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Prevalence of 25-hydroxy Vitamin D Deficiency: A Hospital Based Study among Healthy Bangladeshi Volunteers

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ABSTRACT

Introduction: *Vitamin D insufficiency is currently recognized as a pandemic.The aim of this study was to determine 25-hydroxy vitamin D [(25(OH)D] concentrations in a hospital-based healthy Bangladeshi volunteer.* ***Methods:*** *This cross-sectional study was conducted in the Department of Rheumatology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July to September 2014. A total number of 100 adult healthy volunteers of both genders were recruited purposively in this study. The anthropometric parameters, dietary evaluation (24 hours food recall) to quantify calcium and protein intake and serum 25(OH)D level were measured.* ***Results:*** *Among the respondents, 73 were female and 27 were male. The age range of the participants was 21 to 39 years. The mean 25(OH)D (ng/ml) was 20.58 ± 4.35. Only 3% of the participants had sufficient 25(OH)D (>30ng/ml); furthermore, 97% respondent had vitamin D deficiency (VDD) or insufficiency. Dietary calcium intake (mg/day) was 310.51±188.02 Protein intake was (gm/day) 52.55 ±16.82.* ***Conclusion:*** *25(OH)D insufficiency and deficiency were found in a considerable number of healthy hospital-based populations.*

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INTRODUCTION

Vitamin D insufficiency affects almost 50.0% of the population worldwide.[1]An estimated one billion people worldwide, across all ethnicities and age groups, have a vitamin D deficiency (VDD).[1–3] This pandemic of hypovitaminosis D can mainly be attributed to lifestyle and environmental factors that reduce exposure to sunlight, which is required for ultraviolet-B (UVB)-induced vitamin D production in the skin.

Vitamin D is critical for bone health. VDD causes impaired calcium absorption which can lead to rickets and osteomalacia.[4-6] Additionally, VDD is associated with osteoporosis and an increased risk of fractures.[7,8] Furthermore, accumulating observational evidence suggests that low vitamin D levels are associated with extra-skeletal sequel, including increased risks of cancer, cardiovascular disease, infection, and autoimmune diseases.[1] Emerging research supports the possible role of vitamin D against influenza, type-2 diabetes, and depression.[9] Vitamin D deficiency has also been associated with female-specific health concern, including preeclampsia, breast cancer and post-menopausal syndrome.[10-12]

Serum 25(OH)D levels reflect body stores of vitamin D.[1] VDD has been historically defined and currently recommended by the Institute of Medicine (IOM, USA: http://www.iom.edu/) as a 25(OH)D <12ng/ml. Vitamin D insufficiency has been defined as a 25(OH)D between 12 and 20 ng/ml.[10] Some of the older publications defined VDD as 25(OH)D <15 (or 20) ng/ml and insufficiency as 16-30 (or, 21-30) ng/ml.[11-15] Endocrine Society of America, National Osteoporosis Foundation (Arlington, VA. USA), International Osteoporosis Foundation (Switzerland), and American Geriatric Society suggest that a minimum 30 ng/ml is necessary in older adults to minimize the risk of falls and fracture.

VDD is common in Australia, the Middle East, India, Africa, and South America.[16,17] A recent study conducted in Pakistan revealed that 90% of premenopausal female had 25(OH)D concentration < 20ng/ml,[18] despite the fact that the country is located in the subtropical region with sunny climate. Another study at Lahore, Pakistan, among healthy women of child bearing age concluded that illiteracy, decreased sun exposure (religious culture of putting on 'hijab' might have contributed) and lack of multivitamin were responsible for VDD.[19]

Prevalence of VDD among staffs in an academic institution in Costa Rica was high. Only 17% of the study population had 25(OH)D ≥ 30 ng/dl.[20] Study conducted in Bangladesh[21] among 189 young women of two socio-economic groups in rural and urban regions revealed that 67.0% and 50.0% from the low and high socioeconomic groups respectively had VDD or insufficiency.

Data from the National Health and Nutrition Examination Surveys (NHANES) in the US showed a decrement trend in mean 25(OH)D.[21-23] This prompted us to an exploratory investigation aimed to determine 25(OH)D in Bangladesh among a hospital based healthy Bangladeshi volunteers.

METHODS

This cross-sectional study was conducted in the Department of Rheumatology at BSMMU, Dhaka, Bangladesh from July to September 2014 for a period of three months. Apparently healthy young subjects aged more than 18 years of both genders were selected as study population. The subjects were 'hospital based', like, physicians/ students of department of rheumatology and some of their spouses, attendants of the patients, hospital stuffs like stuff nurses, laboratory technicians, ward boys, cleaners, security stuffs. After obtaining the informed written consent of the study subjects, study questionnaire was served.

