Section: Physiology

Research

PREVALENCE OF VITAMIN D DEFICIENCY AMONG POPULATION IN SOUTH INDIA: A CROSS SECTIONAL STUDY

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Abstract

Background: High prevalence of vitamin D deficiency is seen in general population in South India. Exposure to sun is the main source of vitamin D. But our present lifestyle provides very less sun exposure. Most people are confined to indoors leading a sedentary life. Our cultural and social practices do not provide enough sunlight exposure. Dietary source of vitamin D are animal products and food items fortified with vitamin D. But vitamin D fortification of food items is very rare. The aim is to assess the serum vitamin D levels in healthy individuals. **Materials and Methods:** A cross sectional study was conducted in ninety apparently healthy individuals attending Comprehensive health care clinic in a tertiary care hospital. Serum vitamin D was analyzed. **Result:** Among the ninety apparently healthy individuals included in the study, a high prevalence of hypovitaminosis D was noted. 70 percent of the people had vitamin D deficiency who were otherwise healthy. **Conclusion:** Hypovitaminosis D is highly prevalent in the general population.

INTRODUCTION

Vitamin D, the fat-soluble sunshine vitamin is a steroid hormone precursor and it is biologically inert.[1,2] Food items containing vitamin D are very few. The major source of vitamin D is sunlight. It is synthesized in the human skin through sun exposure. So vitamin D is rightly called the sunshine vitamin. On exposure to ultraviolet Blight, the initially synthesized vitamin D is biologically inactive and its half-life is 12-16 hours. Later it is converted to 25-OH vitamin D in the liver and in the kidney to 1,25(OH)2 vitamin D which is biologically active. Vitamin D3 (cholecalciferol) and vitamin D2 (ergocalciferol) which are two important forms of vitamin D are hormone precursors which play a major role in metabolism of calcium and phosphate. Thus it plays an important role in maintaining bone health. 1,25 dihydroxy vitamin D is a steroid hormone and it acts by binding to the vitamin D receptor (VDR) seen inside the cell. Vitamin D receptors are seen all over the body and so it is involved in many physiological processes. Thus vitamin D deficiency will adversely affect the bone metabolism. Deficiency of the sunshine vitamin is also associated with a wide range of diseases. So vitamin D very much essential for maintaining normal health.

Hypovitaminosis D is a global issue and its consequences are widespread. Vitamin D deficiency need not be always symptomatic. Subclinical hypovitaminosis D is widely prevalent in general population. This can cause a major risk of developing health problems in the future. Alteration in bone mineral density can lead to osteoporosis. Hypovitaminosis D is also associated with various cardiovascular and metabolic disorders. This makes it important to study the prevalence of the deficiency of the sunshine vitamin.

MATERIALS AND METHODS

A cross sectional study was conducted in 90 apparently healthy individuals attending Comprehensive health care clinic in a tertiary care hospital in Kerala after obtaining written informed consent. The study was conducted between November 2015 and July 2017 after approval from Dissertation Review Committee and Ethical clearance. With 95% confidence and 20% relative error, the minimum sample size was calculated to 15. We included 90 healthy individuals in our study

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which would give a confidence of 99% and relative error of 15%. With 95% confidence and 80% power, the minimum sample size was 5. We included 90 healthy individuals giving 99% confidence and 90% power.

Inclusion Criteria

90 apparently healthy individuals between 18 and 65 years of age.

Exclusion Criteria

1. Individuals below 18 years and above 65 years of age.
2. Conditions known to affect the vitamin D levels like liver disease, renal disease, skeletal disease, cardiovascular disease and primary malnutrition.
3. Individuals on calcium and vitamin D supplementation
4. Individuals with malignancies or any other chronic illness

Study Tools

A detailed history, general examination and systemic examination was done on the first visit to the Comprehensive health care clinic. Blood pressure was measured in millimetres of mercury. A calibrated weighing machine was used to measure the weight in kilograms. A stadiometer was used to measure the height in centimetres. Body mass index was calculated. Other details like sunlight exposure, occupation, history of smoking and alcohol consumption, diet was collected using questionnaire. Laboratory test values like HbA1C, fasting blood sugar, renal function and liver function tests were collected from latest lab reports.

2ml blood was drawn by venepuncture and serum was separated by centrifuging at 3000 rpm for 5 minutes. Serum was stored at -200 Celsius until the analysis for the estimation of vitamin D which was done with Cobas E411 and vitamin D total Roche reagent based on Electro Chemiluminescent Immuno Assay (ECLIA).

Subjects were classified as vitamin D deficient, insufficient and sufficient based on the serum vitamin D concentration of < 20, 20-30 and >30 ng/ml respectively according to recent consensus.[3,4]

IBM SPSS version 20.0 was used for performing data analysis. Numerical variables were expressed as mean and standard deviation. Categorical variables were expressed as frequency and percentages. Karl Pearson correlation coefficient was applied to obtain the correlation between two numerical variables. Kruskal Wallis test was applied to test the statistical significance of serum vitamin D levels among Cambridge grades, since it is significant Dunn Bonferroni multiple comparison test was applied. p value of <0.05 was considered as statistically significant.

