

Is Vitamin D the Elixir of Life?

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ABSTRACT

In recent years, there has been increasing acknowledgment of the important role mental health plays in achieving global development goals, as illustrated by the inclusion of mental health in the Sustainable Development Goals. Depression is one of the leading causes of disability. Suicide is the fourth leading cause of death among 15-29-year-olds. People with severe mental health conditions die prematurely – as much as two decades early – due to preventable physical conditions. Despite progress in some countries, people with mental health conditions often experience severe human rights violations, discrimination, and stigma. Many mental health conditions can be effectively treated at relatively low cost, yet the gap between people needing care and those with access to care remains substantial. Effective treatment coverage remains extremely low. Vitamin D, a fat-soluble vitamin, is well-known for its role in bone health, and research on its effects on mental health has only recently emerged. Vitamin D deficiency is widespread worldwide, and it has been linked to an increased risk of depression. We have assessed, treated, and followed up on 46 patients that are diagnosed with Vitamin D deficiency and noted a marked improvement in the resolution of clinical symptoms through Vitamin D supplementation, either orally or through intramuscular injection. We have also reviewed literature that shows us that Vitamin D deficiency is a risk factor for depression and explored studies that show us the effects of using or supplementing Vitamin D in preventing depression among various populations. Vitamin D testing and treatment is a subject of controversial scientific discussions, and it is challenging to navigate through the expanding vitamin D literature with heterogeneous and partially opposed opinions and recommendations. In this narrative review, we aim to provide an update on vitamin D guidelines and the current evidence on the role of vitamin D for human health with its subsequent implications for patient care and public health issues. Vitamin D is critical for bone and mineral metabolism, and it is established that vitamin D deficiency can cause rickets and osteomalacia. While many guidelines recommend target serum 25-hydroxyvitamin D (25[OH]D) concentrations of ≥ 50 nmol/L (20 ng/mL), the minimum consensus in the scientific community is that serum 25(OH)D concentrations below 25–30 nmol/L (10–12 ng/mL) must be prevented and treated. Using this latter threshold of serum 25(OH)D concentrations, it has been documented that there is a high worldwide prevalence of vitamin D deficiency that may require public health actions such as vitamin D food fortification. On the other hand, there is also the reason for concern that an exploding rate of vitamin D testing and supplementation increases costs and might potentially be harmful. In the scientific debate on vitamin D, we should consider that nutrient trials differ from drug trials and that apart from the opposed positions regarding indications for vitamin D treatment we still have to better characterize the precise role of vitamin D for human health. Osel Group, a private healthcare organization headquartered in Malaysia, with an extensive presence in therapeutics and innovative medical research in Malaysia, Hong Kong, Singapore, and the United States of America; is a member of the United Nations Global Compact and subscribes to United Nations Sustainable Development Goals. Osel Group advocates public-private-people (PPP) collaboration toward solving global problems.

Keywords: vitamin D; human health; mental health

INTRODUCTION

Depression is expected to be the second leading cause of burden of illness by 2030 after Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS). [1] As the vitamin D receptor is found in areas of the brain that are implicated in the development of depression, vitamin D has been linked with depressive symptoms and other psychiatric disorders. [2] Vitamin D plays a vital role in mental health and cognitive functions. [3] Intra and extracellular calcium concentration in neurons is controlled by Vitamin D. [4]

Researchers discovered that patients with low vitamin D levels undergo mood disorders. [5] Vitamin D can exert its effect on neurocognition through several mechanisms such as induction of neuroprotection, modulation of oxidative stress, regulation of calcium homeostasis, and inhibition of inflammatory processes. [6] Patients with schizophrenia demonstrate lower levels of vitamin D. [7]

METHODS

Within our clinical practice guidelines, a cut-off range for the 25-hydroxyvitamin D (25[OH]D) biomarker is

characterized as below:

- (1) Deficiency: < 52
- (2) Insufficiency: 52 - 73
- (3) Sufficiency: 74 - 250
- (4) Toxicity: > 250

The authors have investigated and screened 46 patients samples with 25-hydroxyvitamin D (25[OH]D) biomarker. These groups of patients reported feeling generally "unwell", "fatigue", "not sleeping well", "unable to concentrate", "depression or feelings of sadness", "hair loss", "muscle weakness", "loss of appetite" and "getting sick more easily". These patients are being further assessed, interviewed, and followed by the authors for 12 weeks. Their 25-hydroxyvitamin D (25[OH]D) biomarker result is around the range of 50 - 70 nmol/L. These patients are given supplementation of Vitamin D either through oral supplementation of 25,000 IU weekly to fortnightly or intramuscular Vitamin D injection of 300,000 IU once every 6 to 8 weeks for 3 doses in total. After about 12 weeks of follow-up, the patients generally reported marked improvement to a total resolution of symptoms. No vitamin D toxicity symptoms are observed and no other adverse events are reported.

