

## Vitamin D3D2 Status and its Associated Factors of an Urban Tertiary Care Hospital, Dhaka, Bangladesh

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### Abstract

**Introduction:** Vitamin D is a fat-soluble vitamin that can be found naturally in a few foods, added to others, and taken as a supplement. When ultraviolet (UV) photons from the sun strike the skin and trigger vitamin D synthesis. **Aim of the study:** The aim of the study was to evaluate Vitamin D3D2 status and its associated factors of an urban tertiary care of Bangladesh. **Methods:** The study was conducted at the Bangladesh Institute of Research and Rehabilitation in Diabetes (BIRDEM), to evaluate the Vitamin D3D2 status and its associated factors of an urban tertiary care of Bangladesh. A total of 547 cases were chosen by random sampling, with Vitamin D3D2 status from July 2013 to June 2018. The results were statistically analyzed with Statistical Packages for Social Sciences (SPSS-24). **Results:** Most of the respondent in this study 329 (59.9%) belonged to the age group of 31-60, mean  $\pm$  SD was 41.4 $\pm$ 19. Out of 547 respondents, female were 397(72.6%) and male were 150 (27.4%), 385(70.4%) respondents had less than 30 nmole/L of vitamin D3D2 level, mean  $\pm$  SD was 25.5 $\pm$ 18. No significant association was found between gender of the respondents and vitaminD3D2 status of the study population (*p* value was 0.619). A significant difference was found between vitamin D3D2 (nmole/L) level and age of the respondents (*p* value was 0.002). Comparison of vitamin D3D2 status among Bangladesh, China, Malaysia and India was stated that vitamin D3D2 deficiency was more common in male than female. **Conclusion:** Vitamin D is an important vitamin which impacts many systems in the body but this study indicates that more than 70% of the Bangladeshi population are vitamin D deficient. In order to maintain healthy bone and boost up immunity as well as to sustain a balanced weight one has to ensure proper level of this indispensable protector of human being in one's bloodstream.

**Keywords:** Vitamin D3D2 status, Deficiency, Osteoporosis, Bone growth

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### I. Introduction

Vitamin D is a fat-soluble vitamin that occurs naturally in a few foods, may be added to others, and is available as a dietary supplement. Endogenous production occurs when ultraviolet (UV) photons from sunshine impact the skin and initiate vitamin D synthesis. It consists of more than one vitamin. It is a group of nutrients with similar chemical structures. The most prevalent members in a typical diet are vitamin D2 and D3. While both kinds assist in meeting the body's vitamin D requirements, they differ in a few key ways. Vitamin D2 is commonly found in plants like mushrooms, plant-based food, fortified foods and in dietary supplements, while vitamin D3 is only found in animal sourced foods like fish oil, liver, yolk, etc. Vitamin D is one of the primary vitamins that the human body needs to stay healthy. It helps the body in keeping bones strong, by absorbing calcium from various sources. Without adequate enough of Vitamin D, children can develop Rickets,<sup>[1]</sup> a disorder that causes children to have soft and weak bone tissues.<sup>[2]</sup> It can also cause loss of bone density in adults, leading to fractures. Vitamin D also helps develop the immune system of the body. Although both vitamin D2 and D3 are absorbed in the bloodstream, they are metabolized differently by the liver. And while vitamin D2 is supplied to the body by an indirect method, where plants and mushrooms use UVB lights along with plant oils to form the Vitamin D2,<sup>[3]</sup> Vitamin D3 is generated directly in the human body, using the Ultraviolet B radiation from sunlight along with the compound 7-dehydrocholesterol found in the skin.<sup>[4]</sup> While there is a risk of overdosing in vitamin D2 while using dietary supplements, it is not possible to overdose in Vitamin D3, as the body starts to produce less of it when there is an adequate amount in the body.<sup>[5]</sup> The lack of

Vitamin D, or Vitamin D deficiency, is a major problem globally, especially in regions where the sunlight is scarce. Research has shown that overall, 50% of the global population has less than adequate levels of Vitamin D, and almost 35% of the adult population of USA suffer from Vitamin D deficiency.<sup>[6]</sup> Sun exposure, geographic latitude, daily outdoor activities, body surface exposed to sunlight, and dietary intakes all have an impact on vitamin D status.<sup>[7]</sup> Vitamin D deficiency has been found in several tropical locations where the risk of deficiency was previously believed to be minimal due to cutaneous vitamin D production induced by sun exposure.<sup>[8]</sup> Vitamin D levels in a body can be observed by measuring the level of Calcifediol in the blood.<sup>[9]</sup> The general range of serum concentration of Calcifediol is between 130-150 nmol/l, according to the “Meyler’s side effects of drugs: the international encyclopedia of adverse drug reactions and interactions”, 2015 edition.<sup>[10]</sup> Although experts are unsure which is superior, most research suggest that vitamin D3 is more efficient than vitamin D2 at increasing calcifediol levels in the blood.<sup>[11],[12]</sup> The present study was conducted to observe the associated factors of Vitamin D3 and D2 status in a selected tertiary care hospital of Bangladesh.

