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Original Research Article

ASSESSMENT OF THE PREVALENCE OF VITAMIN D DEFICIENCY IN PATIENTS WITH DEPRESSION – A CROSS SECTIONAL STUDY

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ABSTRACT

Background: Depression is one of the most common comorbid conditions. Vitamin D deficiency has been suggested as a contributing factor to depression, and the potential role of vitamin D supplementation as an adjunctive treatment is being explored. However, there is limited data on the prevalence of vitamin D deficiency among patients with depression in India and its association with sociodemographic factors. Study aimed to determine the prevalence of Vitamin D deficiency and association with severity of depression and sociodemographic factors. **Materials and Methods:** The study included patients aged 18 years and older diagnosed with depression. Sociodemographic details, past medical history, family history, and disease severity were assessed. Blood samples were collected to measure vitamin D levels. **Result:** Vitamin D deficiency was observed in 82% of the participants. There was no significant correlation between sociodemographic factors and vitamin D deficiency. According to HAM-D criteria, 75% of the participants had very severe depression, while 48% were classified as having severe depression under ICD-10 criteria. A significant association was found between vitamin D deficiency and the severity of depression based on ICD-10 criteria, but no such relationship was identified using HAM-D criteria. **Conclusion:** Vitamin D deficiency is highly prevalent among patients with depression. The severity of depression, as per ICD-10 criteria, is significantly linked to vitamin D deficiency. However, there is no significant association between sociodemographic factors and vitamin D deficiency.

INTRODUCTION

Depression is among the most prevalent psychiatric disorders globally, characterized by low mood, anhedonia, and low energy or fatigue.[1] According to the World Health Organization (WHO), an estimated 322 million people worldwide were affected by depression in 2015.[2,3] In India, WHO estimates suggest that 57 million people suffer from depression, accounting for approximately 18% of the global burden.[4,5] Treatment typically includes both pharmacological and non-pharmacological approaches.6 However, despite the availability of these therapies, depression is associated with a high risk of recurrence or relapse, with recurrence rates reaching up to 85% within a decade.[7] This high recurrence rate and treatment failure may be attributed to the limited understanding of the underlying pathogenesis of depression.

The proposed theories for the etiology of depression are diverse, including alterations in neurotransmitter levels—particularly monoamines in the central nervous system (CNS), disruptions in neurocircuitry, reduced levels of neurotrophic factors, and disturbances in circadian rhythms. However, none of these theories can fully explain depression in all patients, highlighting the variability in its pathophysiology among individuals.8 The glutamatergic theory of depression and its focus on neuroplasticity offers an alternative perspective to the traditional monoamine theory. This shift has broadened the scope of research into the pharmacological treatment of depression.[9]

Vitamin D deficiency is another significant factor that may expand research and provide new insights into the pathogenesis of depression. Vitamin D, a fat-soluble vitamin, is crucial for calcium absorption and bone mineralization. Its deficiency has been linked to several other conditions, including diabetes, hypertension, neurodegenerative disorders, and mental illnesses such as schizophrenia.[10] Vitamin D receptors are found in the central nervous system,

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particularly in the amygdala, which plays a key role in regulating emotions.[11] While the precise mechanism by which Vitamin D influences depression remains unclear, Berridge hypothesized that it may involve buffering calcium ions (Ca^{2+}) in the nervous system.[12] Additionally, some theories suggest that the immunomodulatory effects of Vitamin D may protect the nervous system from neuroinflammation, which has been proposed as a contributing factor to depression.[13] Several studies have established a link between vitamin D deficiency and depression. The Cooper Center Longitudinal Study concluded that higher vitamin D levels were associated with lower odds of developing depression.[14] However, a review of the literature revealed a lack of data on vitamin D deficiency among Indian patients. Vitamin D supplementation could potentially play a vital role in the treatment of depression. Therefore, we undertook this study to investigate the prevalence of vitamin D deficiency in Indian patients with depression and to examine its association with various aspects of the condition.

MATERIALS AND METHODS

This cross-sectional study conducted in the psychiatry OPD of a Tertiary care hospital in South India for a period of 2 years. Patients aged >18 years of either sex diagnosed with depression with ICD-10 criteria were included in the study. Patients who refused to give consent and who were cognitively incapacitant to answer were excluded from the study. Based on the percentage of cases with vitamin D deficiency in the population of depression observed in an earlier publication14 and with 95% confidence interval and 20% allowable error, minimum sample size of 90 was to be obtained. However due to non-availability of the cases during my study period, we could include only 71 cases in our study.

