ORIGINAL ARTICLE

Psychiatric Implication of Deficiency of Vitamin B 12 and Vitamin D: A Cross-sectional Study from North India

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Abstract

Background: Both vitamin B12 and vitamin D are closely correlated with various neurological and psychiatric disorders. These vitamins might have an etiological and prognostic value across a variety of psychiatric illnesses, especially depressive disorder, anxiety disorder, substance use disorder, schizophrenia, dementia, schizophrenia, and so on.

Objective: To explore about the deficiency of vitamin D and vitamin B12 in patients presenting to the psychiatry OPD and admitted in indoor wards and explore its relation with various psychiatric disorders.

Materials and methods: In our cross-sectional, observational study, data were taken out retrospectively from the psychiatry and biochemistry record system of patients who had visited psychiatry OPD and IPD in the last 6 months and had undergone vitamin B12 and vitamin D investigations.

Results: About 168 subjects were included in the study, of which 96 had undergone vitamin B12 level and 72 underwent vitamin D investigations. The mean of vitamin B12 was 314.02 ± 420.28 and the mean of vitamin D was 72.5 ± 62 in the study sample. Vitamin B12 deficiency was majorly found in patients suffering from anxiety disorder (29.8%) followed by depressive disorder (19.1%) and substance use disorder (17%), while vitamin D deficiency was mainly present in cases with an anxiety disorder (29.7%) followed by depressive disorder (13.5%). An equal number of cases with substance use disorder, schizophrenia, and somatic symptom disorder had the vitamin D deficiency.

Conclusion: Early recognition of the deficiency and prompt management would surely affect the course of various psychiatric morbidities.

Keywords: Mental disorders, Psychiatric disorders, Vitamin B12**,** Vitamin B12 deficiency, Vitamin D, Vitamin D deficiency.

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Introduction

Vitamin B12 is an important water-soluble vitamin. It is also known as cobalamin. It is important in the synthesis of DNA during the division of cells.[1] Brain neurotransmitters, such as dopamine and serotonin use vitamin B12 as a cofactor in their synthesis.[2] Various theories of psychiatry disorder prove that dopamine and serotonin play an important role in psychiatric symptomatology.[3]

Vitamin D is a lipid-soluble vitamin, which is also called sunshine vitamin. It is not only an essential vitamin for muscle performance, metabolism of bone, calcium, and phosphorus but also has a neuroprotective role.[4] It regulates the intracellular and extracellular calcium levels in neurons. Vitamin D also helps in the regulation of calcium ion, facilitates the release of neurotrophins, and communicates with reactive oxygen and nitrogen species and neuroimmunomodulator effects of calcitriol.[5]

Vitamin D has a strong relation with disorders, such as parkinsonism, schizophreniform disorder, autism spectrum disorder (ASD) and Alzheimer's disorders.[6] A study reports that low levels of vitamin D are associated with psychiatric symptoms, such as negative emotions and decreased adjustment pre-morbidly.[7] Another study by McCue from North America reports about deficiency of vitamin D in patients admitted to psychiatric ward/indoor.[8]

Skarupski et al.[9] in 2010 concluded that a higher intake of vitamin B12 improves depressive symptoms and cognition. Another study by Walker in 2012 reports that vitamin B12 leads to improvement in cognitive symptoms.[10] Syed et al. reported that supplementation of vitamin B12 with antidepressants improves depressive symptoms.[11]

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When looking at the Indian population, not much data are available related to low levels of vitamin B 12 and vitamin D and their association with neuropsychiatric disorders, especially from North India in our catchment area of Dehradun, Rishikesh, and Haridwar.

Hence with this background, we planned this study. The main aim was to assess the prevalence of vitamin D and vitamin B12 deficiency in patients presenting to the psychiatry OPD and admitted in the indoor ward and explore its relation with various psychiatric disorders.

Table 1: Demographic variables and psychiatric disorder in patients who underwent vitamin D and vitamin B 12 investigations

	Frequency (SD)/Percentage	
Variables	*Vitamin D levels (n = 72)*	*Vitamin B12 levels (n = 96)*
Age	40 ± 15	
Sex		
M	54.2%	
F	45.8%	
Depressive disorder	17.7%	15.3%
Anxiety disorder	32.3%	26.4%
Substance use disorder	12.5%	12.5%
Dissociative disorder	5.2%	5.6%
Schizophrenia	4.2%	8.3%
Bipolar affective disorder	9.4%	8.3%
Somatic symptom and related disorder	5.2%	8.3%
Adjustment disorder	4.2%	5.6%
Dementia	4.2%	4.2%
Post-traumatic stress disorder	1.0%	1.4%
Persistent delusional disorder	1.0%	4.2%
Obsessive compulsive disorder	3.1%	15.3%

Materials and Methods

In our cross-sectional, observational study, data were taken out retrospectively from the psychiatry and biochemistry record system of patients who had visited psychiatry OPD and IPD in the last 6 months and had undergone vitamin B12 and vitamin D investigations. These patients were visiting the psychiatrist for the first time and were drug naïve, and did not have any other major medical and surgical illness.

