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Prevalence of Vitamin D deficiency in adults of Saharsa district of Bihar: A Hospital Based Study

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Abstract
Background and objectives: *Vitamin D is a group of fat-soluble secosteroids responsible for increasing intestinal absorption and bioavailability of calcium, phosphate and multiple other biological effects. Vitamin D deficiency is widely prevalent in India despite abundant sunlight throughout the year. There are many studies on vitamin D deficiency in India but there is limited data from eastern Bihar. Keeping this in view, the aim of our study is to find out the prevalence of vitamin D deficiency in Saharsa district of eastern Bihar.*
Material and methods: *This cross-sectional study carried out at Department of Biochemistry from March 2018 to February 2019 comprising of 314 apparently healthy adults (163 males and 151 females) of Saharsa, a district of eastern Bihar. All the individuals were tested for serum 25(OH)D level by automated analyzer BIOMERIEUX Mini Vidas by Enzyme Linked Fluorescent Assay (ELFA) method.*
Results: *Out of 314 subjects included in our study, 163 (52%) were males and 151 (48%) females. Vitamin D deficiency (<20 ng/ml) was present in 211 (67.2%) subjects, insufficiency (21-29 ng/ml) was present in 52 (16.6%) and only 51 (16.2%) subjects had normal (>30 ng/ml) level. The deficiency was more in females (89%) as compared to males (79%) in this study population. The prevalence of Vitamin D deficiency exhibited an age associated increment in both the males and females.*
Conclusion*: Despite abundant sunlight vitamin D deficiency is highly prevalent in our region that is in eastern Bihar. Regular serum vitamin D status must be assessed to review the nutritional status in apparently healthy population and supplementation may be introduced along with regular monitoring.*
Key Words*: Vitamin D, Hypovitaminosis D, Deficiency, Insufficiency, prevalence.*

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I. Introduction

Vitamin D is a fat soluble vitamin involved in the calcium and phosphorus metabolism.[1] It is also known as the antirachitic factor, or the sunshine vitamin because it can be synthesized in sufficient amounts by most vertebrates on adequate exposure of the skin to sunlight (UVB rays).[2] . About 90% of the required Vitamin D is synthesized in the skin under sun exposure.[3] It is considered unique due to its ability to be synthesized in the body and functioning as a hormone. Vitamin D is described as a part of vitamin D – Calcium – Parathyroid hormone endocrine axis.[4] Vitamin D is a group of fat-soluble secosteroids responsible for increasing intestinal absorption of calcium, magnesium, and phosphate, and multiple other biological effects. [5]The two forms of Vitamin D, i.e., ergocalciferol and cholecalciferol, differ only in their side chain structure; however, these differences have no significant impact upon the metabolism. Studies have shown that both forms of Vitamin D (D2 and D3) exhibit identical responses in the body upon activation and the potency to cure Vitamin D-deficiency rickets[6]

Vitamin D is obtained from sunlight or from food rich in vitamin D such as mushrooms, dairy products and fish. In the body vitamin D is metabolized in the liver to 25 hydroxy vitamin D [25(OH)D] or calcidiol. This is found in the blood circulation and is measured in the serum to access deficiency states. The renal enzymes metabolize calcidiol to calcitriol, the physiologically active form of vitamin D called 1,25-dihydroxy vitamin D. This form regulates the calcium and phosphorus metabolism.[7]

It is needed for the maintenance of normal blood levels of calcium and phosphate that are required for normal mineralization of bone, muscle contraction, nerve conduction, and general cellular function in all cells of the body. It is also found to be important for immune function, for inflammation, cell proliferation, and differentiation.[8,9.] The recent study during covid pandemic shows that possible correlation of Vitamin D levels with COVID-19 mortality on the basis of its impact on cytokine response to pathogen.[10]

Overt vitamin D deficiency causes demineralization of bones, manifests as rickets and fractures in children. In adults, chronic vitamin D deficiency leads to osteoporosis, osteomalacia, muscle weakness and increased risk of falls and fractures. Low blood levels of vitamin D is related to increased incidence of several autoimmune diseases (multiple sclerosis, rheumatoid arthritis, type I diabetes, systemic lupus erythematosus and psoriasis) infections, and risk of developing cancers of the breast, colon, prostate and ovaries.[11,12]

Vitamin D deficiency is estimated to affect >1 billion people worldwide and it has been seen in all races, age groups, and ethnic backgrounds. [13] The community-based Indian studies of the past decade done on apparently healthy controls reported a prevalence ranging from 50% to 94%. [14,15] Hospital-based studies showed a prevalence of Vitamin D deficiency ranging from 37% to 99%.[8]

Studies from various research workers have shown that the prevalence of Vitamin D deficiency has been done for different states of India but it appears that there has been no study carried out at eastern Bihar. In view of above a study has been made to find out the Vitamin D level in patients attending a tertiary care hospital in Saharsa district of eastern Bihar.