Sociodemographic data of the patients like age, sex, economic status, educational status and marital status were recorded. The severity of depression was assessed using HAM-D and ICD 10 criteria. Past history and family history of the patient were recorded with respect to other psychiatric disorders and suicidal history. Venous samples were collected under aseptic precautions for Vitamin D estimation. The samples were centrifuged at 3000 rpm for 5 minutes. Serum 25-hydroxyvitamin D levels were estimated by Electro chemiluminescence Assay (ECLIA) using COBAS immunoassay analyser. Vitamin D status (serum 25 hydroxyvitamin D levels) was assessed based on US Endocrine Society classification: Vitamin D Deficiency <20 ng/mL; Vitamin D Insufficiency 21-29 ng/mL; Vitamin D Sufficiency >30 ng/mL; Vitamin D Toxicity >150 ng/mL.

Statistical analysis was performed using IBM SPSS version 20.0 software. Categorical; variables are expressed using frequency and percentages. To test the statistical significance of the association of each factor with vitamin D deficiency, chi square/Fisher's exact test was used depending upon the number in each cell.

RESULTS

A total of 71 patients have been recruited in the study which included 21 males and 50 females. 58 patients were deficient in Vitamin D, 9 patients were insufficient and only 4 patients were sufficient Vitamin D levels (Table 1).

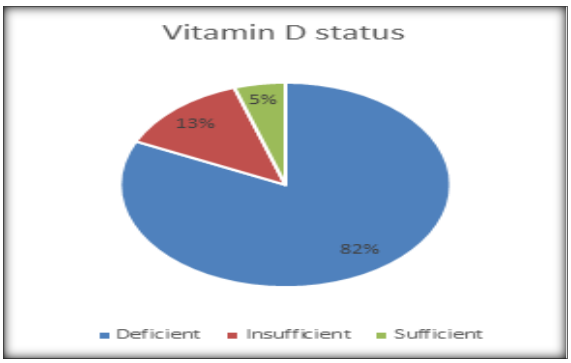

Figure 1: Showing vitamin D status

Table 1: Showing the vitamin D status

Vitamin D status	Frequency	Percentage
Deficient	58	82%
Insufficient	9	13%
Sufficient	4	5%
Total	71	100

Table 2: Sociodemographic details and Vitamin D status

	Vitamin D Status		
	Deficient (58) (82%)	Insufficient (9) (13%)	Sufficient (4) (5%)
Gender			
Male	17 (29%)	3 (33%)	1 (25%)
Female	41 (71%)	6 (67%)	3 (75%)
Family Type			
Nuclear	35 (60%)	7 (77%)	4 (100%)
Joint	16 (27.5%)	0	0
Generation	2 (3%)	0	0
Other Type	5 (8%)	2 (23%)	0
Marital Status			

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Single	12 (21%)	2 (22%)	0
Married	39 (67%)	5 (56%)	4 (100%)
Widowed Divorced/Separated	7 (12%)	2 (22%)	0
Educational Status			
Graduate and Above	20 (34%)	3 (33%)	2 (50%)
Primary and High school education	38 (64%)	6 (67%)	2 (50%)
Family Income			
>20000/month	40 (69%)	4 (44%)	3 (75%)
<20000/month	18 (31%)	5 (56%)	1 (25%)

Their sociodemographic details of the patients and their Vitamin D status is given in the table. There were 19 patients with past history of suicide and 5 patients received ECT in the past. About 20 (28%) patients had a family history of depression. About 19 patients (27%) had history of other psychiatric illnesses. 9 patients (13%) had a history of psychoactive substance abuse. Out of the 71 patients 51 had first episode of depression and 20 had recurrent episodes. None of the sociodemographic factors had any significant association with Vitamin D status.

Table 3: Severity according to HAM D score

Severity	Frequency	Percentage
Moderate	7	10
Severe	11	15
Very Severe	53	75

According to HAM D score 53 patients (75%) had very severe depression. 11 cases were having severe depression and 7 had moderate depression. (Table 3)

There was no significant association between the severity of the disease assessed using HAM D and the status of Vitamin D deficiency.

Table 4: Severity according to ICD 10 Criteria

Severity	Frequency	Percentage
Mild	4	6
Moderate	33	46
Severe	34	48

According to the ICD 10 criteria (Table 4), 34 patients (48%) had severe depression, 33 patients (46%) had moderate depression and only 4 (6%) had mild depression.

Table 5: Association between severity of depression (based on ICD-10 classification and Vitamin D status

Severity of depression	Vitamin D Status		p-value
	Deficiency & Insufficiency	Sufficiency	
Mild & Moderate	37(100%)	0(0%)	**0.048***
Severe	30(88%)	4(12%)	
Total	67(95%)	4(5%)	Analysed using Fisher's Exact Test

There was a significant association ($p<0.05$) with reduced levels of Vitamin D and severity of depression. (Table 5)

DISCUSSION

Studies on vitamin D and depression face a significant potential for confounding, as various factors influencing 25(OH)D levels are also associated with the incidence of depression. However, most cross-sectional studies conducted so far have reported unadjusted results, often failing to account for key variables or socio-demographic factors. This limitation makes it challenging to determine whether the observed associations are genuine or simply explained by confounding.[15] Furthermore, there is no available Indian data on the prevalence of vitamin D deficiency in patients with depression or its association with socio-demographic factors and the severity of depression. Therefore, we conducted this study to assess the prevalence of vitamin D deficiency in Indian patients with depression and to explore the relationship between vitamin D deficiency and various factors associated with depression.