They were first assessed by the consultant psychiatrist and a diagnosis of psychiatric illness was made, then they were referred to the blood collection room where under all aseptic precautions, the blood sample was drawn and sent to the Department of Biochemistry for evaluation. As per our OPD protocol, all routine investigations, such as complete hemogram, thyroid profile, liver and kidney function test are done in drug naïve patients to rule out/identify the causes of psychiatric illness. We cross-checked all other investigations which were found to be normal, and we included only those patients who underwent vitamin B12 and vitamin D investigations to fulfill the objective of the study.

The vitamin B12 and vitamin D levels were found out from the data stored in the system of biochemistry and were correlated with the psychiatric diagnosis that was made.

Statistical Analysis

After entering the data in SPSS version 28.0.0, descriptive analysis of age and sex was done. The level of vitamin B12 and vitamin D was matched with the various psychiatric illness diagnosed in the subjects.

Results

About 168 subjects were included in the study, of which 96 had undergone vitamin B12 and 72 underwent vitamin D investigations. As per Table 1, the mean age of the whole study subjects was 40 ± 15 years. Gender-wise males were 54.2% and females were 45.8%.

Table 2: Mean of vitamin levels

Variable	*Mean + SD*
Vitamin B12	314.07 ± 420.28
Vitamin D	72.5 ± 62

Table 3: Percentage of levels of vitamin B12 among various psychiatric disorders

	Deficient <145 pg/mL	*Intermediate 146–180 pg/mL*	*Normal 180–914 pg/mL*
Depressive disorder	19.1%	20.0%	15.4%
Anxiety disorder	29.8%	30.0%	35.9%
Substance use disorder	17.0%	10.0%	7.7%
Dissociative disorder	4.3%	10.0%	5.1%
Schizophrenia	4.3%	0.0%	5.1%
Bipolar affective disorder	10.6%	10.0%	7.7%
Somatic symptom and related disorder	4.3%	0.0%	7.7%
Adjustment disorder	4.3%	10.0%	2.6%
Dementia	0.0%	10.0%	7.7%
Post-traumatic stress disorder	2.1%	0.0%	0.0%
Persistent delusional disorder	0.0%	0.0%	2.6%
Obsessive compulsive disorder	4.3%	0.0%	2.6%

Table 1 also depicts the percentage-wise psychiatric diagnosis that was made in subjects who had undergone vitamin B12 and vitamin D levels 96 had undergone vitamin B12 and 72 underwent vitamin D investigations.

The mean of vitamin B12 was 314.02 ± 420.28 and the mean of vitamin D was 72.5 ± 62 (Table 2).

The levels of vitamin B12 and the patient with various psychiatric disorders are given in Table 3. Vitamin B12 deficiency, that is, levels less than <145 pg/mL was present majorly in patients suffering from anxiety disorder (29.8%) followed by depressive disorder (19.1%) and substance use disorder (17%).

Among the patients having deficient levels of vitamin D, that is (<50 nmol/L) percentage-wise various psychiatric disorders are given in Table 4. Vitamin D deficiency was found majorly in patients having anxiety disorder (29.7%) followed by depressive disorder (13.5%). Equal numbers of cases with substance use disorder (10.8%), schizophrenia (10.8%), and somatic symptom disorder (10.8%) had vitamin D deficiency.

Discussion

As per our findings, majority of the patients with vitamin B12 and vitamin D deficiency were suffering from anxiety disorder, depressive disorder, and substance use disorder.

Comparing our findings with various published literature, we found that a study by Syed et al.[11] which included 199 patients' reported reduced vitamin B12 levels associated with a decrease in treatment response and they recommended that with antidepressants, if vitamin B12 is given, then it improves the

Table 4: Percentage of levels of vitamin D in various psychiatric disorders

	Deficient <50 nmol/L	*Insufficient 50 to <75 nmol/L*	*Sufficient 75–250 nmol/L*	*Potential toxic >250 nmol/L*
Depressive disorder	13.5%	6.7%	21.1%	1.0%
Anxiety disorder	29.7%	26.7%	21.1%	0.0%
Substance use disorder	10.8%	20.0%	10.5%	0.0%
Dissociative disorder	2.7%	0.0%	15.8%	0.0%
Schizophrenia	10.8%	13.3%	0.0%	0.0%
Bipolar affective disorder	13.5%	6.7%	0.0%	0.0%
Somatic symptom and related disorder	10.8%	0.0%	10.5%	0.0%
Adjustment disorder	0.0%	6.7%	15.8%	0.0%
Dementia	2.7%	13.3%	0.0%	0.0%
Post-traumatic stress disorder	2.7%	0.0%	0.0%	0.0%
Persistent delusional disorder	2.7%	6.7%	5.3%	0.0%
Obsessive compulsive disorder	2.7%	0.0%	0.0%	0.0%

response. We found that deficiency of vitamin B12 in our sample was higher in depressive disorder as compared with other diagnosis.