Pregnant and lactating women, those who had received drugs likely to affect vitamin D status in last 2 years (like corticosteroids, gonadotrophin-releasing hormone agonists, aromatase inhibitors, thyroxine, anticonvulsants, heparin), current tobacco user, those with medical disorders likely to affect bone mineral density and vitamin D status like hypogonadism, hyperthyroidism, hyperparathyroidism, Cushing's syndrome inflammatory bowel disease, rheumatoid arthritis, ankylosing spondylitis, chronic liver disease, chronic kidney disease, malabsorbtion were

excluded from the study. Subjects who were on calcium and vitamin D supplements for more than 3 months were also excluded from this study.

After selection of subjects, screening, non-fasting venous blood sample was collected for vitamin D assay. Anthropometric parameters including weight, standing height, BMI was obtained. Food recall interview was done by an experienced nutritionist. Study subjects stated about the food and beverages they consumed in the last 24 hours (24 hour food recall), from which daily calcium intake (mg/day) and elemental protein intake (gm/day) were determined. Any inconsistency was dealt with by re-interview. Vitamin D level was expressed as nanogram/ml (ng/ml). VDD was defined as serum 25 (OH) D <10.0 ng/ml and insufficiency as 25(OH) D between 10 and 29.9 ng/ml. Simple descriptive measures like percentage, mean and standard deviation of different variables were used. Analysis was done using SPSS version 15.

RESULTS

A total number of 100 adult respondents were recruited for this study (female 73, male 27). The age range of the study population was 21 to 39 years. Baseline demographic characteristics of the study subjects and their daily intake of calcium and protein are depicted in Table I. Mean age of the study subject was 29.16±5.32 years, male 30.63±5.15, and female 28.61±5.32. Mean height and weight of male (165.33± 5.85 cm, 64.74 ±9.735 kg), were higher than those of female (152.23±5.70 cm, 56.36±10.61kg). The BMI (Body mass index) of female (24.28±4.13 kg/m^2) was higher than that of male (23.68±3.31 kg/m^2).

Dietary intake of calcium (mg/day) for male was 346.25±196.77, for female was 297.29±184.31 in the series. Protein intake (gm/day) for male was 65.34±19.70, for female was 47.83±12.85.

Table I: Demographic characteristics and daily intake of calcium and protein of the study subjects

Variables	Mean ± SD		
	Female	Male	Total
Age (years)	28.61± 5.32	30.63 ±5.15	29.16± 5.32
Height (cm)	152.23±5.70	165.33± 5.85	155.88 ± 8.21
Weight (kg)	56.36±10.61	64.74 ±9.735	60.28 ± 10.36
BMI(kg/m^2)	24.28 ±4.13	23.68± 3.31	24.01 ± 3.61
Calcium intake (mg/day)	297.29±184.31	346.25±196.77	310.51±188.02
Protein intake (gm/day)	47.83±12.85	65.34 ±19.70	52.55±16.82

The vitamin D level was estimated in all 100 study subjects (female 73, male 27). The mean of 25(OH)D (ng/ml) was 20.58 ± 4.35 (all study population), 19.57±3.53 (female), 23.30±5.18 (male) (Table II).

Table II: Vitamin D Status of Study Subjects (n-100)

Gender	Age Group in years	Number	Total Number	25(OH) D (ng/ml) mean± SD
Female	21 to 30	49	73	19.57±3.53
	31 to 39	24		
Male	21 to 30	14	27	23.30±5.18
	31 to 39	13		
Total			**100**	**20.58±4.35**

The prevalence of sufficiency, insufficiency, and deficiency of 25(OH)D in the study subjects were 3(3.0%), 96 (96.0%) and 1 (1.0%) respectively (Table III).

Table III: Distribution of Study Population according to vitamin D level (ng/ml)

Vitamin D range	Frequency	(%)
30-100 (sufficient)	3	3.0
11-29 (insufficient)	96	96. 0
<10 (deficient)	1	1.0
Total	**100**	**100.0**

