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Examination of vitamin D status in individuals with obsessive-compulsive disorder

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ABSTRACT

Context: It is uncertain how vitamin D affects obsessive-compulsive disorder (OCD).
Aim: Research indicates that neuropsychiatric disorders may be linked to vitamin D insufficiency. This study aims to look into vitamin D levels in people with OCD diagnoses. Furthermore, the relationship between the severity of OCD symptoms and serum vitamin D levels is examined.
Materials and Methods: The study included 170 healthy volunteers and approximately 174 newly diagnosed OCD patients. To evaluate the intensity of OCD symptoms, the Yale–Brown Obsessive Compulsive Scale (YBOCS) was employed. The two groups' serum vitamin D levels were contrasted.
Results: It was discovered that the OCD group's serum vitamin D levels were noticeably lower than those of the control group. There was no association found between the length of disease in OCD patients and blood vitamin D levels, but there was a negative correlation between the serum vitamin D levels and the overall scale scores, obsession, and compulsion as measured by YBOCS.
Conclusions: To the best of our knowledge, this is one of the first studies looking at vitamin D levels in adult OCD patients who have just received a diagnosis and do not have any concomitant conditions. Even though our results imply that vitamin D might be involved in the pathogenesis of OCD, more research is required to corroborate our findings.

1. Introduction

The lifetime prevalence of obsessive-compulsive disorder (OCD), a mental disease marked by intrusive thoughts, pictures, and urges, and/or compulsions (repetitive behaviors undertaken to alleviate obsessional distress), is 1.6-2.3% in the adult population.[1] OCD typically manifests as soma to form disorder, major depressive disorder, anxiety disorder, or adolescence. In individuals with OCD, these mental conditions are frequently co-occurring.[2] It is believed that a combination of immunological, neurochemical, genetic, and structural factors contribute to the development of OCD.[3] According to certain research, neurotransmitters like glutamate, dopamine, and serotonin may be involved in the development of OCD.[4–6] These investigations are supported by the use of selective serotonin reuptake inhibitors (SSRIs) as the first line of treatment for OCD patients who are not responding to treatment and by the addition of clomipramine, glutamatergic medications, and typical/atypical antipsychotics for patients who are not responding to treatment.[7–9]

Cholecalciferol, or vitamin D3, is created in the epidermis and is then hydroxylated in the liver to produce 25-OH D3. In the kidneys, 25-OH D3 is hydroxylated once more to produce 1,25 dihydroxy vitamin D3, which is the active form.[10] Vitamin D is a crucial chemical that affects immunity, the body's inflammatory response, antioxidant activities, and the balance of calcium and phosphorus.[1] The

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development of the brain and the preservation of regular brain function depend on vitamin D.[11] In the central nervous system (CNS), it is also crucial for cell differentiation and proliferation.[12,13] Studies suggest that neuropsychiatric conditions such major depression, schizophrenia, attention deficit hyperactivity disorder (ADHD), and others may be linked to vitamin D insufficiency.

1,25 dihydroxy vitamin D3 controls the levels of tryptophan hydroxylase, a speed-limiting enzyme in the production of serotonin, and tyrosine hydroxylase, a speed-limiting enzyme in the synthesis of dopamine, adrenaline, and norepinephrine. Therefore, by interfering with serotonin and catecholamine production, vitamin D deficiency may be useful in the genesis of OCD.[14,15] On the other hand, by blocking the enzyme that produces nitrite oxide, called inducible nitrite oxide synthetase (iNOS), vitamin D shields cells from neurotoxicity. A lack of vitamin D can lead to a reduction in neuroprotectivity, which can aid in the development of OCD. This theory is supported by studies that show elevated nitrite oxide levels in OCD patients.[16–18] As of right now, serum 25 (OH) D3 levels in the adult population are classified as follows: serum 25 (OH) D3 deficiency is defined as serum 25 (OH) D3 levels less than 20 ng/mL, while serum 25 (OH) D3 levels greater than 30 ng/mL are considered sufficient.[19] The relationship between OCD and vitamin D has only been the subject of a small number of research, and all of them involved adult OCD patients.[20–23] These factors lead us to think that further research on this matter is warranted. This study looked at vitamin D levels in adult OCD patients and compared them to healthy controls. Other associated measures were calcium, phosphorus, alkaline phosphatase, thyroid-stimulating hormone (TSH), and parathyroid hormone (PTH). Additionally, we wanted to find out how vitamin D levels related to the intensity of OCD symptoms and the length of the condition.

