

Prevalence of Vitamin D Deficiency among Patients Attending Tertiary Level Hospitals in Bangladesh: Hospital-Based Cross-Sectional Study

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Abstract

Introduction: Vitamin D (Vit D) is essential for calcium and phosphate homeostasis, critical for bone growth and remodeling. Its deficiency leads to conditions like osteomalacia and rickets, with adverse effects on osteoporosis, growth, and skeletal health. This study aimed to assess Vitamin D Deficiency prevalence among patients in Bangladeshi tertiary-level hospitals. **Materials and Methods:** A prospective cross-sectional study was conducted from January to December 2019 at Cumilla Medical College Hospital and Central Medical College Hospital. We enrolled 1250 patients meeting inclusion criteria and collected data via a pre-designed questionnaire. **Results:** Most participants (31.8%) were aged 31-40, with a mean age of 37.31±13.37. Male patients constituted 53.3%, and 46.7% were female. Rural residents accounted for 52.6%, while 25.8% lived in urban areas, and the rest abroad, mainly the Middle East. The majority (88.5%) belonged to middle-class families, and only 1.5% reported sufficient sun exposure. Strikingly, 54.2% were Vitamin D deficient, 40% had insufficient levels, and only 6.4% had adequate Vit D. **Conclusion:** This study highlights a significant prevalence of Vitamin D deficiency among patients in Bangladeshi tertiary hospitals. The data underscore the urgent need for healthcare authorities to address this public health concern. Policymakers and healthcare providers should be aware of the potential long-term health consequences of Vitamin D deficiency, emphasizing the importance of strategies to promote adequate Vit D levels in the population.

Keywords: Bangladeshi population, Vitamin D, Vitamin D deficiency, Sunlight exposure.

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Introduction:

Vitamin D (Vit D) is a micronutrient that is a group of fat-soluble steroids with a broken ring responsible for increasing intestinal absorption of calcium, magnesium, phosphate, and many other biological effects. Vit D (represents D2, D3, or both) is produced endogenously in the skin from sun exposure or obtained from foods that naturally contain vitamin D, including cod liver oil and fatty fish (eg, salmon and tuna); UV-irradiated mushrooms; foods fortified with Vit D; and supplements¹. The two main sources of Vit D are sunlight exposure and diet. Vit D2 is obtained from the diet via sources of plants and Vit D3 is constituted by skin exposure to sunlight and can also be attained from the diet through animal products. Vit D which is derived from the skin and diet is transformed into 25hydroxyvitamin D which is the circulating in

blood, metabolized in liver². Vit D deficiency is considered to be one of the most common medical conditions worldwide. Lower Vit D status has found in every nation even in lower latitude countries with darker skin types where most of the scientists have assured that UVB radiation is adequate to restrain the deficiency of Vit D. According to NHANES, only 30% of the US population has obtained sufficient amount of Vit D³. A recent study on the US, Canadian and European citizens revealed that they had a high frequency of Vit D deficiency compared to the Asian, African, Central Americans, and Jamaicans⁴. Certainly, the current recommendations are that children (older than 6 months) are allowed to have 400 IU Vit D, and young adults (over the age of 24) are allowed to have 1200U Vit D⁵. The prevalence of mild, moderate, and severe Vit D deficiencies among the adult population were 19.6%, 23.9%, and 26.9% respectively in South Asia. Vit D deficiency was more prevalent among women ($p=0.001$) and younger age-group ($p=0.001$). Poor serum 25-hydroxyvitamin D concentrations (25(OH)D) have been detected among young infants as well as pregnant women in Bangladesh, advised to have Vit D supplementation⁶. In Bangladesh, 86% of people have hypovitaminosis D; 61.4% have a deficiency and 24.1% have insufficiency⁷. Symptoms and signs of Vit-D deficiencies are fatigue, bone pain, muscle weakness, joint pain, etc. The consequences of Vit D deficiency include poor bone development and health and also increased risk of many common and serious diseases including some common cancers-including breast, colorectal, cervical, ovarian, pancreatic as well as cardiovascular diseases, type1 diabetes and other autoimmune diseases. Severe Vit D deficiency can also lead to diseases like rickets in children which is a rare disease that makes the bones soft and bend and osteopenia in adults⁸. The aim of the study is to see the prevalence of Vitamin D Deficiency among patients attending the tertiary level Hospital in Bangladesh and to assess the socio-demographic profile and investigate the presenting complications among the study population with Vitamin D deficiency.

