

## CORRELATION BETWEEN VITAMIN D DEFICIENCY AND DEPRESSION A PROSPECTIVE STUDY FROM CENTRAL INDIA

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### ABSTRACT

Depression is a mood disorder which is characterized by helplessness, hopelessness and worthlessness. According to World Health Organization (WHO), more than 4 percent of the world's population deals with depression. Vitamin D plays an important role in the transcriptional activation of serotonin (an important neurotransmitter) which influences various brain functions including mood, sleep and appetite. As an important neurosteroid hormone, vitamin D plays an important role in depression. Vitamin D insufficiency may result in depression. It has been observed in several studies that patients with depression had low vitamin D. The study was carried to find out correlation between vitamin D and depression. 100 cases of depression and 100 age and gender matched controls were studied over a period of 3 years in Dept of Medicine, Dr RML Institute of Medical Sciences Lucknow, UP, India-226010. Serum Vitamin D was found to be statistically significant and higher in the control group as compared to patients having depression ( $p=0.033$ ). In this study it was found that depression shows a correlation with serum vitamin D level, indicating the intricate mechanism of vitamin D deficiency and depression.

**KEYWORDS:** Vitamin D, Depression, Vitamin D deficiency, Mood disorder.

### INTRODUCTION

Depression has emerged as a leading cause of disability with around 264 million people affected.<sup>[1]</sup> Depression is quite distinct from usual mood fluctuations and short-lived responses to the day to day challenges in life. Depression is a common, yet serious mental disorder with symptoms that can have detrimental effects on daily activities, especially in the work environment as well as family life.

Depression can turn out to be a serious health condition when it is long-lasting or of moderate to severe intensity. Depression can lead to suicide in the worst scenario. It has become a silent killer engulfing lives worldwide. Over the years, many researchers have studied various aspects of depression. Still, there is social stigma surrounding depression. Increased awareness and seeking out professional help can reduce the disabilities caused due to depression. Depression is mostly common in ages between 18 and 25 (11.9 per cent) and in individuals belonging to two or more races (10.5 percent). Women are at a double risk than men, according to the NIMH and the World Health Organization (WHO) Trusted Source. From 2017 to 2019, 10.4 percent of women were

found to be suffering from depression, compared with 5.5 percent of men, which is almost half, according to the CDC Trusted Source.<sup>[2]</sup> According to the WHO, around 300 million people worldwide suffer from depression and is one of the world's leading causes of disability.<sup>[2]</sup> Depression can be defined as a common mental disorder, characterized by persistence of sadness and a loss of interest in daily activities that one normally enjoys along with an inability to perform daily activities for at least two weeks.<sup>[3]</sup> People with depression have helplessness, hopelessness, worthlessness, insomnia, psychosomatic disorder, thoughts of self-harm or suicide.<sup>[3]</sup> Depression is treated with counselling or antidepressant medications or a combination of both.<sup>[3]</sup>

Depression in adults is usually manifested as a difficulty or change in the functional level or can even be accompanied with suicidal thoughts and abnormal behaviour. Depression, in late life, is often presented with marked psycho-motor agitation or irritability. Individuals may frequently report somatic complaints, poor appetite and with psychotic features sometimes. Thus, due to these varied presentations, the recognition of mild to moderate depression by family members or close

associate/friends at an early stage, is quiet challenging.<sup>[2,3]</sup> Depression may be mild, moderate or severe and Vitamin D level may be deficient (value less than 30) or insufficient (value less than 20).<sup>[2,3,4]</sup>

More types include Double depression, Secondary depression, masked depression, Seasonal depression (Winter/Summer).<sup>[5,6,7]</sup> Although, vitamin D is mostly known to play an important role in calcium homeostasis and bone development but it can also have a neuroprotective role. Various studies have reported that vitamin D has a role in cognitive function and in maintaining mental health.<sup>[6]</sup> Many studies have shown a link between patients suffering from depression and low serum vitamin D levels. Numerous vitamin D receptors have been located in various parts of the brain like the neuroglia, pre- frontal cortex, substantia nigra.<sup>[7]</sup> Vitamin D acts as a factor for the transcriptional activation of serotonin. Vitamin D activates the enzyme tryptophan hydroxylase which catalyzes the conversion of tryptophan to serotonin. Vitamin D hormone (calcitriol), then activates the transcription of the serotonin-synthesizing gene which is tryptophan hydroxylase 2 (TPH2) in the brain at a Vitamin D Response Element (VDRE).<sup>[8]</sup> Serotonin acts as a neurotransmitter which influences mood, regulates appetite, sleep and other brain functions. Vitamin D deficiency is considered as serum levels of 25(OH)D less than 20 ng/mL, insufficiency as 20–29 ng/mL and sufficiency as  $\geq 30$  ng/mL.

