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Original Article

Comparison of Vitamin D Level between Patients with Depressive Disorder and Apparently Healthy Individuals Attending Rajshahi Medical College Hospital

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Abstract

Background: Vitamin D has received considerable interest from the medical community and the public because of recent evidence for the nonskeletal effects of vitamin D combined with the finding of widespread global deficiency. It has been estimated that almost 1 billion people worldwide suffer from vitamin D deficiency or insufficiency. In addition, neurobiological and neuroendocrinological substrates have been identified that indicate a link between hypovitaminosis D and several psychiatric conditions, including depression.

Objectives: This study aimed to assess vitamin D level in patients with depressive disorders and to compare it with normal individuals.

Materials & Methods: This cross-sectional type of comparative study was carried out in the Department of Physiology, Rajshahi Medical College, Rajshahi, in collaboration with the outpatient department of Psychiatry Rajshahi Medical College Hospital over 12 months from January 2019 to December 2019 among the Depressive patients and healthy individuals to find out and compare the vitamin D level between the two groups. Approval from the Ethical Review Committee (ERC) was obtained before the commencement of the study. A pA pre-designed, validated, structured questionnaire was used to gather information from 108 respondents by purposive sampling. Out of the 54 were newly diagnosed depressive patients, and 54 were healthy persons. In addition, a blood sample was collected to measure 25(OH)D level, and all values were analyzed statistically.

Results: The result showed a significant difference in mean plasma 25(OH)D level between the patients with depressive disorder and the healthy individuals. Circulating 25(OH)D level was found to be significantly low in the group of patients with depression.

Conclusion: The present study demonstrated a significant correlation between hypovitaminosis D in patients with depressive disorders. It is suggested that possible factors such as hypovitaminosis D should be done as a routine investigation to reduce the incidence of depression. Furthermore, vitamin D supplementation might be a complementary treatment for depression.

Keywords: Depression, 25(OH)D.

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Introduction

Vitamin D, described as the 'Sun vitamin,' is essential for the growth and development of the body. Unfortunately, there is a high prevalence of vitamin D deficiency in South Asian populations due to a lack of proper diet and social customs and

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remaining confined within the four walls of primitive housing that deprives the elderly, children, and female population of the benefit of the sunshine The mean serum concentration of 25 (OH) D for health is 30ng/ml.[1] In the South Asia, apparently healthy populations are deficient in vitamin D (<20ng/ml), and up to 40% are deficient in vitamin D (<9ng/ml).

Vitamin D is a steroid hormone synthesized in the skin from 7-dehydrocholesterol in a UV light-mediated, nonenzymatic proteolytic reaction. Functions of vitamin D are calcium, phosphate homeostasis, bone mineralization, immunoregulation, neuromuscular function, antineoplastic (colon, prostate, breast), etc.[2]

The primary source of vitamin D for humans is its endogenous synthesis from a precursor, seven dehydrocholesterol, in a photochemical reaction that requires solar or artificial UV light in the range of 290 to 315nm (UVB radiation). A smaller amount of dietary sources, such as deep-sea fish, plants, and grains, may be provided by cheese, beef liver, and egg yolk. Under usual sun exposure conditions, about 90% of the required vitamin D is endogenously synthesized in the skin.1

Vitamin D plays a vital role in maintaining bone health, but recently, researchers have been emphasizing the role of vitamin D in the newer domains of health. Many parts of the brain contain vitamin D receptors, suggesting that vitamin D is acting in some way in the brain's functioning. These receptors are located in the brain's areas linked to the development of depression. For this reason, vitamin D has been linked with depression and other mental health problems.[3]

Depression is a significant public health problem projected to be the second most important cause of disability worldwide in 2020.[4] It is the third leading cause of disability in developed countries. It affects approximately 840 million people worldwide. Although biological, psychological, and environmental theories have been postulated, the underlying pathophysiology of depression remains unknown. A plausible aetiologic explanation is that receptors for vitamin D are present on neurons and glia in many areas of the brain, including the cingulate cortex thalamus, cerebellum, substantia nigra, amygdala, and hippocampus, which have been implicated in the pathophysiology of depression.[5] It has been shown that one of the actions of vitamin D is to induce the expression of the serotonin-synthesizing gene tryptophan hydroxylase two while repressing the expression of tryptophan hydroxylase 1. Both tryptophan hydroxylase one and tryptophan hydroxylase 2 play a role in serotonin synthesis. Vitamin D may thus prevent depression by maintaining normal serotonin levels. There is evidence that depression is also associated with low levels of the neuronal inhibitory neurotransmitter GABA (γ-amino butyric acid). The number and function of GABAergic neuron is controlled by vitamin D.[6]