Materials and Methods:

A Prospective cross-sectional study was carried out in the outpatient and inpatient Medicine department of Cumilla Medical college and hospital and Central Medical College and Hospital, Cumilla during the period of Jan 2019 to Dec 2019. A total of 1250 patients ($N=1250$) over the period of one year were enrolled in this study following the inclusive criteria. Data were collected using the predesigned semi-structured questionnaire. Serum Vit D concentration was determined by Chemiluminescent Microparticle Immunoassay in the Hospital laboratory. Verbal consent was taken before recruiting the study population. Ethical clearance was taken from the Ethical Committee of Central Medical College and Hospital, Cumilla. The information was kept confidential only to be

used for the study purpose. Patients with unclear complaints, patients living abroad, patients with complaints of body ache, low back pain, muscle cramp, and joint pain met the inclusion criteria. Exclusion criteria were those using Vitamin D supplements, those with malignant disorders or organ failure, and those reluctant to participate in the study.

Data analysis

The study coordinators performed random checks to verify data collection processes. Completed data forms were reviewed, edited, and processed for computer data entry. Frequencies, percentages, cross-tabulations were used for descriptive analysis. χ^2 test was used to analyze statistical significance. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 25.0. The significance level of 0.05 was considered for all tests.

Result:

Table I shows that most of the study population (398, 31.8%) were in the age group thirty-one to forty. Moreover, one-fourth of the patients were in the age group (324, 25.9%) twenty-one to thirty, one-fifth of them (250, 20.0%) were in the age group forty-one to fifty. Only fifteen patients (15, 1.2%) had their age less than ten years and sixty-two patients (62, 4.9%) had their age more than sixty. The mean age was 37.31 ± 13.37 and the minimum age was seven years of age and the maximum age was 95 age. More than half of the study population (666, 53.3%) were male in gender and the rest of the patients (584, 46.7%) were female in gender. One-tenth of the study population (135, 10.8%) were illiterate. Perhaps, only one-tenth of the patients (131, 10.5%) completed their graduation. Around one-fourth of the study population (304, 24.3%) were educated up to secondary school certificate, two-fifth of the patients (517, 41.4%) did not appear in the secondary school certificate exam.

Half of our study population (657, 52.6%) stays in the rural part of the Cumilla district. One-fourth of the patients (322, 25.8%) were living in the urban part and the rest of the population were staying permanently abroad, especially in the Middle East. The greater bulk of the study population (1106, 88.5%) were from middle-class families. Ninety-six (96, 7.7%) patients are from lower-class families and the rest of the forty-eight patients (48, 3.8%) were from higher class families. Only nineteen patients (19, 1.5%) have a history of adequate sun exposure. Twelve hundred and thirty-one patients have a history of inadequate sun exposure. Only one-tenth of patients (147, 11.8%) had a history of comorbidity. Besides, the majority of the patients (1103, 88.2%) had no history of comorbidity. Those who are comorbid patients fifty-eight (58, 4.6%), forty-two (42, 3.4%), twenty-four (24, 1.9%), sixteen (16, 1.3%) and seven (7, 0.6%) patients are Diabetic, Hypertensive, both Diabetic and Hypertensive, Asthma and Ischemic Heart Disease respectively (Table I).

Table I: Characteristics of Study Population (N=1250)

Characteristics	n (%)
Age	n (%)
<10	15 (1.2%)
11-20	89 (7.1%)
21-30	324 (25.9%)
31-40	398 (31.8%)
41-50	250 (20.0%)
51-60	112 (9.0%)
>60	62 (4.9%)
Mean age	37.31±13.4
Minimum	7
Maximum	95
Gender	n (%)
Male	666 (53.3%)
Female	584 (46.7%)
Level of Education	n (%)
Illiterate	135 (10.8%)
1-5	206 (16.5%)
6-9	311 (24.9%)
SSC	304 (24.3%)
HSC	163 (13.0%)
Graduate	131 (10.5%)
Location	n (%)
Rural	657 (52.6%)
Urban	322 (25.8%)
Abroad	271 (21.7%)
Economic Condition	n (%)
Low	96 (7.7%)
Middle	1106 (88.5%)
Higher	48 (3.8%)
Sun exposure	n (%)
Inadequate	1231 (98.5%)
Adequate	19 (1.5%)
Comorbidities	n (%)
HTN	42 (3.4%)
DM	58 (4.6%)
HTN+DM	24 (1.9%)
Asthma	16 (1.3%)
IHD	7 (0.6%)
No-Comorbidities	1103 (88.2%)
Total	1250 (100%)

Table II: Endocrine Society’s classification of vitamin D status (N=1250)

References value of Vitamin D3- 25(OH)D	Ranges in serum (ng/ml)
Vitamin D sufficiency	≥30
Vitamin D insufficiency	20-29.99
Vitamin D deficiency	<20

More than half of the study population (678,54.2%) were Vitamin D (Vit D) deficient, around two-fifth of the study population had Vitamin D insufficiency and the rest of eighty patients (80, 6.4%) had an adequate level of Vitamin D level (Table III). More than three-fifths of the study population (175, 54.0%) from the age group ten to twenty were Vit D deficient. Three-fifths of the female study population (351, 60.1%) were suffering from Vit D deficiency. On the other hand, about half of the male study population (327, 49.1%) were having Vit D deficiency.