2. Materials and Methods

2.1. Research plan

The STNM Hospital in Gangtok, Sikkim, India, was the site of this investigation. All subjects provided written informed consent, which was authorized by the STNM Hospital Ethical Committee.

2.2. Participants

The study included approximately 307 patients, aged 18 to 40, who were newly diagnosed with OCD based on the Diagnostic and Statistical Manual for Mental Disorders, Fifth Edition (DSM-V) criteria and were admitted to the STNM Hospital Psychiatry Outpatient Clinic between January 2021 and December 25, 2023.[24] Taking into account the age and gender distribution of the OCD group, a healthy control group was chosen from hospital employees or volunteers in good health.

2.3. Study's excluded criteria

Patients with co-occurring psychiatric disorders other than OCD; mental retardation diagnosis; use of calcium or vitamin D supplements within the previous six months; use of corticosteroid medication for any reason within the previous three months; history of alcohol or drug abuse; chronic systemic diseases, such as diabetes, hypothyroidism, hyperthyroidism, hypoparathyroidism, and hyperthyroidism; clinically active infections; pathology identified in routine biochemical tests; and pregnant or nursing. By using The Structured Clinical Interview for DSM-V (SCID-V) with the patients, diagnoses were verified.[25] The study included thirty-eight patients with co-occurring depression, 19 patients with co-occurring generalized anxiety disorder, 12 patients with co-occurring panic disorder, 3 patients with co-occurring social anxiety disorder, 5 patients with co-occurring bipolar disorder, 9 patients who used calcium or vitamin D supplements in the previous six months, 6 patients who used corticosteroids for any reason in the previous month, 7 patients with a history of alcohol or substance use in the previous six months, 6 patients with hypothyroidism, 3 patients with hyperthyroidism, 4 patients with diabetes, 14 patients with pathology in routine biochemical tests (leukocytosis was found in 7 patients, anemia in 5 patients, and thrombocytopenia in 2 patients), 2 nursing patients, and 2 pregnant patients were not included in the study. Three patients declined to take part in the research. The study had 170 healthy people and 174°CD participants.

2.4. Biochemical analyses

Due of the seasonal physiologic fluctuation in plasma vitamin D concentrations, all participant blood was only drawn between July 15 and September 15. In the morning, between the hours of 8:00 and 10:00 AM, 10 milliliters of fasting venous blood were drawn into serum separator tubes that contained K2-EDTA. After collection, serum and plasma were centrifuged for thirty minutes. Using an Immuchrom 25 OH Vitamin D3/D2 kit, liquid chromatography coupled with tandem mass spectrometry (LC MS/MS) was used to assess the total 25 (OH) D3 concentrations in plasma. Using Roche Cobas c501 and 601, sandwich immunoassay techniques were used to quantify serum calcium (Ca) and phosphorus (P), alkaline phosphatase (ALP) via colorimetric method, and thyroid-stimulating hormone (TSH) and parathyroid hormone (PTH).

2.5. Tools for gathering data

Clinician Version of SCID-V Disorders (SCID-V-CV): This clinical interview scale was created and organized with

DSM-V diagnoses in mind.[25] Elbir et al. conducted validity and reliability tests on the Turkish version.[26]

2.6. The YBOCS, or yale-brown obsessive compulsive scale

Goodman et al.[27] created this scale to assess the intensity of obsession and compulsive symptoms. Ten of the scale's 19 items—five of which are compulsive and five of which are obsessions—are rated. The scale can be used to calculate three separate evaluation scores: total, compulsion, and obsession. The scale's overall score varies from 0 to 40. Greater severity of OCD symptoms is indicated by higher overall scores. Karamustafalıoğlu et al. conducted tests for the Turkish version's validity and reliability.[28]

2.7. Evaluating statistics

The IBM SPSS Statistics Standard Concurrent User V 26 statistical package program (IBM Corp., Armonk, New York, USA) was used to examine the data. Numbers and percentages were used to summarize categorical measurements, and mean and standard deviation (as well as, if applicable, median and minimum-maximum) were used to summarize continuous measurements. The Shapiro-Wilk test was employed to ascertain whether the study's parameters had a normal distribution. The categorical expressions were analyzed using the Chi-square test. For binary variables with parameters that did not exhibit a normal distribution, the Mann-Whitney U test was employed. To ascertain the relationship between continuous measures, Spearman correlation analysis was employed. For all tests, the statistical significance level was set at 0.05.

