

Vitamin D - A sunshine hormone

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INTRODUCTION

Vitamin D was considered only as a vitamin, but its role as a Preprohormone is gaining importance due to its wide range of non-calcemic benefits. So, it should be better addressed as a Sunshine Hormone rather than a vitamin.

The roots of Vitamin D discovery dates back to 1650. F. Glisson¹ described rickets in detail. In 1824 D.Scheutte was the first person to use cod liver oil (a source of vitamin D) for a long time for the treatment of rickets. In 1906, Hopkins postulated the existence of essential dietary factors necessary for the prevention of rickets. In 1914, Mc. Collum and his team isolated a fat soluble factor from butter fat and named it as Fat-soluble factor A (later called as vitamin A) and treated Xerophthalmia in rats. Later in 1922, they observed that heated, oxidized cod liver oil could not prevent Xerophthalmia but could cure rickets in the rats and they considered that fat soluble factor A consisted of two entities – vitamin A and vitamin D. Later, Professor HarrietteChick² and her team observed that sunlight would cure rickets just as well as cod liver oil. In 1928, Adolf Windaus³ was awarded Nobel Prize for his studies on vitamin D.

Vitamin D is present in 2 forms - Ergocalciferol or vitamin D₂(present in plants and some fish) and Cholecalciferol or vitamin D₃. It is synthesized in the skin by sunlight. Humans can fulfill their vitamin D requirements by either ingesting vitamin D or being exposed to the sun for enough time to produce adequate amounts.

Vitamin D₃ is synthesized from 7-dehydrocholesterol in the skin by UVB light. The vitamin D binding protein transports the vitamin D₃ to the liver where it undergoes hydroxylation to 25(OH)D (the inactive form of vitamin D) and then to the kidneys where it is hydroxylated to active form 1,25(OH)D by 1 α hydroxylase. This enzyme is also present in a variety of extrarenal sites including osteoclasts, skin, colon, brain and macrophages.

Half-life of Vitamin D in the liver is 3 weeks. The major circulating form is 25(OH) Vit D. High Performance Liquid

chromatography – Tandem mass spectroscopy is the gold standard method to measure serum Vit D levels.

Vitamin D and Osteoporosis :

Osteoporosis is the most common metabolic bone disease in the world. A low vitamin D level is an established risk factor for osteoporosis. Inadequate serum vitamin D levels will decrease the active transcellular absorption of calcium.

Non- Calcemic benefits of Vitamin –D :

Vitamin D and Cancers : Adequate sun exposure and vitamin D levels are protective against breast, colon, pancreas, ovary and urinary bladder malignancies. DINOMIT⁴ model of cancer progression outlines the benefit of vitamin D in restraining cancer development and spread.

Type -1 Diabetes: Adequate serum vitamin D levels in infancy have been associated with a lower risk of type 1 diabetes in adulthood. A qualitatively similar difference in diabetes risk is reported from the EURODIAB⁵ study in which countries recommending vitamin D supplementation in infancy had lower type I DM incidence rates by age 15 than those countries not recommending vitamin D.

Pregnancy: Vitamin D supplementation during pregnancy decreases the risk of maternal preeclampsia, gestational diabetes, preterm labour, gingivitis and periodontal disease in the mother and impaired fetal growth, impaired dentition and risk of Respiratory Syncytial virus infection in the infant.

Multiple Sclerosis⁶: Vitamin D supplementation lowers the risk of MS by 40%. Vitamin D affects the growth and differentiation of immunomodulator cells such as macrophages, dendritic cells, T cells and B cells. This immune-modulatory effect is implicated in the pathogenesis of other autoimmune diseases including Rheumatoid arthritis, SLE, Type I DM and Inflammatory bowel disease.

Alzheimer's disease: Patients with Alzheimer's dementia have lower vitamin D levels. The biological plausibility of this relationship includes vitamin D's antioxidative effects and the presence of vitamin D receptors in the hippocampus.

Chronic pain syndrome: Vitamin D deficiency may also correlate with chronic pain syndromes, including chronic low back pain.

Bronchial asthma: Vitamin D deficiency is highly prevalent in patients of bronchial asthma. Vitamin D deficiency influences the inflammatory responses in the airways. Significant correlation exists between the serum vitamin D levels and pulmonary function tests.

Poly cystic ovarian syndrome: ⁷ Vitamin D plays an important role in patients of PCOS. It improves fertility, decreases androgen levels, improves insulin resistance and decreases low grade inflammation.

Sun exposure:

The healing power of the sun and its use in medical treatment (heliotherapy⁸) have roots extending back into antiquity. Heliotherapy was used in Europe and North America for the treatment of cutaneous tuberculosis, for which Niels Finsen was awarded the Nobel Prize for Medicine in 1903. Active UVA radiation exposure results in decrease in diastolic pressure by 5mm Hg on an average, resulting in decreased risk of stroke and CAD.

Exposure of arms and legs to UVB light for 5 to 30 minutes between the hours of 10 am and 3 pm twice a week can be adequate to prevent vitamin D deficiency. Additionally, human skin produces beta-endorphin in response to UVB exposure which increase a feeling of well-being, boosting the immune system, relieving pain, promoting relaxation, wound healing and cellular differentiation. Light signals received through the eye regulate production of melatonin and serotonin for circadian rhythm control and also play a role in Seasonal affective disorder. Regardless of the amount of sun exposure, the serum 25(OH)D concentration does not increase to more than approximately 60 ng/ml.

Vitamin D levels: (Serum 25(OH) D):

Deficiency	< 20 ng/ml
Insufficiency	20-29 ng/ml
Normal	30 - 100 ng/ml
Toxicity	> 100 ng/ml

CONCLUSION

Vitamin D deficiency is very common in all age groups. Few foods contain vitamin D, therefore guidelines recommend vitamin D supplementation at tolerable levels along with optimal sunexposure. Its role as a hormone is gaining importance. Its impact in promotion of overall health and prevention of chronic diseases are at the forefront of research.

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