Table III: Vitamin D Level of Study Population (N=1250)

Vitamin D Level (ng/dl)	N,%
<20	678 (54.2%)
20-29.9	492 (39.4%)
>30	80 (6.4%)
Mean level of Vit D	19.77±7.13
Minimum	2
Maximum	61

Furthermore, more than three-fifths of patients from the age group ten to twenty were Vit D deficient. Of three twenty-one urban people, one eighty-seven patients (187,58.3%) had Vit D levels less than 20ng/ml. Additionally, about half of the population (145,53.7%) of two-seventy patients who were living abroad were Vit D deficient (Table IV).

Table IV: Distribution of Vitamin D Level of Study Population According to Age and Sex(N=1250)

Vitamin D Level	<20 ng/ml	20-29.9 ng/ml	>30 ng/ml	Total	p-value
Age					
<10	7 (46.7%)	7(46.7%)	1(6.7%)	15,100%	
10-20	57(64.0%)	26(29.2%)	6(6.7%)	89,100%	<0.05
21-30	175(54.0%)	135(41.7%)	14(4.3%)	324,100%	<0.05
31-40	213(53.5%)	159(39.9%)	26(6.5%)	398,100%	<0.05
41-50	144(57.6%)	93(37.2%)	13(5.2%)	250,100%	<0.05
51-60	55(49.1%)	47(49.1%)	10(8.9%)	112,100%	<0.05
>60	28 (45.1%)	25(40.3%)	10(16.1%)	62,100%	<0.05
Sex	<20 ng/ml	20-29.9	>30	N,%	p-value
Female	351(60.1%)	206(35.2%)	27(4.6%)	584,100%	<0.05
Male	327(49.1%)	286(42.9%)	53(8.0%)	666,100%	<0.05
Location	<20 ng/ml	20-29.9 ng/ml	>30 ng/ml		
Rural	345(52.4%)	262(39.8%)	51(7.8%)	658,100%	>0.05
Urban	187(58.3%)	117(36.5%)	17(5.3%)	321,100%	>0.05
Abroad	145(53.7%)	113(41.9%)	12(4.4%)	270,100%	>0.05

About half of the study population (560, 44.8%) had body ache and one-fourth of the population (328, 26.24%) had low back pain (Table V). Statistical significance was noted in age, sex, education, and presenting complaints with a p-value of <0.05% with respect to the Vit D level.

Table V: Clinical Presentation of Study Population (N=1250)

Clinical Presentation	N,%
Low Back Pain	328 (26.24%)
Body ache	560 (44.8%)
Muscle Cramp	108 (8.6%)
Joint Pain	21 (1.68%)
Others	33 (2.64%)

Discussion:

A total of twelve hundred and fifty study populations were included in this study, with a mean age was $37.31 \pm \text{SD}$ and mean serum 25-OHD Level of $19.77 \pm \text{SD}$. A similar study was conducted in Tehran in 2016 where Emdadi et. al., (2016) reported their study population had a mean age of $31.17 \pm \text{SD}$ and a mean serum 25-OHD Level of $18.41 \pm \text{SD}$.⁹ In our study, three-fifths of the female study population (351, 60.1%) were Vit D deficient. Hossain et. al., (2016) revealed in this study that around four-fifths of the female study population (46, 82.1%) was Vit D deficient. Lack of sun exposure due to staying at home and wearing skin covering veils might be the reason for the low Vit D level among the study population¹⁰. In the current study, 10.8% of the study population were illiterate and 7.7% of patients were found to belong to the lower socioeconomic status. A similar study was found which is conducted in the Popular Medical College and Hospital in the year 2016 and revealed 8% of the study population were illiterate and 8.4% population was pertaining to a lower-class family¹⁰. In the present study, more than half of the study population (657, 52.6%) was residing in the remote part of the Cumilla district. Hossain et. al., (2016) found people from lower socio-economic status and rural areas were having a higher level of Vit D and noted more denunciation to sunlight exposure is the contributing factor¹⁰. Additionally, of two-seventy patients (n=270) who are staying abroad (mostly in the middle-east), more than half of them are Vit D deficient. Kaddam et. al., (2017) said in their study that Vit D deficiency became a health threat in Saudi Arabia which is very distressing¹¹. In this study, only nineteen patients (19, 1.5%) had a history of adequate sun exposure (at least 20 min a day between 10 am and 3 pm with 20% of skin surface exposed)¹² Patwardhan et. al. (2018) showed in their study that serum 25 (OH) D concentrations are significantly correlated with sunlight exposure¹³. In the present study, 3.4% of patients were hypertensive. Several studies reveal that Vit D is effective in lowering blood pressure in Vit D deficient people. Hence, Vit D has an active role in lowering blood pressure¹⁴⁻¹⁶. In the current study, 4.6% study population were diabetic. Depressed Vit