RESULTS

Serum vitamin D levels of 90 apparently healthy individuals were analyzed. Serum calcium levels, serum vitamin D levels and body mass index were correlated within the study group. Among the study group 45 were females and 55 were males. The mean age of subjects was 46.19+ 13.68 years. 47.5% were smokers and 45% were alcoholics among the study group. 38.5% of the study group was vitamin D deficient, 45% was vitamin D insufficient and 16.5% had normal vitamin D levels. Serum calcium and serum vitamin D levels positively correlated with each other. Duration of sunlight exposure had a negatively correlated with serum vitamin D levels. ($p < 0.0001$) Serum vitamin D and calcium levels were significantly lower in females as compared to males in our study.

We did not find any correlation between dietary habits and serum vitamin D levels. Family history also did not correlate with serum vitamin D levels.

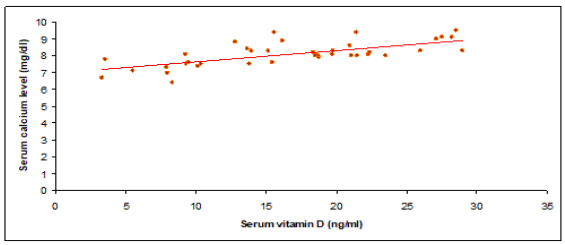

Figure 1: Correlation between serum vitamin D levels and serum calcium levels in study group

Table 1: Correlation between BMI and duration of sun exposure.

	Serum vitamin D (ng/ml)		
	n	**Pearson Correlation**	**p Value**
Duration (hours)	90	- 0.602	<0.001

Table 2: Comparison of serum Vitamin D levels between male and female subjects

Groups	**n**	**Serum vitamin D (ng/ml)**		**p Value**
		Mean	**SD**	
Females	45	16.91	7.17	<0.05
Males	55	22.43	6.09	

Table 3: Comparison of BMI between male and female subjects.

Groups	**n**	**BMI (kg/m^2)**		**p Value**
		Mean	**SD**	
Males	55	19.98	1.40	<0.001
Females	45	24.36	1.87	

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DISCUSSION

Hypovitaminosis D is an alarming concern that we are facing in the recent times. Our study showed that vitamin D deficiency is highly prevalent in the general population. 38.5% of the study group was vitamin D deficient, 45% was vitamin D insufficient and 16.5% had normal vitamin D levels. Serum calcium and vitamin D levels positively correlated with each other. This shows that vitamin D supplementation could possibly improve calcium levels too. Surprisingly we found that females were more likely to be having vitamin D deficiency as compared to the male population. This may be attributed to lesser exposure to sunlight as compared to males because females are more confined to indoors. We did not find any association between smoking and alcoholism and vitamin D deficiency. Dietary habits and family history also did not correlate with vitamin D deficiency in our study.

Studies conducted in Asian population reveals higher prevalence of vitamin D deficiency.[5] Lower serum calcium values may be due to serum vitamin D deficiency. Calcium is absorption is only 10% in Vitamin D deficient state.[6] Increased loss of calcium through urine may result from hypovitaminosis D. Poor dietary intake of vitamin D and less exposure to sunlight might also have contributed to the lower serum calcium levels in our study group.

Supplementation of the sunshine vitamin can be a solution to this problem. But an earlier study showed that intramuscular supplementation of vitamin D did not considerably improve the deficiency while vitamin D supplementation orally increased the serum levels.[7] Another study reported that only 40% of experimentally applied, radioactively labelled vitamin D3 is absorbed by the intestines of patients with pancreatic exocrine insufficiency,[8] contrary to 80-90% in healthy persons, exocrine pancreatic function gains significance. This leads us to the conclusion that vitamin D deficient individuals should also be screened for any malabsorption disorders.

Vitamin D is very important. It plays an important role in many physiological activities and is required for the proper functioning of different organ systems of the body. Vitamin D is essential for normal bone metabolism and so its deficiency is very well related to many musculoskeletal disorders. It is also seen that this can affect the bone mineral density, gradually leading to osteopenia, osteoporosis and pathological fractures in future. Thus timely intervention is very necessary to prevent such health problems.

Recent times it is known that the sunshine vitamin deficiency can also result in various other negative effects like adverse pregnancy outcomes.[9] Vitamin D has also been found to play a role in malignancies. Miriam PY et al. 2018 reported that vitamin D deficiency has a role in development of breast cancer.[10] Sunshine vitamin also has action in the respiratory system. Supplementation of vitamin D in asthmatics have been found to reduce exacerbation.[11] Vitamin D is also known to have a role in body's immune system. Some studies have shown relation of immune diseases to vitamin D. One such study was by Giorgia et al. 2017 which says patients affected with many immune disorders have very low levels of vitamin D.[12] But is vitamin D the causative factor of immune diseases or has the immune disorder resulted in vitamin D deficiency is still unknown.

India being a tropical country receive enough sunlight and it is presumed that vitamin D deficiency is rare in the subcontinent. But our study findings are totally against this presumption. This may be due to more people confined to indoors, having white collar jobs and also having a sedentary lifestyle. Clinically unrecognized Vitamin D deficiency in the long run can lead to complications like osteoporosis.[6,13,14,15,16,17] Timely intervention thus becomes very important. This can be done only if we screen for vitamin D deficiency.

CONCLUSION

It is high time vitamin D tests should be made part of the routine blood examination which will help us filter our those with deficiencies and take necessary measures. Time and financial constraints made it difficult for us to take a detailed diet history and do DEXA scan to find out the bone mineral density. Further studies with larger sample size must include bone mineral density screening to find out long standing cases of hypovitaminosis D so that timely intervention is possible. This would enhance the standard of living of the general population.

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