## II. Methods

The study was conducted at the Bangladesh Institute of Research and Rehabilitation in Diabetes (BIRDEM), to evaluation the vitamin D3D2 status and its associated factors of an urban tertiary care of Bangladesh. A total of 547 cases were chosen by random sampling, with Vitamin D3D2 status from July 2013 to June 2018. Vitamin D2 and Vitamin D2 were measured of each participant. The results were statistically analyzed with Statistical Packages for Social Sciences (SPSS-24).

## III. Results

Socio demographic characteristics of the respondents presented in Table 1 showed, most of the respondent 329 (59.9%) belonged to the age group of 31-60, Mean  $\pm$  SD was 41.4 $\pm$ 19, maximum 88, minimum 1. Out of 547 respondents, female were 397(72.6%) and male were 150 (27.4%). Vitamin D3D2 status of the respondents was showed in Table 2 respondents 14% of the participants were in group 1 (severe deficient); 31% of the participants were 2 (moderate deficient); 26% of the participants were in group 3 (mild deficient); 29% of the participants were in group 4 (normal serum vitamin D levels). No significant association was found between gender of the respondents and vitaminD3D2 status of the study population was showed in Table 3 (p value was 0.619). A significant difference was found between vitamin D3D2 (nmole/L) level and age of the respondents showed in Table 4 (p value was 0.002). Comparison of vitamin D3D2 status among Bangladesh, Chaina, Malaysia and India [15] was showed that vitamin D3D2 deficiency was more common in male than female (Table 5). The study result showed that age, vitamin D3, vitamin D2, diabetes mellitus, hypertension was found significantly associated with vitamin D status considering total vitamin D (when vitamin D3 and vitamin D2 are included) (Table 6).

**Table-1:** Socio-Demographic features of the study population (n=547)

Variables	n	%
Age group of the respondents (Years)		
1-30	140	25.5
31-60	329	59.9
61-90	78	14.2
Mean $\pm$ SD= 41.4 $\pm$ 19, Maximum=88, Minimum=1		
Gender distribution		
Male	150	27.4
Female	397	72.6

**Table-2:** Distribution of Vitamin D3D2 status of the respondents

Group	n=547	%
Group 1(<10ng/mL), severe deficient	77	14
Group 2(10-20ng/mL), moderate deficient	170	31
Group 3(20-30ng/mL), mild deficient	142	26
Group 4(>30ng/mL), normal	158	29

**Table- 3:** The association between the Vitamin D3D2 (nmole/L) level and gender of the respondents

Variables	Mean± SD	p-value*
Male	25± 17	0.619
Female	26±19	

\*P value was determined by an independent samples T test and the result was not found statistically significant

**Table- 4:** The association between the Vitamin D3D2 (nmole/L) level and age of the respondents

Age group (in years)	Vitamin D3D2 (nmole/L)	p-value*
	Mean±SD	
1-30	21.3± 12	0.002
31-60	26.3±19 <sup>@</sup>	
61-90	30±22.3 <sup>@#</sup>	

\*P value was determined by ANOVA test.

@ Denotes significant difference between age 1-30 and 31-60 and 61-90 years

# Denotes significance difference between 31-60 and 61-90

**Table-5:** Comparison of Vitamin D3D2 status among different countries

Vitamin D3D2 status	Bangladesh		China		Malaysia		India	
	Female	Male	Female	Male	Female	Male	Female	Male
Less than 30	276(69.5%)	109(72.7%)	0(0)	0(0)	10(4)	0(0)	33(13)	25(10)
31-50	88(22.2%)	30(20%)	53(21)	30(12)	78(31)	48(19)	53(21)	50(20)
51-75	26(6.5%)	10(6.7%)	33(13)	48(19)	13(5)	38(15)	13(5)	23(9)
76-100	3(0.8%)	1(0.7%)	10(4)	20(8)	0(0)	15(6)	3(1)	3(1)
More than 100	4(1%)	0(0)	5(2)	3(1)	0(0)	0(0)	0(0)	0(0)
Total	397(72.6%)	150(27.4%)	101(40%)	101(40%)	101(40%)	101(40%)	102(40%)	101(40%)