D levels considerably impair insulin and glucose metabolism that conduce to the pathogenesis and development of DM. Thus lower Vit D levels increase the risk of DM^{17,18}. In the study, nearly half of the population (560, 44.8%) complained of body aches. Many studies were conducted with fibromyalgia patients and found negative correlations between vitamin D levels and body pain^{19,20}. Correction of Vit D level improved these symptoms drastically. Sunlight is the major source of Vit D for most children and adults. Few foods contain Vit D naturally like salmon, oily fish, cod liver oil, and sun-dried mushrooms²¹. Some developed countries promote food fortification²². In order to augment Vit D intake with a regular diet, the food industry would find out more operative strategies to improve general health conditions. The amplitude of widely used foods in junction with milk, cheese, margarine, dairy products can improve the condition of Vit D deficiency in Asian countries such as Bangladesh. Auspicious strategies for Vit D fortification of foods and drinks should be developed and accentuated to reduce Vit D deficiency in general people as well as in different age groups. Vit D intoxication mostly betides after incongruous supplementation of Vit D. Moreover, prolonged sunlight exposure never produces extravagant Vit D3. Ultra Violate Ray is more prevalent during the hours of 10 am to 3 pm. During spring, summer, and autumn, 10 to 15 min of sun exposure from 10 am to 3 pm can generate satisfactory Vit D in light-skinned populations. Perhaps, the epidermal melanin of darker-skinned individuals is required more denunciation for cutaneous Vit D synthesis. Likewise, it is reputed that Asians from the Indian subcontinent demand 3 times as much sun exposure as Caucasians since Africans might need 6 to 10 times more^{23,24}. Patwardhan et. al., (2018) found in their study that western Indian men living in an urban setting with dark skin required over 1-hour casual sunlight exposure between 11 am to 3 pm to assert serum 25 (OH) D concentration above 50 mmol²⁵. The extensive prevalence of Vit D Deficiency in Bangladesh is incontrovertible. In fact, sun exposure is an inconceivable solution for most individual winnings towards Vit D deficiency. The need for amelioration in Vit D status is crucial and important. The government needs to take substantive measures to alleviate the problem. Reformed facilities and technologies should be made accessible nationwide to enable timely diagnosis of clinical manifestations of Vit D deficiency in individuals who need vigilance by clinicians. Population-based programs at the national level must be advanced to augment awareness concerning the effects of Vit D deficiency. Providing Vit D supplements and Vit D fortified foods to the target population would be salubrious. Research in this field requires continued support to provide a comprehensive synopsis of the ongoing Vit D problem and the effects of the inadequacy of Vit D on the human body of affiliation among government, healthcare system, industry, and consumers in the aim of recuperating the Vit D status in Bangladesh.

Conclusion:

In spite of abounding sunlight in Bangladesh, the prevalence of Vit D deficiency among the adult population presenting with generalized body ache and back pain is found in considerable numbers across all age groups and both sexes. Female gender, urbanization, obesity, dark skin complexion, wearing skin coverings veils, lifestyle like staying inside the home, offices are some of the significant factors associated with Vit D deficiency and/or insufficiency in Bangladesh. There is a need for health awareness programs using evidence-based recommendations. There is destitution for identifying the burden of Vit D deficiency to restraint and improve the prognosis of these conditions.

Recommendations:

Bangladesh's public health initiatives must prioritize achieving adequate Vitamin D sufficiency. Specific guidelines are crucial, including adding Vit D screening to the National Health program. Screening across age groups is essential for early detection and treatment. The government should promote food fortification, supplementation, and outdoor activities to maintain adequate Vit D levels. Policy-makers need multicenter studies to understand and mitigate the burden of Vitamin D Deficiency and improve prognosis.

Conflict of Interest: None.

Ethical Approval

The ethical permission received from the ethics review committee of the institution – Central Medical College Hospital. Confidentiality was strictly maintained during data processing and report writing.

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