform to these effective measures in order to prevent the chances of developing the deficiency as well as achieve optimum conditions for their health.

**References.**

- (1) Ann Prentice. “*Vitamin D Deficiency: a global perspective.*” 2008. Nutrition Reviews Vol. 66 (Suppl. 2): S153-S164 <<http://web.ebscohost.com.proxy-ub.researchport.umd.edu/ehost/pdf?vid=6&hid=113&sid=e9b7a233-487e-47d7-b0f3-f684f1ddf18e%40sessionmgr112>>
- (2) JJ Cannell et al. “*Diagnosis and treatment of Vitamin D Deficiency.*”2008 <<http://www.corepsychblog.com/wp-content/uploads/useful-references/vitd3overview.pdf>>
- (3) Joel F. Farley et al. “*Trends and Determinants of Prescription Medication use for treatment of Osteoporosis.*”2009. Am J health-Syst Pharm Vol 66:1191-1201 <<http://web.ebscohost.com.proxy-ub.researchport.umd.edu/ehost/pdf?vid=11&hid=113&sid=e9b7a233-487e-47d7-b0f3-f684f1ddf18e%40sessionmgr112>>
- (4) Maryland. National Institute of Health. “*Dietary Supplement Fact Sheet: Vitamin D.*” Office of Dietary Supplements. 2009 <<http://ods.od.nih.gov/factsheets/vitamind.asp>>
- (5) Michael F. Holick et al. “*High Prevalence of Vitamin D Inadequacy and Implications for Health.*” Mayo Clinic Proceedings. 2006; 81(3): 353-373 <<http://web.ebscohost.com.proxy-ub.researchport.umd.edu/ehost/pdf?vid=8&hid=113&sid=e9b7a233-487e-47d7-b0f3-f684f1ddf18e%40sessionmgr112>>
- (6) S.A Lanham-New et al. “*Importance of Vitamin D, Calcium and Exercise to Bone Health with Specific Reference to Children and Adolescents.*” British Nutrition Foundation. 2007: 32, 364-377

(7) Wikipedia. The Free Encyclopedia. "*Hypocalcaemia.*"<

<http://en.wikipedia.org/wiki/Hypocalcaemia>>

(8) Wikipedia. The Free Encyclopedia. "*Vitamin D.*"<

[http://en.wikipedia.org/wiki/Vitamin\\_D](http://en.wikipedia.org/wiki/Vitamin_D)>