Hypovitaminosis-D in medical students: Unrecognized or Undertreated

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ABSTRACT

Introduction: Vitamin D deficiency is a pandemic, non communicable disease in India and worldwide. Vitamin D, which is technically a hormone rather than a fat soluble secosteroid responsible for increasing intestinal absorption of Calcium, Magnesium, Phosphate and multiple other biological effects. Researchers found that shift workers, indoor and healthcare workers are at an increased risk to develop Vit-D deficiency due to reduced outdoor time and sunlight exposure.

Aims and Objective : The rationale of this study was to find the Vit-D (1,25 OH2 Vit D) levels in apparently healthy medical students in Prathima Institute of Medical Sciences, Karimnagar.

Materials & Methods: The present study was done in General Medicine outpatient department, Vit-D levels were assessed in randomly selected 300 medical students with BMI of 18.5-24.9kg/m2, who had no past medical illness. 3ml of fasting venous sample from cubital vein was collected and analyzed for Vit-D levels by ADVIA –CENTAUR-XP automated analyzer by chemiluminescence immunoassay within 12 hrs.

Results: The total number of sample was 300 medical students, of which 160 were females and 140 were males. Among the girl students 77% (123) were Vit-D deficient and 21% (33) were having insufficiency. Among the Boys 66% (92) were deficient and 21% (30) were insufficient and 13% (18) were having normal Vit-D levels. Among the 300 medical students, 278 (92.7%) were having low vitamin D levels and only 22 (7.3%) were having normal Vitamin D levels.

Conclusion: A very high percentage of students were Vit-D deficient which correlates with higher incidence among health care workers. Limitations for the present study are it's a cross sectional study than longitudinal study. No validated questionnaire was used, analysis method used was not gold standard, needs study in a larger population group. However it is a safer practice to supplement all the students with Vitamin D supplements.

Keywords: 1, 25 (OH)2 Vit-D levels, Medical students, chemiluminescence method.

INTRODUCTION

Vitamin D is synthesized in fairly sufficient amounts on exposure to sunlight (Ultraviolet B rays) through the skin and also can be obtained by diet containing milk & milk products and also sea foods. Vit-D is available in two forms i) Vit-D2 or Ergocalciferol, ii) Vit-D3 Cholecalciferol derived from 7-dehydrocholecalciferol by UVB radiation of skin. Vit-D is a prohormone which requires hydroxylation at two steps

i) Liver: Hydroxylation at C-25, resulting in 25hdroxy Vit-D (Calcidiol) the major circulatory form of Vit-D.

ii) Kidney: hydroxylation at C-1?, to produce 1,25 OH2 cholecalciferol or active Vit-D, which binds to Vit-D receptors.

Vit-D receptors were found mostly in the target cells of enterocytes, osteoblasts and distal renal tubular cells, to some extent in the Parathyroid gland cells, skin keratinocytes, promyelocytes, lymphocytes, colon cells, pituitary cells and ovarian cells, but failed to represent in the Liver, skeletal muscles and heart muscle.

Vit-D deficiency leads to Rickets in children and Osteomalacia in adults, low Vit-D levels in adults also can induce hyperparathyroidism, leading to decreased bone mass in the form of osteopenia and osteoporosis with its consequent pathological or fragile fractures.

Rickets can be classified into

i) Vitamin D- Deficiency or classical Rickets (low endogenous Vit-D)

ii) Vitamin D- Dependant Rickets type 1 (1? hydroxylase deficiency) and type 2 (mutation in the Vit-D receptor)

iii) Vitamin D- Resistant Rickets (defect in tubular reabsorption of phosphate).

Functions of Vit-D unrelated to calcium:

a) Terminal differentiation of promyelocytes to monocytes and then to giant osteoclasts through RANKL system.[1]

b) In patients with chronic kidney disease with Renal osteodystrophy, Vit-D supplementation will keep the

preproparathyroid gene under control, otherwise Vit-D deficiency and adequate calcium levels in circulation will result in proliferation of parathyroid cells, hypersecretion of parathormone and secondary hyperparathyroidism.[2]

c) Vit-D is associated with development of T-cell mediated immunity, deficiency of which related to many autoimmune disorders like Multiple Sclerosis, Autoimmune encephalomyelitis and Type1DM[3], SLE[4], IBD[5], and RA.[6] In Type 1DM, large doses of Vit-D supplementation could suppress the autoimmune destruction of ß-Islet cells and prevent the risk of developing DM.[7,8]

d) Vit-D supplementation could result in decreased Atopy, viral infection, asthma exacerbations and increase in steroid responsiveness, lung maturity and lung function in both children and adults.

e) Low Vit-D levels in PCOS patients were associated with increased insulin resistance, Ovulatory and menstrual irregularities, lower pregnancy success, Hirsutism, Obesity and elevated Cardiovascular risk factors.

f) Vit-D deficiency during early pregnancy is associated with increased risk for development of pre-eclampsia.

g) Population based studies showed that people living in higher altitudes are at increased risk for development of prostate, breast, ovarian, colorectal, lung and esophageal cancers especially at 30-50% increased risk when 25OHD levels were below 20ng/ml.[9,10]

In recent studies on Vit-D levels from India, with mostly sunshine regions reveals that 70-100% of patients having hypovitaminosis-D because of social and cultural practices and also because of nutritional deficiency.[11]

In Karimnagar district of Telangana state with average annual temperature of 27.7°C, most of the medical students are vulnerable to the development of Vit-D deficiency due to in-house curriculum and reduced sun exposure hence the present study was undertaken.

