

# Vitamin D status in patients with mental disorders in Bangladesh: a cross sectional study

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## Summary

Vitamin D deficiency may contribute to the etiology of mental disorders by affecting the pathway of serotonin and catecholamine synthesis. Substantial research showed a relationship between mental illness and Vitamin D deficiency. The present study was aimed to see the status of vitamin D in different groups of patients with mental disorders. It was a cross-sectional study carried out from June 2020 to November 2021. Out of 220 patients who took telemedicine sessions, 205 were responded and included in the study. According to Clinical Practice Guidelines from the United States Endocrine Society, vitamin D categorical definitions were followed. Among 205 study subjects, 67.3 % were females and their mean age was 34.55±15.2 years. Among the mental disorder, obsessive compulsive disorder (OCD) patients were in the highest number (40.5%), followed by major depressive disorder (MDD) (17.36%), bipolar mood disorder (BMD) (12.7%), schizophrenia (10.7%), dual diagnosis (8.3%) and others 10.2%. Age and habitat of the patients had a significant association with vitamin D severity level. The mean Vitamin D level of the study subjects was 19.97±11.8 and the prevalence of hypovitaminosis was 87.80%. The severity of vitamin D status was; deficiency (<20ng/ml) 61.95%, and insufficiency (21-30ng/ml) 25.85% respectively. The mean vitamin D level among OCD (17.93±9.6) and schizophrenia (16.35±9.8) was much closer to each other. Vitamin D level was found to be significantly different among the groups of mental disorders i.e. between OCD versus MDD (p=0.021), BMD versus OCD (p=0.021). Vitamin D deficiency is an under-diagnosed entity, especially in treating patients with psychiatric disorders. Hopefully, further studies will come out exploring the issue in Bangladesh.

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## Introduction

Vitamin D deficiency is a common under diagnosed and unrecognized condition. Substantial research shows an association between mental illness and vitamin D deficiency particularly in depression, seasonal affective disorder and schizophrenia.<sup>1,2</sup> It was also found that depressive disorders and premenstrual affective symptoms and depressive disorders in women during the reproductive age, and cognitive difficulties in older adults were correlated with lower vitamin D level.<sup>2</sup> However, there is also evidence contradicting the association between vitamin D deficiency and mental disorders. In a mini review study findings showed that adolescents with severe mental illness and psycho geriatric patients were highly prevalent for both vitamin D deficiency and insufficiency.<sup>1,3</sup>

Different studies have revealed that vitamin D maintain calcium homeostasis, regulates gene expression of serotonin-synthesizing essential enzyme tryptophan hydroxylase, mediate

several biological pathways including insulin and serotonin and also had a role in amyloid beta clearance.<sup>3-6</sup> Harms et al. and Michael et al. observed that active vitamin D enhanced glutamate and glutamine metabolism in neurons in the rodent experiment that takes part in behavioral modifications and neurotransmitter-level changes. Several studies identified vitamin D as an essential coenzyme in the synthesis of monoamines such as norepinephrine and dopamine.<sup>4</sup> Review studies reported increased vitamin D receptors associated with anxiety symptoms, reduced activity and muscular and motor impairments. Moreover all of these growing evidences are showing that vitamin D plays a beneficial role associated with depression, anxiety and other mood symptoms.<sup>1,5</sup>

In corona virus disease 2019 (COVID 19) period, patients with psychiatric disorders particularly MDD, BMD, OCD were found more in online. They were not improving with adequate doses and duration of psychotropic medicines. Their medical co

morbidities like diabetes, hypertension, asthma, thyroid profile were under control. Vitamin D deficiency may play role in current situation. Thus the study was aimed to see the status and severity of vitamin D level and pattern of psychiatric disorders of online patients as well as the difference between vitamin D status and psychiatric disorders, socio-demographic variables of the patients.

