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Original Research Article

Correlation of Vitamin D Level with Biochemical Parameters in Healthy Indians Aged ≥50 Years

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Abstract: Vitamin D deficiency is pandemic, yet it is the most under-diagnosed and under-treated nutritional deficiency in the world. Paucity of literature on vitamin D status in population more than 50 years of age also warrants this study. The aim is to assess the vitamin D status in individuals above 50 years of age and to study correlation of Vitamin D Levels with Biochemical parameters among them. The current study was conducted by the Department of Biochemistry of a tertiary care teaching hospital of western Uttar Pradesh. The study was carried in population more than 50 years of age. A total of 722 individuals were recruited from the field practice area of this medical college. Purposive sampling method was adopted. Vitamin D deficiency [VDD, serum 25(OH)D levels < 20 ng/ml) was present in 91.87% subjects studied. Weight and BMI decreased with age. Serum phosphorus decreased in males with age compared to females with age. PTH levels also decreased with age. VDD was present in 497 (91.87%) subjects and 90.61% aged ≥65 years. The prevalence of Vitamin D Insufficiency was found to be 6.84% subjects aged 50 - <65 years and 6.63% aged ≥65 years. Majority (45.08%) of subjects had moderate VDD. Age, calcium and phosphorus correlated positively with serum 25(OH)D levels. Serum 25(OH)D levels had negative correlation with PTH levels, ALP and BMI. Vitamin D deficiency is rampant in individuals aged ≥50 weather there is intake of vitamin D supplements or not. Absence of a PTH response was observed in more than 50% of individuals with VDD, the cause of which warrants further probe.
Keywords: Vitamin D deficiency, Insufficiency, Biochemical evaluation, Age, Correlation.

INTRODUCTION

Vitamin D deficiency (VDD) prevails in epidemic proportions all over the Indian subcontinent, with a prevalence of 70%–100% in the general population [1]. There is widespread prevalence of varying degrees (50- 90%) of VDD with low dietary calcium intake in Indian population according to various studies. Majority of its population lives in areas receiving ample sunlight throughout the year and hence there was disbelief that VDD is uncommon in India [2]. However from the data available in the published literature, Vit D deficiency is very common in India in all the age groups and both sexes across the country [3]. Apart from low dietary intake, people suffering from hepatic, renal, dermatological disorders, alcoholics and inflammatory rheumato logical conditions also have VDD. Subclinical VDD is highly prevalent in both urban and rural settings, and across all socioeconomic and geographic strata. VDD is likely to play an important role in the very high prevalence of rickets, osteoporosis, cardiovascular diseases, diabetes, cancer and infections such as tuberculosis in India [4]. It has also been linked to infection, cardiovascular disease, malignancy, and autoimmunity which are commonly seen in the elderly, as are fragility fractures [1]. Paucity of literature on vitamin D status in population more than 50 years of age also warrants this study [5]. Therefore aim of the present study was to assess the vitamin D status in individuals above 50 years of age and to study correlation of Vitamin D Levels with Biochemical parameters among them.

METHODS

The current study was conducted by the Department of Biochemistry of a tertiary care teaching hospital of western Uttar Pradesh. The study was

carried in population more than 50 years of age. A total of 722 individuals were recruited from the field practice area of this medical college. Purposive sampling method was adopted. Exclusion criteria were subjects with hepatic, renal, dermatological disorders, alcoholism, and receiving medication likely to adversely affect vitamin D status. Demographic, anthropometric and clinical data were captured alongwith clinical examination of subjects. For the purpose of this study, individuals taking calcium (minimum 500 mg/day) and Vitamin D (200-400 IU) for >6 months were considered as taking supplements. Fasting blood samples were drawn for the estimation of serum 25(OH)D, intact parathyroid hormone, total calcium, inorganic phosphorus, and alkaline phosphatase. These subjects were divided in two groups: Group-1 - those 50 - <65 years (as all females were postmenopausal in this group) and Group-2 - those with 65 years or above (as senile osteoporosis sets in after 65 years of age).

Automatedanalyser and commercial kits were used to capture biochemical parameters. The serum concentrations of 25(OH)D and PTH were measured by RIA and electrochemiluminescence assay respectively. Serum 25(OH)D level of 20.0 - <30.0 ng/ml was classified as vitamin D insufficiency (VDI), and levels < 20 ng/ml were classified as vitamin D deficiency (VDD) [1]. VDD was further categorized based on Lips classification as mild (10.0 – <20.0 ng/ml), moderate (5.0-<10.0 ng/ml) and severe (< 5.0 ng/ml) [6]. All the proforma were manually checked and edited for completeness and consistency and were then coded for computer entry. After compilation of collected data, analysis was done using Statistical Package for Social Sciences (SPSS), version 21. The results were expressed using appropriate statistical methods.