II. Materials & Methods

The hospital based cross sectional study was carried out at Department of Biochemistry, Lord Buddha Koshi Medical College & Hospital,, Saharsa, Bihar from March 2018 to february 2019 comprising of 314 subjects. The present study was started after obtaining ethical clearance from the institutional ethical committee. The study subjects were apparently healthy adults selected randomly from patient's attendants visiting the OPDs and indoors of various departments like department of Medicine, paediatrics ENT and Eye. Medical Students, Para Medical Students, staffs and local population of Saharsa were also taken as study subjects. Informed consent was obtained from all the participants.

Inclusion Criteria: Inclusion criteria were apparently healthy adults' willingness to participate in the study, age between 18-80 years and a state of fasting for at least 10 hours.

Exclusion Criteria: Exclusion criteria included the patients suffering from any acute or chronic diseases like liver disease, renal disease, cardiac disease, respiratory disease or any other acute or chronic diseases. Patients suffering from AIDS, thyroid disorders or psychiatric illness, pregnant or lactating women, or Individuals on vitamin supplements were excluded.

Fasting venous blood was collected in plain vials. It was allowed to clot for 30 minutes. After clot formation the blood was centrifuged at 3000 rpm for 10 minutes. Serum was separated from cells and collected in a separate aliquot vial. Serum 25(OH) D assays were performed by automated analyzer BIOMERIEUX Mini Vidas by Enzyme Linked Fluorescent Assay (ELFA) method. The values were documented in ng/mL. The diagnostic cut offs of levels of serum Vitamin D are as follow [8,16]

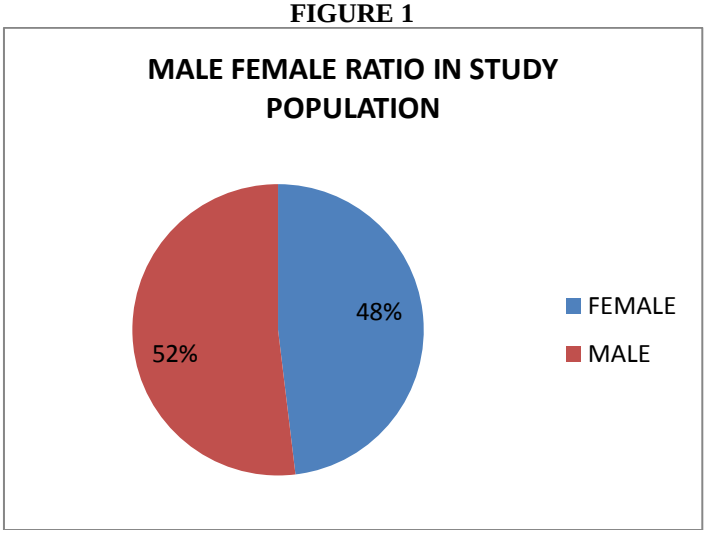
Vitamin D status	**Serum level of Vitamin D in ng/ml**
Deficiency	<20
Insufficiency	21-29
Suffi ciency	>30
Toxicity	> 150

Statistical analysis was performed using SPSS software version 20.0 Data were expressed as percentage and numbers.

III. Results:

The present study was a cross sectional, hospital based study, carried out from March 2018 to February 2019 comprising of 314 subjects (163 (52%) males and 151(48%) females) who underwent vitamin D estimation. (Figure 1)

FIGURE 1



The proportion of vitamin D deficiency has been calculated among total population, females and males. The age of the study population ranged from 20 to 80 years. We had 93 subjects (52 male and 41 females) in age group 20-40 years. In age group 41-60 years, there were 150 (78 males and 72 females) subjects. Only 71 cases (33 males and 38 females) were present in 61-80 year age group**. [Table 1]**

Table 1: Age wise gender distribution of the study population (n = 314).

Age Group (Years)	Male	Female	Total (Percent)
20-40	52	41	93 (29.6%)
41-60	78	72	150 (47.8%)
61-80	33	38	71(22.6%)

Among the study population, 263 individuals (83.8%) out of the total study population of 314 were deficient in vitamin D (vitamin D levels< 30ng/ml. Only 51 individuals (14%) had normal level of vitamin D. ((vitamin D levels ≥30ng/ml **[Table 2]**

Table 2: Vitamin D status in study population (n = 314).

	Vitamin D Level		
	Low (<30ng/ml)	**Normal ≥ 30ng/ml**	**Total**
MALE	129 (79%)	34 (21%)	163
FEMALE	134 (89%)	17 (11%)	151
	263 (83.8%)	51 (16.2%)	N=314

Out of 211 patients who had frank deficiency (vitamin D levels <20 ng/ml) 101 were male and 110 were female, whereas out of 52 patients who had insufficient vitamin D levels (21 to 29 ng/ml), 28 were male and 24 were female. 51 subjects had normal vitamin D levels out of which 34 were male and 17 were female subjects. **[Table 3]**

Table 3: Vitamin D deficiency status in study population (n = 314).