Bangladesh is a densely populated developing country in Southeast Asia with gradual improvement in health and literacy, but mental health illnesses are the least admitted. The prevalence of depressive illness is about 4.6% in Bangladesh.[7] this study aims to determine the relationship between vitamin D levels and depression. So vita, min-D supplementation could be considered a complementary therapy for depression.

Materials and Methods

This was a cross-sectional type of comparative study at the Department of Physiology, Rajshahi Medical College, Rajshahi, from January 2019 to December 2019 to assess Vitamin D level in depressive patients and to compare it with normal individuals. Individuals attending at outpatient Department of Psychiatry of Rajshahi medical college hospital were primarily the study population included in this study. Among those who were diagnosed as depressive, patient was taken in group A, and healthy individuals were taken in group B. Diagnosis of depression was done by the psychiatrist on the basis of history and physical examination. A purposive sampling technique was used, and the total sample size was 108 (54 in each group). Consulting with the supervisor and reviewing the previously published literature researcher developed the research instrument for the study. The depressive patients and healthy individuals who fulfilled the inclusion criteria were enrolled in this study. After taking informed consent, complete history taking and physical examination were done and recorded in a preformed data sheet. Then whole blood (about 5ml) was collected from the anterior cubital fossa by venepuncture technique using a 21 gauge hypodermic needle, and determination of 25-hydroxy vitamin D (25-OH vitamin D) in human serum and plasma was done by Microplate Enzyme Immunoassay, Colorimetric. All efforts were made to collect data accurately. Data were expressed as mean with standard deviation (mean ± SD) and number with a percentage. Differences in categorical variables were determined by the chi-square test, and that in continuous variables were determined by unpaired t-test. All statistical analysis was done by SPSS (version 24) for windows. In the interpretation of results, a p-value < 0.05 was accepted as significant.

Results

Out of the total 108 respondents, the mean age of the study subjects was 33.41 ± 9.69 years and 35.09 ± 9.45 years in group A and group B, respectively. There was no significant difference in age between the two groups. In both groups, females were more predominant than males. In group A, male to female ratio was 1:1.7 and in group B, male to female ratio was 1:1.25. In both groups, more than half of the study subjects were from urban areas. In both groups, the maximum number of study subjects were service holders. Most of the study subjects were literate in both groups. The mean monthly family income of the study subjects was 37814 ± 12545 taka and 38351 ± 14180 takas in group A and group B, respectively. There was no significant difference in age between the two groups (Tables I and II).

Table I: Distribution of the study subjects on the basis of age, gender, and residence (N=108)

	Group A (n=54) n (%)	Group B (n=54) n (%)	p-value
Age (years)			
≤20	6 (11.1)	4 (7.4)	
21 - 30	20 (37.0)	16 (29.6)	
31 - 40	14 (25.9)	18 (33.3)	
41 - 50	14 (25.9)	16 (29.6)	
Mean ± SD	33.41 ± 9.69	35.09 ± 9.45	0.362
Gender			
Male	20 (37.0)	24 (44.4)	0.433
Female	34 (63.0)	30 (55.6)	
Residence			
Urban	31 (57.4)	35 (64.8)	0.430
Rural	23 (42.6)	19 (35.2)	

Data were analyzed using the Chi-square test and were presented as Frequency (%).