A study done by Sherchand et al. concluded that individuals with vitamin D deficiency have 3.5 times higher chances of depression as compared with individual with sufficient vitamin D.[12]

Among the cases of anxiety disorder in our study, the prevalence of people with vitamin B12 deficiency was 29.8% and vitamin D was 15.3%. A study done by Todorov et al. reports that vitamin B12 deficiency in patients with anxiety and depression is very common, according to their data, 30% of the patients with anxiety and depression have low vitamin B12 levels.[13] According to Kelley et al. in 2018, lower level of vitamin D was associated with higher levels of anxiety and depression.[14]

Vitamin B12 and vitamin D deficiencies in substance use disorder patients were 17.5% and 10.8%, respectively. A study done by Medebo et al. reports that there were around 1.2% of case subjects of their study have a clear deficiency of vitamin B12.[15] A study done by Neupane et al. reported a deficiency of vitamin B12 in 64% of subjects with alcohol use disorder and also there was a strong association between severity of alcohol use and vitamin D deficiency.[16] In a study done in Melbourne, the youth drug treatment services study reported that among the 77 youth, 80.5% have vitamin D deficiency.

According to our study, the prevalence of vitamin B12 and vitamin D in bipolar affective disorder (BPAD) patients was 10.6% and 13.5%. Gomez Bernal et al. reported a case report where a vitamin B12 deficiency was manifested as a case of mania, they also gave importance to the administration of vitamin B12 in a manic patient, after which his symptoms started to improve[17] Sangle et al. reported in their study that vitamin B12 can affect mood symptoms in positive ways by improvement in mood symptoms due to its immunomodulatory effect.[18]

The deficiency of vitamin B12 and vitamin D in other disorders like dissociative disorder was 4.3% and 2.7%, respectively. There are not many studies which report the role of vitamin D and vitamin B12 in dissociative disorder. Of these, a study by Katı and Aşoglu. reports about vitamin B12 deficiency but they were not able to identify any relationship between the same.[19]

About 4.3%and 10.8% of the subjects with somatic symptom disorder had vitamin B12 and vitamin D deficiency, respectively. Srivastava et al. reported that half of the study sample with somatization had a deficiency of vitamin D and that if a regular estimation of vitamin D is done in these patients, it may bring significant improvement.[20]

About 4.3% and 0% of the patients with adjustment disorder had vitamin B12 and vitamin D deficiency. Aydin et al. reported that 98.5% of the study subjects with adjustment disorder had a deficiency of vitamin D.[21]

Similarly, 2.7% of the patients with vitamin D deficiency had dementia. None of the patients with dementia had B12 deficiency but 10% of the patients had intermediate levels of B12. According to a research conducted in 2016 by Spence around 10–40% of the patients are frequently missed for deficiency of vitamin B12 in dementia. If it is recognized early, then it is beneficial for the prevention of dementia and stroke[22] Littlejohns et al. reported that vitamin D deficiency is largely associated with an increased risk for dementia and Alzheimer's.[23]

Post-traumatic stress disorder (PTSD) cases were 2.1% and 2.7% with B12 and D deficiency. Wentz et al. reported that a deficiency of vitamin D leads to increase chances of having PTSD.[24]

About 4.3% and 2.7% of the patients with obsessive compulsive disorder (OCD) had vitamin B12 and vitamin D deficiency, respectively. Yan et al. in 2022 concluded in their systemic review that vitamin B12 deficiency is closely correlated with OCD patients.[25] Esnafoğlu and Yaman reported that vitamin D levels are low in their study samples of cases with OCD, and this has a negative correlation with disease severity.[26]

Conclusion

We found that the deficiency of vitamin B12 and vitamin D was found to be significantly associated with various neuropsychiatric disorders. Though the deficiency was found to be rather not so uncommon, consulting physicians often tend to miss investigating it, when they encounter patients presenting with neuropsychiatric manifestations. In North India, there is a significant population, which is vegetarian in their diet and that could be a plausible reason for the high prevalence of deficiency of these vitamins to some extent. Both these vitamins might have an etiological and prognostic value across a variety of psychiatric illnesses especially depressive disorder, anxiety disorder, substance use disorder, schizophrenia, dementia, schizophrenia, and so on. Early recognition of the deficiency and prompt management would surely affect the course of various neuropsychiatric morbidities.

Limitations

There was a bias in the selection of candidates. We were not aware of the prior nutritional status of patients, which included their dietary habits and intake of oral supplements. Also, being a retrospective study cases were not followed up to see the response after supplementation of vitamins. As ours is a hospital-based study, we cannot comment on the association of vitamin deficiency and its relation to various psychiatric illnesses in the general population.

Informed consent: All the patients had given written informed consent for the study.

Permission from Institution Ethics Committee: Permission obtained

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