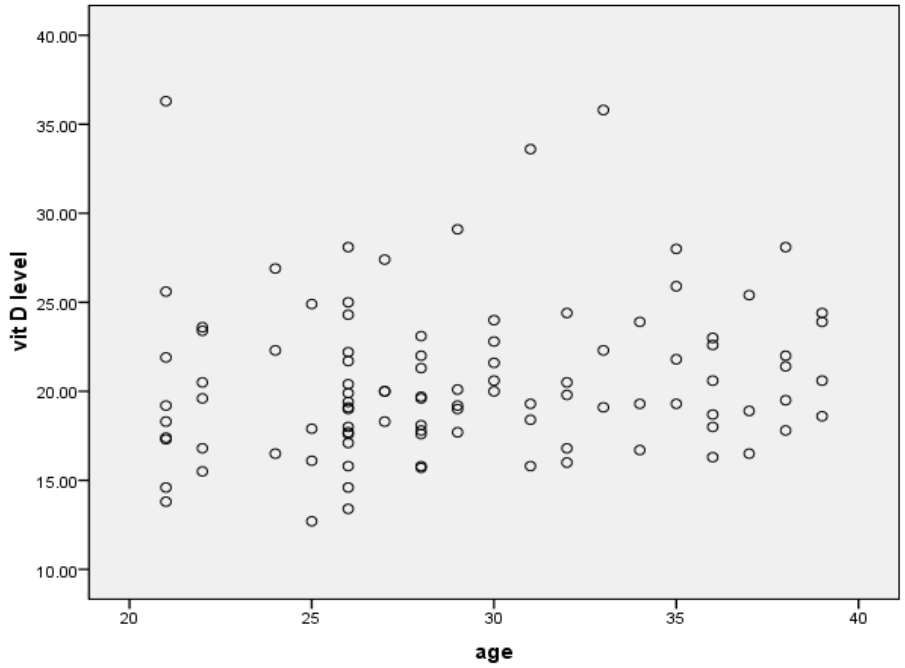

Figure 1: Vitamin D level plotted against age of the participants

DISCUSSION

This study evaluated the concentration of 25(OH) D in a small sample of an apparently healthy, hospital based young (age 21-39) population of both gender in Dhaka city in 2014 (July to September). The anthropometric parameters, dietary evaluation to quantify calcium and protein intake was also done.

The mean 25(OH)D (ng/ml) was 20.58 ± 4.35(All study population), 19.57±3.53 (female), and 23.30 ±5.18 (male). This mean value is a bit lower than the level found in a similar study conducted in Costa Rica (23.9 ±7.0) on a similar number of population.[20]Among the study population 96% had 25(OH)D in the insufficiency range. Only 3% of the study population had sufficient 25(OH)D. Value [25(OH)D] of the female subjects was found significantly lower than the male in our study.

Mean daily protein intake (gm/day) for male was 65.34 ±19.70, and for female was 47.83 ±12.85. Male meets more or less the recommended daily allowance (RDA, 1 mg/kg body weight) but female consume significantly less amount of protein. Significant difference of protein intake between male and female might have impact on the vitamin D level difference between male and female.

The number of study population (n-119) and study results (92% had vitamin D deficiency or insufficiency) conducted in Aga khan university hospital, Pakistan[24] is similar to this present study. Although that study was conducted on a group of ambulatory patient, from medicine and endocrine clinic. Vitamin D status among Bangladeshi women of reproductive age (study conducted in 2009 Pabna, Bangladesh) revealed that 119 women (80.96%) had vitamin D deficiency or insufficiency and 28(19.04%) had sufficient vitamin D.[25]

Another study conducted in Bangladesh[21] among 189 young women of two socio-economic groups in rural and urban regions (Dhaka and Nandail of Mymensingh respectively) revealed that 67.0% and 50.0% from the low and high socio-economic groups respectively had VDD or insufficiency.

This current study showed a poorer vitamin D status compared to both of those earlier Bangladeshi studies. Vitamin D level of 18 physicians and their spouses in rheumatology and medicine department revealed even a poorer status (mean vitamin D 19.50 ± 3.92 ng/ml). Daily calcium intake was observed low in the series (male 346.25±196.77 mg/day, female 297.29± 184.31mg/day), which is well below the recommended daily allowances (400 mg/day). It is lower in comparison to a study conducted in India.[26] Global decrement trend of the level of vitamin D, and the fact that most of the current study population spend more indoor hours during day time, and a lower (mean) intake of calcium and protein, than the recommended daily allowances, may explain the vitamin D status.

Sample size was small (n-100) and sampling was purposive. For resource constraint, serum level of calcium, inorganic phosphate, alkaline phosphates and serum albumin were not done. Further study may be carried out in the context of low vitamin D, in particular female subpopulation.

Vitamin D insufficiency and deficiency were found in healthy hospital based population in Dhaka, Bangladesh. Only 3% of the study population had sufficient vitamin D, 96% had their values (vitamin D) in the insufficiency range. From a public health approach, healthy solar ultraviolet radiation exposure along with physical activity and vitamin D supplementation could be recommended in office workers and homebound citizens with VDD. Comprehensive study may help to resolve many critical issues on vitamin D deficiency and insufficiency.

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Conflict of Interest: There is no conflict of interest.

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