RESULTS

In this study, data of 722 study subjects aged ≥50 Years was analyzed. Mean age of subjects was 57.0±9.1 years. Gender wise there were 541 males (74.9%) and remaining were females. Weight and BMI decreased with age and the data was found to be statistically significant. Serum phosphorus decreased significantly (p<0.001) in males with age compared to females with age. PTH levels also decreased with age. VDD was present in 497 (91.87%) subjects aged 50 - <65 years and 164 subjects (90.61%) aged ≥65 years. The prevalence of Vitamin D Insufficiency was found to be 37 (6.84%) subjects aged 50 - <65 years and 12 subjects (6.63%) aged ≥65 years. (Table 1)

Table 1: Anthropometric, Biochemical and Vitamin D Status in the two age groups

Variable	**Group 1** (50 - <65 years) **(n=541)**	**Group 2** (≥65 years) **(n=181)**	**P – Value**
Anthropometric variables			
Height (cm)	158.9 ± 8.3	159.5 ± 9.2	0.043
Weight (kg)	68.2 ± 11.5	65.3 ± 11.7	<0.001
BMI (kg/m2)	28.1 ± 5.2	26.2 ± 4.3	<0.001
Biochemical variables			
S. Calcium (mg/dl)	9.8 ± 0.5	9.7 ± 0.3	<0.001
S. Phosphorus (mg/dl)	3.8 ± 0.5	3.6 ± 0.7	<0.001
ALP (IU/L)	221 ± 66	210 ± 59	<0.05
PTH (ng/ml) mean ± SD	60.2 ± 40.1	54.5 ± 35.2	<0.05
Vitamin D Status			
Mean±SD	10.1 ± 7.9	9.8 ± 6.9	0.62
Vitamin D Deficiency	497 (91.87%)	164 (90.61%)	0.75
Vitamin D Insufficiency	37 (6.84%)	12 (6.63%)	0.90

Regarding severity of VDD, majority (45.08%) of subjects had moderate VDD followed by mild (29.95%) and severe (24.96%) grade of VDD respectively. (Table 2)

Table 2: Severity Vitamin D Deficiency among study subjects

Severity	N
25(OH)D Levels (ng/dl)	9.6 ± 7.5
Severe (<5 ng/ml)	165 (24.96%)
Moderate (5-<10 ng/ml)	298 (45.08%)
Mild (10-<20 ng/ml)	198 (29.95%)
Vitamin D Insufficiency (20-<30 ng/ml)	49 (6.79%)

Age, calcium and phosphorus correlated positively with serum 25(OH)D levels but it was not statistically significant. serum 25(OH)D levels had negative correlation with PTH levels, ALP and BMI which were statistically significant. (Table 3) Almost 55% subjects were taking vitamin D and calcium supplements. Serum 25(OH)D levels were not significantly different among those who were taking supplements and those who were not (p=.68).

Table 3: Correlation of Vitamin D Level with Anthropometric, and Biochemical parameters

Variables	Coefficient (r value)	P Value
Age	0.033	0.58
BMI	-0.062	<0.05
Calcium	0.04	0.362
Phosphorus	0.004	0.648
ALP	-0.073	<0.05
PTH	-0.164	<0.001

DISCUSSION

Vitamin D deficiency is pandemic, yet it is the most under-diagnosed and under-treated nutritional deficiency in the world. Various studies conducted in tropical countries have shown that VDD is rampant in tropical countries including India despite plenty of sunshine due to several factors [8]. In this study we found that vitamin D deficiency [VDD, serum 25(OH)D levels < 20 ng/ml) was present in 91.87% subjects studied. These results are cohort with others. Another study from Central Indiaobserved those 84.3% urban women and 83.6% rural women suffered from vitamin D deficiency [9]. In another study from Kashmir, 58.5% adults have been shown to suffer from vitamin D deficiency [10]. Toddlers residing in areas of high levels of atmospheric pollution in Delhi have shown to have significantly higher levels of vitamin D deficiency as compared to those from less polluted areas [11]. It is really surprising that despite the wide spread VDD, Indian Council of Medical Research (ICMR) has not given specific recommendations for daily vitamin D consumption except in specific medical conditions where it recommends a daily supplement of 400 IU. For normal healthy children and adults, ICMR only recommends outdoor activities in sun as a means to acquire adequate vitamin D levels which really doesn't seem to be sufficient in the current Indian scenario to achieve optimum levels of vitamin D given the wide spread prevalence of deficiency in India [12].

In this study age, calcium and phosphorus correlated positively with serum 25(OH) D levels. Serum 25(OH) D levels had a negative correlation with PTH levels, ALP and BMI. Lips P observed in his study that serum PTH levels had strong negative correlation with vitamin D levels [6] and a negative correlation between ALP and vitamin D levels has been reported by Harinarayan CV [5]. Another study by Komar L et al is also in concordance with our observations. He observed a negative correlation between 25(OH) D and PTH in elderly population on admission to nursing home with fracture [13].

In our study more than half of subjects were taking calcium and vitamin D supplements, but there was no difference in serum 25(OH) D levels between those who took and did not take supplements. Malhotra N from Delhi reported requirement of 60,000-120,000 IU per month to achieve vitamin D level > 30 ng/ml [14]. In another study by Goswami R *et al* observed correction of vitamin D level to normal after 8 weeks supplementation with weekly supplementation of 60,000 IU [15]. Both these studies highlight the need of regular supplementation of at least 2000 IU/day vitamin D supplementation to maintain normal vitamin D levels.

CONCLUSIONS

On the basis of empirical findings of this study, it can be concluded thatVitamin D deficiency is rampant in individuals aged ≥50 weather there is intake of vitamin D supplements or not. Absence of a PTH response was observed in more than 50% of individuals with VDD, the cause of which warrants further probe.

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