



Original Research Article

Level of Vitamin D in hypothyroid subjects: a study on the suburban population of North-West Delhi

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ABSTRACT

Introduction: Vitamin D deficiency (VDD) is a global health concern. Previous studies have shown significant deficiency of vitamin D in hypothyroid subjects compared to euthyroid subjects with higher deficiency in the female population compared to males.

Materials and Methods: A total of 70 adult females aged 41-65 years were enrolled in the study after obtaining their informed written consent. They were categorized into 2 groups consisting 35 Hypothyroid cases and 35 Euthyroid controls respectively. Serum vitamin D, TSH, fT3 and fT4 levels were assessed by chemiluminescent immunoassay (CLIA). VDD was designated at levels lower than 20 ng/ml and Vitamin D insufficiency (VDI) at level between 20 ng/ml - 30 ng/ml. Levels > 30 ng/ml were stated as vitamin D sufficiency state. Level <4.2 ng/ml was stated as severe vitamin D deficiency state.

Results: The study shows significantly reduced levels of Vitamin D in hypothyroid female subjects compared to age and gender matched euthyroid controls. Majority of hypothyroid subjects and euthyroid controls were falling in VDD range rather than VDI range. We also observe that hypothyroid subjects were more in VDD category as compared to euthyroid subjects.

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1. Introduction

Vitamin D deficiency (VDD) is widespread not only in India but across the world. Many studies done outside this country has also shown low level of vitamin D in their population making VDD a global health concern. Vitamin D is a prohormone. It is named so because though it is synthesized in skin cells, it has got diverse role to play at more distant locations at various organs like bone, intestine, kidney etc. Action of vitamin D is mediated through Vitamin D receptor which is a heterodimer. It has a complex interaction at various tissue level.

Deficiency of Vitamin D has been associated with not only immune disorder like SLE, rheumatoid arthritis, multiple sclerosis, autoimmune thyroiditis, type 1 diabetes but even non-immune disorders like cardiovascular disorders, cancers, infectious diseases, adiposity, osteoporosis etc.¹⁻⁷

Though abundant reports are available on association of VDD with various immune and non-immune disorders, the exact status is still inconclusive because of diversity in patient selection and most importantly due to selection of different cut-off values to decide the presence of Vitamin D Insufficiency (VDI) and VDD.

There are number of studies done on level of vitamin D in hypothyroidism with mixed results Majority of studies have shown significant deficiency of vitamin D in hypothyroid subjects compared to euthyroid subjects with higher deficiency in the female population compared to males. On the other hand, there are also studies which have shown equal deficiency of vitamin D in male and female hypothyroid subjects.⁸

Though medical literature contains abundant reports on the prevalence of hypothyroidism in the Indian population, reports on vitamin D status in hypothyroid or euthyroid subjects are rather scarce. In this context it is important to mention here that in one of the population based studies,

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hypothyroidism is estimated to be more prevalent (11.7%) in Indian population residing in inland cities like Delhi, Ahmedabad, Bengaluru and Hyderabad as compared to coastal cities like Mumbai, Goa, Chennai etc. where the prevalence was reported to be 9.5%. Similar studies are required to assess the values of Vitamin D levels in various geographical locations of India, to gain a better insight into the association of Vitamin D and hypothyroidism, if any.

There is a controversy regarding whether VDD is the cause or effect of hypothyroidism. As hypothesized by Zhang et al VDD may play a causative role in the occurrence of hypothyroidism. They have hypothesized that vitamin D may influence thyrotrophs by acting on vitamin D receptor, which are distributed widely through the brain.⁹ M.Sar et al have shown in their study that vitamin D modulates pituitary thyrotropin TSH secretion by binding to specific binding sites.¹⁰

In yet another study Vitamin D deficiency in hypothyroid subjects is suggested to be a consequence of the disease rather than the cause of it. The authors have hypothesized that patients with hypothyroidism are lethargic and hence are not exposed to sunlight outside, there is poor absorption of vitamin D from the GIT, and also suggested that in these patients vitamin D may not get activated properly.¹¹

2. Aims and Objectives

The present study aims to explore the status of vitamin D in hypothyroid female subjects and compare it with vitamin D levels in euthyroid female subjects.