Vitamin D deficiency is prevalent in 70%–100% in the general population of the Indian subcontinent. The

commonly consumed food items in India, such as dairy products are not usually fortified with vitamin D. The social, cultural and religious practices of India do not provide adequate exposure to the sun, thus potential benefits of plentiful sunshine are prevented from being utilized. Consequently, sub-clinical vitamin D deficiency is commonly prevalent in urban as well as rural areas, and across all geographic, social & economical strata.<sup>[9,10,11]</sup>

## MATERIALS AND METHODS

The study was carried out over a period of 3 years from April 2017 to April 2021. 100 patients of depression were selected from the OPD of Department Of Psychiatry and 100 age and gender matched apparently normal subjects (who came for routine check up/patient's attendants/ hospital staffs) were selected as controls. Patients aged between 18-60 years who were newly/old diagnosed of depression by ICD-10 (International classification of Diseases, tenth revision) diagnostic criteria by the psychiatrist were included as cases. Pregnant women, patients on Vitamin D supplementation or with diseases like osteoporosis were excluded. It was a Cross sectional case- control study. HAM D score was used to assess the degree of depression. (mild/moderate/severe). Family history and treatment history (if any) were taken into account. Statistical Analysis was done using SPSS version 20.0.

**Table 1: Association of Vitamin D with depression.**

Vitamin D level	Depression Absent (HAM D < 7) N(%)	Depression present (HAM D $\geq$ 7) N(%)	Chi squared value
< 20 ng/ml	33 (57.9)	24 (42.1)	3.852
$\geq 20$ ng/ml	17 (39.5)	26 (60.5)	

\*p value < 0.05 (significant)

**Table 2: Comparison of vitamin D levels in between the groups.**

Parameters (ng/ml)	Cases (Mean $\pm$ SD)	Control (Mean $\pm$ SD)	Mann Whitney (U value)
Vitamin D	16.88 $\pm$ 9.88	20.88 $\pm$ 9.46	1559.0

\*p value < 0.05 (significant)

## RESULT AND DISCUSSION

In the current study, a total of 200 subjects were included. Among them 100 were suffering from depression called as case group and 100 of them were apparently healthy individuals called as control group. Vitamin level was higher in control group as compared to the mean Vitamin D level in cases Vitamin D level was higher in control group (20.88  $\pm$  9.46) as compared to the mean Vitamin D level in cases group (16.88  $\pm$  9.88). This difference was statistically significant (p value= 0.033) (Table 2).

In the present study it was found that patients suffering from depression had lower vitamin D levels as compared to the healthy controls.

No statistical significance was found in the physical parameters and routine parameters in between the case and control groups. The difference of Vitamin D levels between cases and control was statistically significant. (p value= 0.033). Biosynthesis of Vitamin D3 is majorly dependent on sunlight exposure and 15 minutes to one-hour exposure to sunlight is sufficient for generating 10,000-50,000 IU vitamin D synthesis within 24 hours of exposure.<sup>[9,10]</sup> Studies have shown that the noontime

around 11 AM to 1PM is the best time to get vitamin D as the sun is at its highest point and our body may produce it most efficiently around that time of day.<sup>[10]</sup>

People suffering from chronic illnesses like diabetes, heart disease, AIDS, lupus, multiple sclerosis etc are likely to get depressed as these diseases can cause disturbance in sleep-wake cycle, can diminish ability to exercise and productivity in work. These diseases can overall decrease the performance of a person and the person can isolate himself and get depressed. Hence it becomes a vicious cycle of vitamin D deficiency and outdoor activity decline. Most of the studies done on the subjects go by questionnaires and qualitatively assayed. This study further plans to extend it by measuring the stress markers, such as ROS, serotonin, cortisol quantitatively and studying the correlation which would further reinforce the association between Vitamin D deficiency and stressmarkers.<sup>[8,9,10]</sup>

Counselling and proper medication are helping people to get back to optimizing function. Various workshops, seminars and 'webinars' are being conducted to create awareness and to encourage people to come out of their 'cocoon' and seek counselling/treatment. Year 2020 had been a worse year due to the corona virus (COVID-19). Though there is ongoing vaccination in 2021, still the number of cases are on the rise intermittently. It is very important to stay connected with family and friends specially in these difficult times and the stigma around mental illness. However, more studies with larger case group are required to establish the fact that low vitamin D levels can cause depression concretely.

## CONCLUSION

In this study it was found that depression disorder has correlation with serum vitamin D level, indicating the intricate mechanism of deficiency of vitamin D and depression. The study being comprised of a small number of cases, a conclusive statement can't be drawn and there is a scope for further research on the same.

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