Table II: Distribution of the study subjects on the basis of occupation, education, and monthly family income (N=108)

	Group A (n=54) n (%)	Group B (n=54) n (%)	p-value
Occupation			
Student	13 (24.1)	15 (27.8)	0.791
Service	19 (35.2)	19 (35.2)	
Day labor	4 (7.4)	6 (11.1)	
Housework	18 (33.3)	14 (25.9)	
Education			
Illiterate	1 (1.9)	1 (1.9)	0.756
Primary	8 (14.8)	13 (24.1)	
SSC	14 (25.9)	15 (27.8)	
HSC	13 (24.1)	11 (20.4)	
Graduate	18 (33.3)	14 (25.9)	
Monthly family income			
≤20,000	6 (11.1)	10 (18.5)	
>20,000 - 30,000	12 (22.2)	7 (13.0)	
>30,000 - 40,000	15 (27.8)	17 (31.5)	
>40,000 - 50,000	16 (29.6)	12 (22.2)	
>50,000	5 (9.3)	8 (14.8)	
Mean ± SD	37814 ± 12545	38351 ± 14180	0.835

Data were analyzed using the Chi-square test and were presented as Frequency (%).

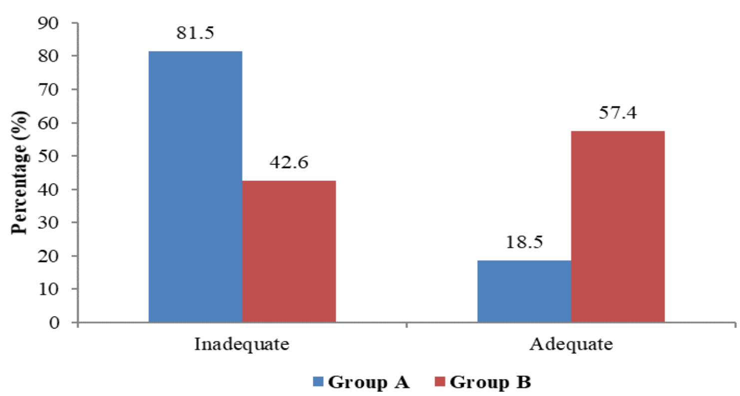

Figure 1: Bar diagram of the study subjects according to sun exposure

Sun exposure of the respondents revealed that in group A and in group B, 10(18.0%) and 31 (57.4%) had a history of adequate sun exposure, respectively. Sun exposure was significantly lower ($p < 0.001$) among the depressive disorder patients comparing healthy individuals (Figure 1).

Table III: Distribution of the study subjects according to work shift (N=108)

Work shift	Group A (n=54) n (%)	Group B (n=54) n (%)	p-value
Morning	48 (88.9)	54 (100.0)	0.026
Evening	6 (11.1)	0 (0.0)	

Data were analyzed using Fisher's Exact test and were presented as Frequency (%).

In group A, 6 (11.1%) study subjects worked in the evening, but in group B, none of the study subjects worked in the evening. There was a significant difference ($p = 0.026$) in working shifts between the patients with depressive disorder and healthy individuals (Table III).

Table IV: Distribution of the study subjects according to the duration of works (N=108)

Duration of work (hours)	Group A (n=54) n (%)	Group B (n=54) n (%)	p-value
<8 hrs	24 (44.4)	37 (68.5)	0.012
>8 hrs	30 (55.6)	17 (31.5)	

Data were analyzed using the Chi-square test and were presented as Frequency (%).

Patients with depressive disorder (group A) worked significantly longer ($p = 0.012$) period than healthy individuals (group B) (Table IV).

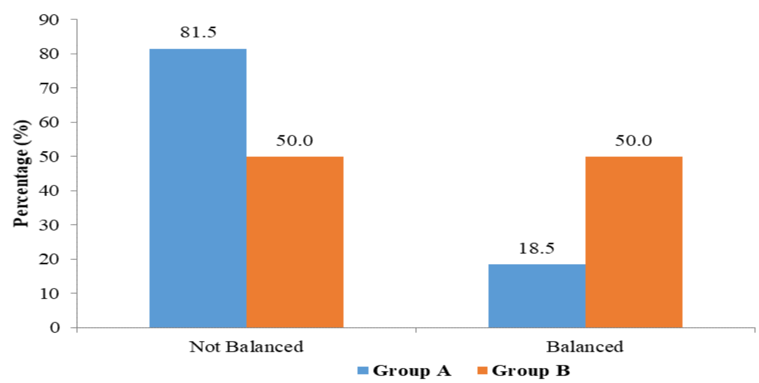

Figure 2: Bar diagram of the study subjects according to diet.