**Materials and methods**

It was a cross sectional study carried out from June 2020 to November 2021. The telemedicine was carried out as video consultation over mobile phone in the COVID 19 period. The consultation center was in Dhaka and service was given all over the country. The adult patients and parents of children and adolescent contacted with online center via Messenger, WhatsApp and imo. After consultation and interviewing them, prescription was sent over online. Follow up visit was done in same process. Their verbal informed consent was taken to use their data afterwards. If not, they were excluded. During consultation, the patients were diagnosed by psychiatrist using Diagnostic Statistical Manual of Mental Disorders 5th edition (DSM-5) diagnosis criteria.<sup>7</sup> On the next visit they sent the picture of the reports of Vitamin D through Messenger, WhatsApp, imo. Then the data were collected. Out of 220 patients 205 subjects attending a telemedicine consultation for their mental health disorders were included in the study. As remaining 15 subjects were unable to do vitamin D level for their financial crisis, laboratory centers were far away from the home and they ignore in doing so. According to Clinical Practice Guidelines from the United States Endocrine Society, vitamin D deficiency is defined as serum 25-hydroxy vitamin D (25-OH D) <50 nmol/l (below 20 ng/ml). Vitamin D insufficiency is defined as serum levels of 25-OH D ranging between 50 and 75 nmol/l (21–29 ng/ml)(6). Continuous variables were graphically inspected for distributional assumptions; and described as the mean and standard deviation for variables with normal distribution. Categorical variables were described as a percentage. Continuous variables were compared using Student’s t test, one way Analysis of Variance (ANOVA) (normal distribution). Comparison between the normal, insufficient and deficient vitamin D groups was compared using chi-square test on categorical variables such as gender, age, habitat, education and mental disorders. Here vitamin D was used as the dependent variable. The significance level was set as <0.05. Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) for Windows version 20.0.

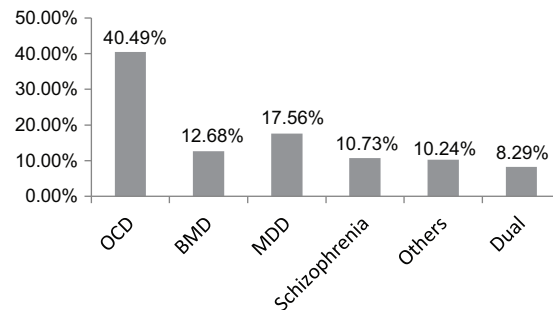
**Results**

A total of 205 patients were participated in the current study. The age of the participants ranged between 10 and 92 years and mean age was 34.55±15.2 years. Socio-demographic and

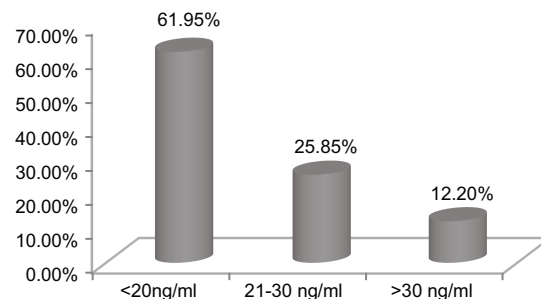
clinical characteristics of respondents were described in Table 1 and Figure 1. The majority of patients were female (67.3 %). About equally half of patients took telemedicine service from rural and urban area. Surprisingly 40.5% patients were suffering from obsessive compulsive disorder (OCD). Eighty eight percent (n=180) of the patients had hypovitaminosis (VDID). Figure 2 showed the severity category of vitamin D level where 61.95% deficient and 25.8% insufficient.

**Table 1: Demographic characteristics of the population sample (n=205)**

Variables	Frequency	Percentage
<b>Age (in years)</b>		
<18	22	10.7
19-36	102	49.8
27-54	57	27.8
>55	24	11.7
<b>Sex</b>		
Male	67	32.7
Female	138	67.3
<b>Habitat</b>		
Inside Dhaka (urban)	105	51.2
Outside Dhaka (rural)	100	48.8



**Figure 1: Frequency of the psychiatric disorders of the population sample (n=205)**



**Figure 2: Percentage of participants found to be vitamin D deficient, insufficient and normal (n=205)**

Table 2 showed that females had lower vitamin D levels than males but were statistically not significant ( $p=0.151$ ). Among the deficient subjects 42.4% and insufficient subjects 15.1% were female. A significant (sig) relationship between vitamin D levels and age was found ( $p=0.01$ ). The patients living in urban areas had lower vitamin D levels than urban people which was statistically significant ( $p=0.04$ ).

As shown in Table 3, Table 4 and Table 5 vitamin D level (Mean $\pm$ SD) of the study subjects was  $19.97\pm 11.8$ . The mean vitamin D level among OCD ( $17.93\pm 9.6$ ) and schizophrenia ( $16.35\pm 9.8$ ) was much closer to each other. Mean vitamin D level was found to be significantly different between OCD versus major depressive disorder (MDD) ( $p=0.021$ ), bipolar mood disorder (BMD) versus OCD ( $p=0.021$ ).