In our study, 82% of patients with depression were found to have vitamin D deficiency, a higher prevalence compared to a similar study by Sanyal and Mukherjee,[16] which reported vitamin D deficiency in 70% of patients with depression. Also, in study by Parel NS et al., there was significant association of vitamin D deficiency with the depression.[17] Kouider DA et al., documented that 99.9% of the participants with vitamin D deficiency were found to be with presence of depression.[18]

Our study population also showed a female preponderance, with 70% of participants being women. This aligns with numerous epidemiological studies conducted globally and in India, which highlight a higher prevalence of depression among

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women.[19] Additionally, the majority of participants in our study came from nuclear families. This reflects the increased prevalence of nuclear family structures in Kerala. Similar findings were reported by Sengupta and Benjamin,[20] who noted a higher prevalence of depression among individuals from nuclear families compared to those from joint or extended families.

In the current study, the majority of subjects with depression were married. However, previous studies have reported that depression is more prevalent among individuals who are single, separated, or divorced.[21] The higher proportion of married subjects in our study may be attributed to the predominance of women in the study population, as women in our culture are often married.

In terms of education, 44% of participants had completed education up to the higher secondary level. Contrary to our findings, other studies and the World Mental Health Survey have indicated a higher prevalence of depression among individuals with lower educational attainment.[21] This difference may be explained by the high literacy rate in Kerala, where most individuals, including those in our study, have likely completed higher secondary education.

Additionally, 66% of the participants in our study reported a monthly family income exceeding ₹20,000. This aligns with the relatively high standard of living in Kerala. It is important to note that this income represents the cumulative earnings of the family rather than the participant's personal income. Most participants were homemakers who were financially dependent on their families.

In our study, approximately one-fourth of the patients had a past history of suicide attempts. This finding aligns with a meta-analysis conducted in China by Dong et al., which reported a lifetime prevalence of suicide attempts at 23.7% among patients with depression.[22] Suicide remains one of the most serious warning signs of depression. Electroconvulsive therapy (ECT) was administered to only 5 patients (7%) in our study population. ECT is known for providing rapid relief from severe depression, mania, and psychosis, often accompanied by a swift reduction in suicide risk.[23]

A highly significant association ($p < 0.05$) was observed between the severity of depression, as classified by the ICD-10 criteria, and vitamin D deficiency. However, no significant association was found when the severity of depression was measured using the HAM-D score. In a study by Hoogendijk et al., depression severity, measured using the CES-D score, was associated with vitamin D deficiency. While several studies have reported a link between vitamin D levels and depression, others have failed to establish such an association.[24] In study by Kamalzadeh L et al., documented with significant association of vitamin D deficiency with the depression.[25] Also, in study by Kouider DA et al., documented with significant relation between the severity of depression symptoms and the level of vitamin D deficiency.[18] Vitamin D deficiency was found to be significantly associated with higher odds of clinically significant depression, even after adjusting for potential confounding factors in study by Sherchand O et al. This suggests that individuals with Vitamin D deficiency are at a greater risk of experiencing clinically significant depression, highlighting the importance of monitoring and managing Vitamin D levels as part of mental health care strategies.[26]

Present study didnot demonstrate any significant association between vitamin D levels and socio-demographic variables. However, significant relationship was found between severity of depression and low 25 (OH)D serum levels, which remained significant after adjusting for age, gender, smoking status and number of comorbid chronic illnesses in the Third National Health and Nutrition Examination Survey of United States.[27]

CONCLUSION

The study reveals a strong positive correlation between vitamin D deficiency and both the prevalence and severity of depression. These results indicate that vitamin D deficiency may significantly contribute to the onset and progression of depression. Although the exact mechanisms remain unclear, addressing vitamin D deficiency could serve as a valuable adjunct in improving depression outcomes. Given the widespread nature of vitamin D deficiency, particularly among those with depression, it is crucial for healthcare providers to include vitamin D screening and supplementation in comprehensive treatment plans. However, further research, particularly through longitudinal studies, is needed to clarify the causal relationship and explore how vitamin D levels may impact the severity of depression over time. Ultimately, this study emphasizes the importance of raising awareness about the potential benefits of monitoring and managing vitamin D deficiency in depression care.

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