3. Materials and Methods

Our study includes OPD patients of a tertiary care hospital of New Delhi which mainly caters to the suburban population especially daily wage labourers. Due to their occupation, the labourers have a higher exposure to sunlight than the rest of the population.

A total of 70 adult females aged 41-65 years were enrolled in the study after obtaining their informed written consent. They were categorized as group I or group II (gender and age matched) as per the following criteria –

Group I (Hypothyroid patients): It included 35 female patients with mean age of 46.7 ± 5.2 years. They were diagnosed as hypothyroid because their TSH levels were higher than $5.0 \mu\text{IU/ml}$.

Group II (Euthyroid controls): It included 35 female patients with their mean age of 48 ± 7.8 years. They were diagnosed as euthyroid because their TSH levels were lesser than $5.0 \mu\text{IU/ml}$.

3.1. Inclusion and exclusion criteria

Only non-pregnant, non-diabetic healthy females were included in the study.

Patients on vitamin D supplementation, pregnant females and patients suffering from any chronic illness were excluded from the study.

Serum vitamin D [25(OH) cholecalciferol] and TSH, fT3 and fT4 analysis was assessed by chemiluminescent immunoassay (CLIA) on Mindray CL-1000i. There is no consensus among researchers regarding the cut-off values to define VDD and VDI. Different values varying from $<10 \text{ ng/ml}$ to $<25 \text{ ng/ml}$ have been defined as the cut off range for VDD and similarly varying cut off values varying from $<20 \text{ ng/ml}$ to $<30 \text{ ng/ml}$ have been defined as the range for VDI.^{11,12}

For this study, the authors have taken the “Endocrine Society Clinical Practice Guidelines” which define vitamin D deficiency (VDD) as levels $<20 \text{ ng/ml}$, Vitamin D insufficiency (VDI) as levels between $20\text{--}30 \text{ ng/ml}$ and vitamin D sufficiency as levels $>30 \text{ ng/ml}$.¹³ Values of Vitamin D as $\leq 4.2 \text{ ng/ml}$ was defined as severe vitamin D deficiency.

4. Results

Mean value of vitamin D in cases and control is represented in Figure 1 and number of patients in different levels of vitamin D are represented in Figure 2.

Table 1 shows number of subjects in each category as per level of vitamin D.

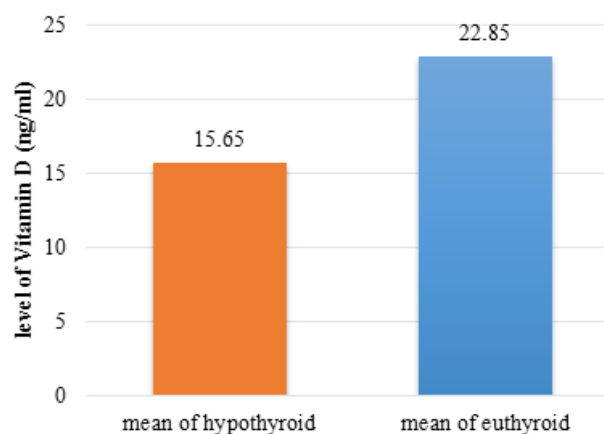


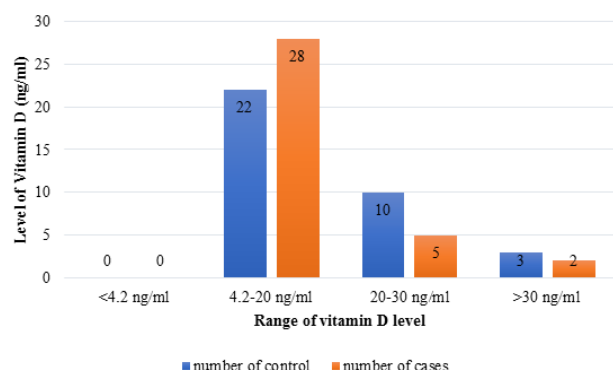
Fig. 1: Mean value of Vitamin D in hypothyroid and euthyroid subjects