3. Results

isplays thesociodemographic details of the OCD group and the control group. Sociodemographic factors such age, gender, marital status, occupation, and level of education did not significantly differ across the groups ($p > 0.05$). Table 2 displays the biochemical data for the OCD group and the control group. The OCD group's blood 25OH-D3 levels were found to be considerably lower than those of the control group ($p < 0.001$), although the two groups' serum calcium, serum phosphate, ALP, PTH, and TSH levels did not differ significantly ($p > 0.05$). The OCD group had a significantly higher number of participants with vitamin D deficiency (< 20 ng/mL) and insufficiency (20–30 ng/mL) than the control group ($p < 0{,}001$). Similarly, the OCD group had a significantly lower number of participants with normal vitamin D levels (> 30 ng/mL) than the control group ($p < 0{,}001$).

The OCD group's YBOCS total score is 26 (CI: 24.5-27), YBOCS obsession score is 12 (CI: 11-13), and YBOCS compulsion score is 13 (CI: 12-14). The average OCD patient's disease lasts for a full year. Serum 25OH-D3 levels showed a negative correlation with the overall scale scores evaluated in YBOCS ($r = -0{,}705$, $P < 0.001$), obsession ($r = -0{,}693$, $P < 0.001$), and compulsion ($r = -0{,}633$, $P < 0.001$). There was no relationship ($p > 0.05$) between the length of OCD patients' disease and their serum 25OH-D3 levels.

4. Discussion

The objective we had in this study was to compare the vitamin D levels of OCD patients with those of healthy controls, as well as to examine other relevant parameters such calcium, phosphorus, ALP, TSH, and PTH levels. We also looked into the relationship between vitamin D levels and the severity and length of OCD symptoms. The study's findings suggested that OCD and vitamin D deficiency may be related, and that there is a somewhat negative relationship between the severity of OCD symptoms and serum vitamin D levels. In accordance with this, YBOCS scores rise when vitamin D levels fall. The hypothesis that lack of vitamin D may contribute to a number of psychiatric illnesses is becoming more and more compelling. Recent research has demonstrated that individuals with anxiety and depression have lower vitamin D levels than healthy controls.[29–31]

Serotonin plays a significant part in the genesis of anxiety and depression, which is comparable to that of OCD.[4] Because low levels of vitamin D inhibit the synthesis of tryptophan hydroxylase, which reduces serotonin, they can exacerbate OCD symptoms. The length of the sickness and serum vitamin D levels did not significantly correlate, according to our findings. This could be the result of seasonal variations in vitamin D levels caused by solar exposure. There are only, as far as we are aware, four research that look into the possible connection between vitamin D and OCD. Furthermore, three of these trials involved OCD patients who were children or adolescents.[20–22] Just one study involving adult OCD sufferers has been done.[23] This is the first study to look at vitamin D levels in adult OCD patients who do not also have co-occurring mental disorders. Other associated parameters that we looked at included calcium, phosphorus, ALP, TSH, and PTH levels.

In 2020, a study discovered that, although not statistically significant, vitamin D levels were decreased in individuals with OCD and pediatric autoimmune neuropsychiatric diseases associated with streptococcal infections (PANDAS) when compared to healthy controls.[20] According to this study, patients' vitamin D levels may have been impacted by elevated oxidative stress brought on by autoimmune diseases. Therefore, it's unclear if autoimmune processes or OCD are to blame for low vitamin D levels. The individuals in our study did not have diabetes, clinically active infections, hypothyroidism, hyperthyroidism, hypoparathyroidism, hyperparathyroidism, or any other acute or chronic systemic disorders that may alter vitamin D levels. In comparison to healthy controls, children and