METHODS & MATERIALS

In this cross sectional present study, 300 medical students with 160 girls and 140 boys were included, who are apparently healthy and not having any previous medical illness.

Medical students with normal BMI (18.5-24.9kg/m^2) were considered in the study group as high BMI is associated with low Vit-D levels because of sequestering effect of high quantity of subcutaneous fat on circulating Vit-D levels or the effect of volume dilution due to the larger body size of obese individuals.[12]

3ml of whole blood collected from the ante-cubital vein through a vacutainer in the fasting state and results were analyzed for Vit-D (25(OH) D) levels within 24hrs by ADVIA CENTAUR-XP automated analyzer by chemiluminescence immunoassay method. Comparison study was done for statistical significance using unpaired t-test. The statistical analysis was performed using SPSS 17 software.

Results of the Vit-D analysis categorized into Normal: 30-100ng/ml, Insufficiency: 20-29ng/ml, Deficiency: below 20ng/ml and Toxicity: above 100ng/ml.

RESULTS

In the present study of 300 medical students 160 were girls and140 were boys. Out of the 300, 215 (71.7%) were having Vit-D deficiency, 63 (21%) were having insufficient Vit-D levels and 22 (7.3%) were having normal Vit-D levels.

Among 160 girl students, 123 (76.9%) were having Vit-D values below 19.9ng/ml (Vit-D deficiency), 33 (20.6%) were having insufficient Vit-D levels (20-29.9ng/ml) and only 4 (2.5%) were having normal Vit-D levels (>30ng/ml).[Table 1]

Table 1: Vitamin D levels in Girls

S.No	Category	Number	%
1	0-19.9 ng/ml (Deficiency)	123	76.9
2	20-29.9 ng/ml (Insufficiency)	33	20.6
3	>30 ng/ml (Normal)	04	2.5

Among 140 boys, 92 (66%) were having Vit-D deficiency (below 19.9ng/ml), 30 (21%) were having insufficient Vit-D levels (20-29.9ng/ml) and 18 (13%) were having normal Vit-D levels (>30ng/ml).[Table 2]

Table 2: Vitamin D levels in Boys

S.No	Category	Number	%
1	0-19.9 ng/ml (Deficiency)	92	71.7
2	20-29.9 ng/ml (Insufficiency)	30	21.0
3	>30 ng/ml (Normal)	18	7.3

In the present study, girls were having meanVit-D levels of 19.8ng/ml with a range of 7.5 to 32.1ng/ml and boys were having a mean of 23.95ng/ml in a range of 10.9 to 37ng/ml, demonstrating the higher mean serum Vit-D levels in boys than girls.

DISCUSSION

Vitamin D deficiency has become an unrecognized pandemic disease in India and worldwide[13] including in sunniest regions[14] in both males and females[15] and also in children & elderly. The lower Vit-D levels in girls can be attributable to

reduced intake of dairy products, exposure to sunlight[16] and pregnancy and lactation.

In the present study, the results are consistent with the similar results obtained in a medical school in the Eastern Province of Saudi Arabia where none of the students had normal levels of vitamin D.[17]

Recently Gonzalez-Padilla et al.[18] reported a high prevalence of hypovitaminosis D in medical students from Spain and Multani et al.[19] from western India found that 87.5% of resident doctors from India had low vitamin D levels, and also from eastern India.[20]

The 25 OHD concentration was found recently to be an independent determinant of peak bone mass[21], adequate Vitamin D levels can prevent Osteoporosis-related hip fractures in elderly people.[22]

The health care workers including the medical students, laboratory workers and also the radiologists usually study for longer hours in libraries, or stay in medical wards or laboratories with minimal or no sun exposure, have long working hours in closed environments and unpredictable meal times with poor nutritional value.

LIMITATIONS OF THE STUDY

The present study was a cross sectional study, needs to be a longitudinal study.

The assay method used was chemiluminescence immunoassay which is not a gold standard method. Liquid chromatography- tandem mass spectroscopy is the gold standard method.

No validated questionnaire was used in the present study regarding the time of sun exposure or dietary habits which could alter the prevalence of Vit-D deficiency.

This study was conducted in the winter season with low sunshine; probably this might have contributed for the high prevalence of Vitamin deficiency.

Being it is a very small study group, needs to be done in larger population and community based studies.

CONCLUSION

Vitamin D a hormone than a vitamin, causes mineralization of the skeleton and increasing serum calcium and phosphorous concentrations, also regulates parathyroid gland growth and parathormone secretion, plays a role in islet cells of pancreas, significant effect on immune system and can also suppress certain autoimmune diseases and certain cancers.

In almost 92.7% of the medical students Vit-D deficiency is present in the present study, measures are to be taken to increase the Vit-D levels by modifying the dietary habits consuming more of milk and milk products and increasing the sun exposure time and physical activity in all the medical students and supplementation of vitamin D in the injectable or oral preparations in fat soluble forms.

In addition to nutritional supplementation, increasing the sun exposure time and fortification of food products with Vitamin D, community based educational programs are needed to increase the awareness of vitamin D deficiency and need for early supplementation.

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