Significantly lower ($p < 0.026$) number of depressive disorder patients (group A) had a balanced diet comparing healthy individuals (group B) (Figure 2).

Table V: Vegetable and fruit consumption by the study subjects (N=108)

Vegetable & Fruit consumption	Group A (n=54) n (%)	Group B (n=54) n (%)	p-value
Frequently	30 (55.6)	32 (59.3)	0.697
Sometimes	24 (44.4)	22 (40.7)	

Data were analyzed using the Chi-square test and were presented as Frequency (%).

More than half of the study subjects consumed vegetables and fruit in both groups. There was no significant difference (p = 0.697) in vegetable and fruit consumption between the two groups (Table V).

Table VI: Distribution of the study subjects according to smoking (N=108)

Smoking	Group A (n=54) n (%)	Group B (n=54) n (%)	p-value
Yes	13 (24.1)	3 (5.6)	0.007
No	41 (75.9)	51 (94.4)	

Data were analyzed using Fisher's Exact test and were presented as Frequency (%).

Significantly higher (p = 0.007) number of depressive disorder patients (group A) had smoking habits comparing healthy individuals (group B) (Table V).

Table VII: Distribution of the study subjects according to to exercise (N=108)

Exercise	Group A (n=54) n (%)	Group B (n=54) n (%)	p-value
Sometime	33 (61.1)	25 (46.3)	0.074
Frequently	5 (9.3)	2 (3.7)	
Never	16 (29.6)	27 (50.0)	

Data were analyzed using the Chi-square test and were presented as Frequency (%).

In group A, 16 (29.6%) and in group B, 27 (50.0%) had never done exercise (Table VII).

Table VIII: Comparison of clinical findings and serum 25(OH)D between Group A and Group B (N=108)

BMI (kg/m^2)	Group A (n=54)	Group B (n=54)	p-value
Normal weight (18.5 – 24.9)	28 (51.9)	33 (61.1)	
Overweight (25.0-29.9)	21 (38.9)	21 (38.9)	
Obese (≥30.0)	5 (9.3)	0 (0.0)	
Mean± SD	25.12 ± 3.05	24.01 ± 2.18	0.036

Data were analyzed using an unpaired t-test and were presented as mean ± SD.

BMI was significantly higher (p =0.036) in depressive disorder patients (group A) comparing healthy individuals (group B). There were 5 (9.3%) obese in group A but none in group B (Table VIII).

Table IX: Comparison of serum 25(OH)D between Group A and Group B (N=108)

Serum 25(OH)D (ng/dl)	Group A (n=54) Mean± SD	Group B (n=54) Mean± SD	p-value
≥30	0 (0.0)	41 (75.9)	
<30	54 (100.0)	13 (24.1)	
Mean ± SD	11.23 ± 3.31	31.27 ± 2.97	<0.001

Data were analyzed using the unpaired t-test and were presented as mean ± SD.

Serum 25(OH)D was significantly lower (p < 0.001) in depressive disorder patients (group A) comparing healthy individuals (group B) (Table VIII).

Table X: Comparison of serum 25(OH)D between adequate and inadequate sun exposure among depressive disorder patients and healthy controls (N=108)

	Sun exposure				p-value
	Inadequate		Adequate		
	n	Mean± SD	n	Mean± SD	
Group A	44	10.40 ± 2.78	10	14.88 ± 3.01	<0.001
Group B	23	29.74 ± 2.50	31	32.40 ± 2.82	0.001

Data were analyzed using unpaired t-test and were presented as mean± SD.

Serum 25(OH)D was significantly lower in inadequate sun exposure cases than that in adequate sun exposure cases both in depressive disorder patients and healthy controls (Table IX).

Discussion

Vitamin D deficiency is more common in South Asia and Southeast Asia. People living in Bangladesh live at a latitude that supports cutaneous vitamin D synthesis all year round. Still, hypovitaminosis D is highly prevalent in our country.