Vitamin D status	**Male**	**Female**	**Total**
Deficient (<20 ng/ml)	101	110	211 (67.2%)
Insufficient(21-29 ng/ml)	28	24	52 (16.6%)
Sufficient (≥30 ng/ml)	34	17	51 (16.2%)
Toxicity (> 150 ng/ml)	0	0	0

From **table 4**, the proportion of vitamin D deficiency in different age groups can be observed. Among age group of 20-40, 44 had frank vitamin D deficiency with female majority. In this age group, vitamin D insufficiency was found in 27 subjects. Insufficiency was more common in males. Only 22 subjects had normal vitamin D levels.

Majority of patients (150 patients) belong to 41-60 age group. Frank vitamin D deficiency was observed in more than two third of patients of this age group (106 patients). 21 were vitamin D insufficient in this group with. 23 subjects had normal vitamin D levels.

In elderly (age group 61-80), there were 71 subjects. 61 (85.9%) had frank vitamin D deficiency with 27 male and 34 female subjects whereas 4 (5.7%) had insufficient levels. Only 6 (8.4%) subjects had normal vitamin D levels in this age group.

Table 4: Pattern of vitamin D levels and its variation according to age and sex in the study population

Age Group (Years)	Deficient (<20 ng/ml)			Insufficient(21-29 ng/ml)			Sufficient (≥30ng/ml)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
20-40	20	24	44 (47.3%)	18	9	27 (29%)	14	8	22 (23.7%)
41-60	54	52	106 (70.6%)	8	13	21 (14%)	16	7	23 (15.3%)
61-80	27	34	61 85.9%)	2	2	4 (5.6%)	4	2	6 (8.4%)

IV. Discussion:

Vitamin D a fat soluble vitamin also functions as a hormone. It is involved in maintaining the integrity of skeletal system as it regulates parathyroid hormone, calcium and phosphorous metabolism. Vitamin D has many noncalcemic functions, which includes immune, cardiovascular, endocrine, neuropsychological functions, neuromuscular performance, cellular differentiation, and anticancer actions. Vitamin D plays a vital role in diabetes mellitus because it enhances insulin release and improves the insulin resistance by sensitizing the insulin receptors to circulating insulin. By inhibiting beta cell apoptosis, it delays the insulin dependency in diabetes mellitus. [13]

Vitamin D deficiency is endemic in India. Various reports have highlighted the low levels of vitamin D noted in various spectrum of the population, including young adults, the elderly population and postmenopausal women in different regions of country and world. [17] There are still many districts in India where we are unaware of prevalence of Vitamin D deficiency. One such district in Bihar is Saharsa. Thus, the present study was conducted to know the prevalence of Vitamin D deficiency in Saharsa district of Bihar. This cross sectional hospital based study was carried out March 2018 to February 2019 comprising of 314 subjects (163 males and 151 females) who underwent vitamin D estimation.

In the present study we found 83.8% subjects had hypovitaminosis D (vitamin D deficiency and vitamin D insufficiency). Studies from various research workers have shown different proportion of Vitamin D deficiency from different states of India. In a similar study by Sonam C Bhutia et al on 360 patients in Sikkim noted hypovitaminosis D in 83% of patients which resembles with our finding. [18]This finding of our study is also supported by study of C P Pal et al in Agra. [2]

In this study maximum `number of subjects was in the age group of 41-60 years followed closely by the age group 21-40 years. In the present cross - sectional study we found that the percentage of males and females in the normal Vitamin D category decreased with increasing age, whereas an inverse trend was documented in Vitamin D deficiency category for both the males and females. This finding of our study is well supported by study of Daly et al. Daly et al in their study found that the mean value of serum 25(OH)D decreased with age for both males and females, thereby showing an increased prevalence of deficiency with advancing age[19]

In the present study, we observed that patients more than 60 years of age had more vitamin D deficiency as compared to younger age group. Similar study shows that older adults are often considered at increased risk of vitamin D deficiency due to limited sun exposure, decreased capacity for cutaneous vitamin D synthesis and reduced intake of dietary vitamin D. [20] However some studies observed that subjects in 51–70 years of age were 35% less at risk for hypovitaminosis D compared with those of 18–50 years of age.[21]The reason could be due to sedentary life style, diet deficient in vitamin D along with insufficient exposure to sunlight.

We observed in the present study that hypovitaminosis was more common in females as compared to the males. In agreement with the findings of the present study, many researchers established that females had lower serum 25(OH) D levels than males. Higher prevalence of Vitamin D deficiency among females may be attributed to greater percentage of body fat among females, dress code, occupation and lifestyle, dietary factor, and duration of exposure to the sunlight.[22,6,23] Extra attention to their diet as well as vitamin D supplementation is warranted to avoid long term complications in the female gender, keeping in mind the increased need due to pregnancy and lactation.[24]

V. Conclusion:

Our study concluded that vitamin D deficiency was seen in 83.8% of our study population. The overall as well as age group wise prevalence of Vitamin D deficiency was significantly higher in females as compared to their age matched male counterparts. This study gives us a preliminary estimate of the widespread deficiency of vitamin D in the region of eastern Bihar and especially in the female population. Prevalence of Vitamin D deficiency is very high despite abundant sunlight. So, yearly screening and sensitization should be initiated to create awareness about the important role of vitamin D in the body. Implementation of food fortification program would be helpful to deal with the epidemic nature of its deficiency.

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