**Table 2: Comparison between severity of vitamin D level and SD variables and psychiatric disorders (n=205)**

Variables	<20ng/ml(%)	21-30 ng/ml(%)	>30ng/ml(%)	P value
<b>Sex</b>				
Male	19.5	10.7	2.4	0.15
Female	42.4	15.1	9.8	
<b>Age</b>				
<18	5.9	3.9	1.0	.010*
19-36	34.1	11.2	4.4	
27-54	15.1	5.9	6.8	
>55	6.8	4.9	0	
<b>Habitat</b>				
Inside Dhaka (urban)	35.65	11.7	3.9	.040*
Outside Dhaka (rural)	26.3	14.1	8.3	
<b>Disorder</b>				
OCD	27.3	8.8	4.4	.209
BMD	8.3	2.4	2.0	
MDD	7.3	7.3	2.9	
Schizophrenia	8.3	1.5	1.0	
Others	5.9	3.9	0.5	
Dual (OCD+BMD)	4.9	2.0	1.5	

Chi-Square test was done. P-value <0.05 is considered as the level of significance

**Table 3: Mean vitamin D level in the subgroup (n=205)**

	Serum vitamin D ng/ml	Standard deviation (SD)
<b>Whole Sample</b>		
Mean	19.97	11.88
Minimum	3	
Maximum	78.25	
<b>Gender</b>		
Male	19.5154	8.09044
Female	20.2035	13.36590
<b>Resident</b>		
Inside Dhaka (urban)	18.0909	11.79849
Outside Dhaka (rural)	21.9607	11.70848
<b>Primary diagnosis</b>		
OCD	17.9340	9.68367
BMD	20.0119	11.23568
MDD	25.2908	13.75529
Schizophrenia	16.3595	9.82742
Others	18.8414	12.49312
Dual (OCD+BMD)	24.7488	16.07327

**Table 4: Comparison between mean differences of vitamin D level with sex and habitat (n=205)**

	Frequency	Mean	SD	t	P value
<b>Sex</b>					
Male	67	19.5154	8.09044	.457	0.648 ns
Female	138	20.2035	13.36590		
<b>Habitat</b>					
Inside Dhaka	105	18.0909	11.79849	2.35	.019*
Outside Dhaka	100	21.9607	11.70848		

P-value <0.05 is considered as the level of significance

**Table 5: Comparison between mean differences of vitamin D level with psychiatric disorders (n=205)**

Disorders	Mean	SD	Test of homogeneity of variances		ANOVA	
			Levene's Statistic	Sig	F	Sig
OCD	17.9340	9.68367	.648	.663	3.072	.011
BMD	20.0119	11.23568				
MDD	25.2908	13.75529				
Schizophrenia	16.3595	9.82742				
Others	18.8414	12.49312				
dual	24.7488	16.07327				
<b>Group difference disorders</b>	<b>Mean difference</b>	<b>Sig</b>	<b>95% Confidence Interval</b>	<b>(LL-UL)</b>		
OCD-MDD	-7.35683*	.021	-14.0153	-.6984		
BMD-OCD	7.35683*	.021	.6984	14.0153		
MDD-Schizophrenia	8.93129	.054	-.0977	17.9603		
Schizophrenia-MDD	-8.93129	.054	-17.9603	.0977		

**Discussion**

An increasing body of evidence revealed hypovitaminosis D as an important environmental risk factor for a variety of physical diseases such as several different cancers (breast, colon, pancreas and prostate), autoimmune disorders (lupus, multiple sclerosis and Type I diabetes), asthma, cardiovascular disease and more recently psychiatric diseases.<sup>2,8</sup> This was the first study to see the prevalence and association between severity category of vitamin D and online psychiatric disorder patients during corona period in our country. In this study, we found a higher prevalence of hypovitaminosis (87.80%) and only 12.20% had vitamin D within normal limit than what we expected in psychiatric disorders patients. The mean level of vitamin D was 19.97±11, 61.95% and 25.85% had a deficient and insufficient level respectively. In a retrospective, laboratory-based, observational study where the cases were collected from a diagnostic center of Dhaka city where the prevalence of hypovitaminosis was 85.5% and mean level 21.66±18.36, 61.4% had a deficiency, 24.1% had insufficiency in Bangladeshi patients.<sup>9</sup> The prevalence of vitamin D deficiency was noted from 40% to 99% in India whilst the most of the studies reporting it of 80% to 90%. The data-based study was carried out in Pakistan where vitamin D deficiency was 66%. In UK the

prevalence of hypovitaminosis was 91.3% in UK 94% in Italy in adult patients admitted to a psychiatric hospital.<sup>6,10,11</sup> The findings of hypovitaminosis suggested that both the psychiatric in and out patients had higher hypovitaminosis than other patients and general population.