Vitamin D and Brain Function

The facts about the importance of vitamin D for human brain functioning are increasing. The prefrontal and cingulate cortex, hippocampus, and hypothalamus are predominantly abundant in vitamin D receptors and vitamin D activating enzymes. However, many other areas contain them to some level too. [8] Vitamin D is a neurosteroid that can affect brain development and function by influencing many regulatory processes. [9] Therefore, associations between vitamin D deficiency and mental disorders, especially those regarding thought and memory processing as well as neuroendocrine axes seem likely. Vitamin D deficiency may be linked with an increased risk of acquiring Alzheimer's disease and dementia. [10]

Association between vitamin D deficiency and mental health

Vitamin D is a modified steroid, synthesized in the skin under the stimulus of sunlight and is essential for the metabolism of calcium and phosphorus. Its RDA is 400 IU or 10 mg, it binds to the receptor of target cells and controls through gene expression. [11] Poor diet, insufficient sun exposure, reduced synthesis of vitamin D, and reduced renal hydroxylation of 25(OH) D due to old age are the key reasons for Vitamin D deficiency. [12] Expression of the receptor for 1,25(OH)₂D₃ (Vitamin D receptor, VDR) has been defined in the brains of several species. [8] Subjects with serum 25(OH)D levels <40 nmol/L scored significantly higher (more depressive characteristics) than those with serum 25(OH)D levels ≥40 nmol/L. Supplementation with high doses of vitamin D seems to improve these symptoms indicating a likely causal connection. [13] The suicide attempters had significantly lower mean vitamin D levels as compared to the non-suicidal depressed patients and the healthy controls. [14] A cross-sectional study indicates that a higher serum 25(OH)D concentration is significantly linked with a decreased risk of depressive disorder and depressive symptoms in a typical sample of the Finnish adult population. [15] Vitamin D sufficiency is best established by measurement of the 25-hydroxyvitamin D concentration in the blood. [16]

Within the central nervous system, Vitamin D is included in neurotransmitter synthesis, neuroprotection from injury and inflammation, regulation of circadian rhythms and sleep, and crucial roles in neurodevelopment. [17]

Psychiatric and neurological illnesses with possible associations with Vitamin D deficiency (hypovitaminosis D) include schizophrenia, autism, Parkinson's disease, amyotrophic lateral sclerosis, Alzheimer's disease, and multiple sclerosis. [18] A mini meta-analysis displaying lower Vitamin D levels in individuals with psychotic disorders, predominantly schizophrenia, as compared to healthy controls. [19] The connection between low Vitamin D and neuropsychiatric illness is also detected in multiple sclerosis and major depression. [17] A systematic review of 14 epidemiological studies discovered that the incidence of low vitamin D serum concentrations was about 30% higher in patients with depression. [20] A meta-analysis found a strong connection between vitamin D deficiency and schizophrenia. Mean serum vitamin D levels were significantly lower in patients with schizophrenia compared with controls. The incidence of vitamin D deficiency was also high in schizophrenic patients. [21] However, some studies did not support the link between vitamin D deficiency and mental disorders: did not demonstrate significant connections between serum concentrations of 25(OH)D and the manifestation of moderate-to-severe depression, major depression, or minor depression among US adults. [22] No statistically significant association between vitamin D level and depression was found in young women aged 18 to 24 years. [23] Depressive symptoms are not linked with 25(OH)D concentrations in middle-aged and elderly Chinese. [24]

Effect of Vitamin D Supplementation on Depression

A meta-analysis comprising 29 studies with 4,504 participants, demonstrated that the use of vitamin D was beneficial to decrease the prevalence of depression and improvement of depression treatment. The effects of vitamin D with a daily supplementary dose of >2,800 IU and intervention period of ≥ 8 weeks were considered significant in both prevention and treatment investigations which showed that vitamin D has a beneficial effect on both the prevalence and the prognosis of depression. [25]

CONCLUSION

Is Vitamin D the elixir of life? The data on the benefit of mortality, prevention of infections, improving mental health status, and general well-being, at least in severely deficient individuals, appear convincing. Vitamin D is not a panacea and is most likely efficient only in deficiency. Vitamin D inadequacy or deficiency is widespread in patients with mental illness and is extensively influenced by lifestyle factors, such as diet, physical inactivity, and tobacco smoking. Given its rare side effects and its relatively wide safety margin, it may be an important, inexpensive, and safe adjuvant therapy for many diseases, but future large and well-designed studies should evaluate this further. A worldwide public health intervention that includes vitamin D supplementation in certain risk groups, and systematic vitamin D food fortification to avoid severe vitamin D deficiency, would appear to be important. Besides vitamin D supplementation, psychosocial intervention can encourage and help sustain physical activity, proper diet, quitting smoking and reasonable sun exposure to prevent and treat Vitamin D deficiency in patients with mental health ought to be employed, assessed, and established in clinical practice. [26]

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