5. Discussion

Our study has shown significantly reduced levels of Vitamin D in hypothyroid female subjects compared to age and gender matched euthyroid controls ($15.65 \pm 4.7 \text{ ng/ml}$ vs $22.85 \pm 7.6 \text{ ng/ml}$; $p < 0.001$) [Figure 1]. This result finding is consistent with the finding of Idiculla et al where they have shown lowering of vitamin D level in hypothyroid subjects as compared to euthyroid subjects (12 ± 8.6 vs

Table 1: Percentage of cases and control subjects as Vitamin D level stratification

Vitamin D level	Number of case (out of 35)	Percentage of cases	Number of control (out of 35)	Percentage of controls
≤ 4.2 ng/ml (Severe VDD)	0	0%	0	0%
<20 ng/ml (VDD)	28	80%	22	62.8%
20-30 ng/ml (VDI)	5	14.3%	10	28.6%
>30 ng/ml (Vitamin D sufficiency)	2	5.7%	3	8.6%

**Fig. 2:** Stratification of cases and control as per level of Vitamin D

17.49±11.89 ng/ml, $p < 0.001$).¹³

Difference in mean value of vitamin D between the two studies may be because of different geographic location of our study subjects (North India vs South India) and this strengthens the need for consideration of geographic locations of study populations in determining the Vitamin D levels in further researches.

Our study has found VDD in 80% of hypothyroid and 62.8% of euthyroid subjects and VDI in 14.3% of hypothyroid and 28.6% of euthyroid subjects. 2 out of 35 (5.7%) cases of hypothyroidism and 3 out of 35 (8.6%) euthyroid control subjects were found to have vitamin D sufficiency. None of the subject in either group was found to have severe deficiency of vitamin D (<4.2 ng/ml). [Table 1] [Figure 2]

Majority of hypothyroid subjects were falling in VDD range rather than VDI (80% vs 14.3%) in our study. Similar trend was seen in euthyroid subjects where majority were VDD rather than VDI (62.8% vs 28.6%).

We can therefore infer that hypothyroid subjects were more in VDD category as compared to euthyroid subjects (80% vs 62.8%).

Our study finding is consistent with the finding of Marwaha et al where they have assessed the vitamin D status in large population-based study done on adults aged 50 years or above in Delhi. They have reported the prevalence of VDD as 91.2% and VDI as 6.8%.¹⁴

Conversely, one study has shown inverse relation of vitamin D level and TSH in middle-aged and elderly population.¹⁵ Similar inverse association was shown in yet

another study done on Chinese younger population by Alrefaie Z et al.¹⁵

Studies have shown that Vitamin D binds at certain specific binding site in the pituitary and modulate (suppress) TSH secretion¹⁰ so it may be hypothesized that the level of vitamin D may have an inverse relation with TSH and lower level of Vitamin D may increase the level of TSH. Therefore, supplementation of Vitamin D may normalize the level of TSH. One of the rare interventional study done by Talaei A. et al based on this hypothesis has shown promising results. In their double-blind, randomized, placebo-controlled trial Talaei A et al have reported the beneficial effect of vitamin D supplementation in the dose of 50,000 IU/week for 12 weeks, on TSH level in hypothyroid subjects compared to another group of hypothyroid subjects which were put on placebo therapy for the same duration. This therapy with vitamin D though did not show any effect on the level of T3, T4, ALP or albumin levels in either group which were simultaneously measured.¹⁶ In yet another similar study Smith et al have shown that vitamin D administration significantly suppresses TSH secretion in basal state.

Finding in certain studies which show that TSH level is higher in female population compared to similar aged male population suggests that TSH secretion may get regulated by sex hormones, genetic susceptibility and environmental factors.^{17,18} These factors can also modulate vitamin D level and the association of lower level of vitamin D in female population compared to male population as noted in certain studies can be justified this way.

6. Conclusions

Vitamin D deficiency is a common problem irrespective of geographic boundaries and health status. Hypothyroid subjects are more prone to having deficiency of this fat-soluble vitamin. Keeping in mind the important role of Vitamin D in maintaining health homeostasis, it is important that routine screening of vitamin D should be done in all patients of hypothyroidism and adequate therapy should be initiated at the earliest to reduce the complications and to break the vicious cycle.

7. Funding and financial disclosures

None.

8. Limitations

The present study included only 70 patients. A larger sample is needed to confirm the findings.

9. Conflict of interest

None.

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