A research assessed vitamin D level in 104 adult patients admitted under psychiatric care in the UK where 49% were vitamin D deficient and 42.3% were vitamin D insufficient. Similar type of study in psychiatric in-patient samples 58%, 74%, 52.3% were insufficient in Australia, New Zealand and North America respectively and in an out-patient sample in Northern Europe 56% was insufficient.<sup>6</sup> The results among out-patient sample of our study suggested that vitamin D deficiency was more and insufficiency was less than western countries and were much closer to each other in this subcontinent.<sup>6,11</sup>

Previous studies had provided evidence that a high prevalence of vitamin D deficiency was identified in recent studies in Bangladeshi women, garments worker females and Australian Muslim healthy women. In a multicenter study, hypovitaminosis was also found among doctors in Bangladesh.<sup>12</sup> In the current study, VDID was higher in females than males but statistically not significant. Ramdurg et al. mentioned significant association between vitamin D levels and gender was found (p=0.001) and

deficiency was more common in females.<sup>11</sup> The VIDID was statistically significant between rural and urban patients ( $p=0.040$ ). Direct sunlight, food habit, lifestyle, exercise might play important role in this aspect which marked similar statements with other study reports.<sup>2,11</sup> In the UK the mean serum level was 34.8nmol/L and the deficiency rate was 39.3%, in 19-64 years old.<sup>6</sup> A significant difference between mean vitamin D levels and age group (19-36 yrs.) was found ( $p=0.01$ ) in our study. Another study observed significant difference ( $p<.001$ ) among age group. The deficient levels were more common among age group below 25 years. But there were no statistically significant difference was noted associated with age, gender or primary diagnosis.<sup>11</sup> Cumo et al. found no significant relationship with vitamin D levels and gender but were inversely proportional to age ( $p<.0001$ ).<sup>10</sup>

The majority of the patients had diagnosis of OCD 40.5% in current study. In the deficient group 27.3% of the patients had diagnosis of OCD. The visit of majority of OCD patients may explain by that OCD was triggered in COVID 19 period. They needed immediate help through telemedicine. In a single cohort hospital based study diagnosed the patient were suffering mostly from schizophrenia spectrum disorders in lesser extent from mood disorders and, in the minority ones, from other mental disturbances.<sup>13</sup> Cuomo et al. stated majority of the had diagnosis of mood disorders (86.6%).<sup>10</sup>

The mean level of Vitamin D ( $19.97\pm 11\text{ng/ml}$ ) in Bangladeshi psychiatric patients was much closer to psychiatric patients in other countries but higher in admitted patients in UK.<sup>6,10,11</sup> It was noted Schizophrenic patients had lowest mean  $16.35\pm 9.8$  and MDD had highest mean  $25.29\pm 13$ . In different studies showed low vitamin D level in Schizophrenia which was also reflected in this study but other study found highest level in bipolar mood disorder patients.<sup>6</sup> We found vitamin D level was significantly different among the groups of mental disorders i.e. OCD versus MMD and OCD versus BMD disorders.

A systematic review has confirmed low concentrations of vitamin-D significantly associated with psychosis. In some studies showed levels of vitamin-D inversely correlated with depressive disorders and negative symptoms of psychotic disorders.<sup>8</sup> A recent meta-analysis reported that two-thirds of patients with schizophrenia had significant vitamin D deficiency. In a systematic review of 14 epidemiological studies noted that prevalence of hypovitaminosis was about 30% higher in patients with depression. These patients were twice more likely to develop hypovitaminosis D than general population during the course of the disease.<sup>13</sup>

All these study results supported vitamin D supplementation could improve or reduce the risk of autism, MDD, schizophrenia, OCD and anxiety disorder. This study would step forward regarding Vitamin D supplementation as a preventive measure for psychiatric disorders patients irrespective of age and sex.

The limitation of our study was the cross-sectional study design, heterogeneity of samples in terms of psychiatric diagnoses. We couldn't work out on causal relationship between vitamin D and psychiatric disorders.

### Conclusion

Mental disorders may have a link with vitamin D deficiency. Vitamin D deficiency is an under-diagnosed entity, especially in treating patients with psychiatric disorders. Hopefully, the patient would be benefited if properly screened and prescribe vitamin D as augmentation with psychotropic medicine.

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