**Table 6: Factors associated with vitamin D status considering dependent variable total vitamin D among the participants (n=547)**

Parameter	B	t	p
Age	-0.003	-1.978	0.048
BMI	-0.003	-1.669	0.096
Diabetes Mellitus	-0.201	-2.273	0.023
Hypothyroidism	0.055	0.677	0.498
Hyperthyroidism	-0.113	-0.783	0.434
Hypertension	-0.223	2.294	0.022

Dependent variable vitamin D3 pvalue<0.005 was considered significant.

#### IV. Discussion

Vitamin D plays a crucial role in bone growth and remodeling along with healthy mineralization. Socio demographic characteristics of the present study (in Table 1) found that most of the respondent 329 (59.9%) belonged to the age group of 31-60, mean ± SD was 41.4±19, maximum 88, minimum 1. Out of 547 respondents, female were 397(72.6%) and male were 150 (27.4%). In Vietnam, a cross-sectional study was done where the mean age of men was 43.8 year and mean age of women was 47.7 year [13], in Hong Kong revealed the mean age of the respondents was 69 ± 9 years [16], another study found mean ± SD was 10.8 ± 4.3 ranging from 1.6 to17.5 where male 69 (54%), female 59 (46%) [19]. Vitamin D3D2 status of the respondents of presents study was enrolled (in Table 2), where most of the respondents 385(70.4%) had less than 30 nmole/L of vitamin D3D2, where female 276(69.5%) male 109(72.7%), mean ± SD was 25.5±18, maximum 173.63, minimum 1.74. A study conducted in Hong Kong stated that mean 25(OH)D level was 28.3 ± 10.8 ng/ml and 62.8% of the respondents had 25(OH)D levels <30 ng/ml [14]. No significant association was found in present study between gender of the respondents and vitaminD3D2 status of the study population was showed (in Table 3) (p value was 0.619). In present study a significant difference was found between vitamin D3D2 (nmole/L) level and age of the respondents showed (in Table 4) (p value was 0.002) narrated that with increasing age

vitamin D3D2 concentration level was also increased and the prevalence of vitamin D3D2 deficiency was found more in young respondents than older. Another study found the serum vitamin D level of respondents significantly lower in age group of 20–29 years compared to age group of 40–49, 50–59 and more than 60 years ( $p < 0.05$ ). This study also revealed that vitamin D deficiency and insufficiency was more common in the younger age groups [17]. A study report of United State stated that, in the US population vitamin D deficiency was more natural. This study defined vitamin D deficiency as a serum 25-hydroxyvitamin D concentrations which was  $\leq 20$  ng/mL or 50 nmol/L. Vitamin D deficiency was found statistically more common among the obese people with hypertension, with low high-density lipoprotein, poor health status, cholesterol level, or not consuming milk daily which was an abundant source calcium necessary for bone growth [16]. Another study in Korea found that vitamin D in sufficiency were mostly determined to those who work for indoor occupation. It was more usual in winter season due to lack of sunshine and in the young age groups living in an urban area. In this study vitamin D insufficiency was most prevalent in Korean population in the age of 20–29, where male were 65.0% and female were 79.9%, and least prevalent was found in the age of 60–69 in males and 50–59 in case of females, only 13.2% male and 6.7% female population had serum 25(OH)D level which was greater than 30 ng/ml [18]. Comparison of vitamin D3D2 status among Bangladesh, Chaina, Malaysia and India was showed that vitamin D3D2 deficiency was more common in male than female (Table 5) [15] narrated that vitamin D3D2 deficiency was more usual in male than female. In this study it is also documented that 14% were severe vitamin D deficient and 31% were moderately deficient which is alarming and needs to take attention how to improve this situation.

### **Limitations of the Study**

This was an observational study with a small sized sample. So, the findings of this study may not reflect the exact scenario of the whole country.

## **V. Conclusion**

These findings are similar with other Bangladeshi study and it is more than seventy percent were deficient of serum vitamin D levels where 14% were severe deficient and 31% were moderately deficient. Therefore, it is important to pay attention to take more active measures by giving information to health professionals and the subjects themselves about the importance of vitamin D for health, including the need for out-of-doors exposure to sunlight, adequate dietary intake of vitamin D and implementation of current recommendations to improve their vitamin D status. Further investigation is required to determine the potential benefits of intervention.

## **VI. Recommendation**

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee

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