In this study, the mean age of the study subjects was 33.41 ± 9.69 years and 35.09 ± 9.45 years in group A and group B, respectively. Age of the two groups were similar. In both groups, females were more predominant than males. Zhu et al.[8] reported low serum 25 (OH) D levels in 79.6% of subjects aged 20 to 69 years in the capital city of Tehran. It was found that 63.0% of the respondents were female and 37.0% were male in group A, 55.6% were female, and 44.4% were male in group B, respectively. Another study done by Hoang et al.[9] 2018 found that among 212 study population, 73.6% were female (n = 156). The mean vitamin D level among males was 14.29 & for females, it was 12.64[9].

The people living in rural areas have a higher level of vitamin D – more exposure to sunlight is the contributing factor[9]. In the present study, there was a highly significant difference in sunlight exposure (p < 0.001) between patients with depressive disorder and healthy individuals. In group A and in group B, 10 (18.0%) and 31 (57.4%) had a history of adequate sun exposure, respectively. These findings agreed with Penckofer S et al.[10], Chiu et al.[11], and Patrick et al.[12]. Sun exposure was significantly lower among depressive disorder patients comparing healthy individuals.

The findings of this study suggest that there was a significant difference among the study subjects according to the working shift. In group A, 45(83.3%) worked in the morning, 6(11.1%) in the evening, and 3 (5.6%) at night. These findings were in accordance with Compher et al.[13], Daly et al.[14], and Gupta[15]. Shift workers and indoor workers are the occupational groups most likely to suffer from a deficiency of vitamin D[16]. In the case of indoor workers, UVB is filtered by glass, but indoor sunlight exposure does not produce vitamin D[17]. In our study, a significantly lower number of depressive disorder patients had a history of taking a balanced diet comparing healthy individuals. The Association of low vitamin D levels with diet and obesity has been seen in a study done by Liel et al. [18]. In another study, we have found that a high dietary supplement of vitamin D may improve depressive symptoms [19,20]. In another study Young SN suggests the main dietary source of vitamin D is fish, and while the inverse correlation between fish consumption and depression has usually been interpreted as an association between omega-3 unsaturated fats and depression, the role of vitamin D in such dietary studies requires clarification[21].

In this study, we have found a significantly higher number of depressive disorder patients had smoking habits comparing healthy individuals. This finding is compatible with Chiu et al.[22], Lips et al.[6], Hossain et al.[23], and Jorde et al.[24]. Association between cigarette smoking and low vitamin D value was also found.

In our study, in group A, 16 (29.6%) and in group B, 27 (50.0%) had never done exercise. With data from the US national health and nutrition Examination Survey (NHANES), Forrest et al.[25] demonstrated that the risk of having serum 25 (OH) D levels <50 nmol/l was about two times higher among the respondents who maintained physical exercise than who did not maintain any physical exercise. Physical activity may help to reduce depressive symptoms.

In our study, we found an inverse association between vitamin D levels and BMI. BMI was significantly higher in depressive disorder patients comparing healthy individuals. There were 5(9.3%) obese in group A, but none in group B. Association between low vitamin D levels and obesity has been found in many other studies. These findings were supported by Gough et al.[26], Nimitphong and Holick [27], and McGill et al.[28].

In the current study, serum 25(OH)D level was significantly lower in depressive disorder patients comparing healthy individuals. These findings were supported by Chiu et al.[11], Gough et al.[26], Sutherland et al.[29], Wagner et al.[30], and Tsankova et al.[31]. in the absence of sunlight, 1000 IU of vitamin D are necessary to maintain a healthy level of 25(OH)D >30ng/ml[1]. A study done by Anglin et al.[5] in Iran found no significant association between serum 25(OH)D level and depression. They investigated the association between vitamin D levels and depressive symptoms in patients with major depressive disorder.

In the present study, we investigated whether circulating levels of 25 (OH)D were associated with depressive symptoms or not. Consistent with several earlier findings, the results showed that serum 25(OH)D levels were associated with depressive disorders. Recent studies have given an increasing amount of attention to the possible role of vitamin D in cognitive function and mental health. A unique neurosteroid hormone may also have an important role in the development of depression.

Conclusion

The present study demonstrated a significant correlation between hypovitaminosis D in patients with depressive disorders. It is suggested that possible factors such as hypovitaminosis D should be looked for and treated as a routine investigation so it can reduce the incidence of depression.

Conflict of interest: None declared

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