Table 1: Sociodemographic data of control group and OCD group

Age (years)	28 (CI:24-30)	29 (CI: 27-32)	0.135a
Gender n (%)			
Female	92 (54,1)	88 (50,6)	0,642b
Male	78 (45,9)	86 (49,4)	
Education (years)	13 (CI: 11-13)	13 (CI: 12-13)	0,251a
Marital status n (%)			
Single	68 (40)	60 (34.5)	0,339b
Married	94 (55.3)	96 (55.2)	
Divorced	8 (4.7)	18 (10.3)	
Profession n (%)			
Not working	70 (41,2)	62 (35,6)	0.455b
Working	100 (58,8)	112 (64,4)	

Table 2: Biochemical data of the control group and OCD group

	Control Group n=170	**OCD Group n=174**	**P**
25OH-D3 (ng/mL)	27,8 (CI: 25,8-29,1)	19,4 (CI: 18,3-20,9)	<0,001a
Min-max (ng/mL)	9.4-37.3	13.6-43.8	
Sufficient (>30 ng/mL)	50 (29.4%)	21 (12.1%)	<0,001b
Insufficient (20-30 ng/mL)	102 (60%)	55 (31.6%)	<0,001b
Deficiency (<20 ng/mL)	18 (10.6%)	98 (56.3%)	<0,001b
Phosphor (mg/dL)	3,73 (CI: 3,64-3,95)	3,76 (CI: 3,65-3,89)	0.870a
TSH (mU/L)	2,68 (CI: 2,45-3,12)	2,64 (CI: 2,45-3,23)	0,814a
PTH (pg/mL)	34,4 (CI: 30,8-36,4)	34,9 (CI: 30,2-37,8)	0.575a
ALP (IU/L)	65 (CI: 58-72)	64 (CI: 58-72)	0.879a

adolescents with OCD have reduced vitamin D levels, according to a 2018 study by Esnafoğlu and Yaman.[21] Our analysis differs significantly from Esnafoğlu and Yaman's in terms of technique and constraints. First, it is well recognized that depression and anxiety disorders are linked to vitamin D deficiency.[32] It is unknown whether low vitamin D levels in the OCD group are linked to comorbidities of depression or anxiety disorder because the patients in this study co-occurred with other anxiety disorders in addition to OCD.

Second, the researchers omitted details regarding the patients' past or present usage of psychiatric medications. The patients in our study had not used any drugs for at least three months, and they did not have any co-occurring psychiatric conditions other than OCD. Thirdly, all blood samples must be taken in the same season because sunshine has an impact on vitamin D levels. Because of this, blood was only drawn for our investigation between July 2021 and September 2021, however Esnafoglu and Yaman's study does not specify exactly when blood was drawn. Serum vitamin D levels were observed to be lower in children and adolescents with OCD patients in the study by Yazıcı et al.[22] compared to healthy controls, however this difference was not statistically significant. These results corroborate what we found.

Lastly, Marazziti et al.'s study[23] revealed that 50 adult OCD patients had serum vitamin D levels that were statistically substantially lower than those of the control group. Despite the fact that this study involved adult OCD patients, it differs significantly from our study in terms of methodology. Firstly, there found a high prevalence of comorbidity with several psychiatric conditions. Out of 50 individuals, thirty-eight had OCD co-occurring with at least one psychiatric illness. Thus, comorbidity may have an impact on OCD patients' low vitamin D levels. Second, at least one psychotropic medication, such as an antidepressant, mood stabilizer, antipsychotic, or benzodiazepine, was taken by 34 out of 50 patients. Drugs that cause psychosis can have an impact on vitamin D levels and OCD severity. Additionally, in certain cases, it may conceal underlying mental illnesses. Consequently, patients who had abstained from psychotropic medication use for a minimum of three months comprised the OCD group in our investigation. Thirdly, no research has been done on vitamin D-related indicators such calcium, phosphorus, ALP, TSH, and PTH levels. Finally, because of the limited sample size, it might not accurately reflect all OCD patients in the community. Additionally, the study did not include a control group, thus a comparison of vitamin D was made between patients and normative values.

5. Limitations

It is important to acknowledge the limitations of this study. Between July 21 and September 21, when the sun is at its strongest in our nation, we took blood samples. This might have had an impact on both groups' vitamin D levels.

Furthermore, no information was gathered about the length of time spent in the sun. OCD sufferers tend to spend a lot of time at home because of their obsessions. They might therefore receive less sunshine exposure. The OCD group's vitamin D levels might have been impacted.

6. Conclusion

The results showed that compared to healthy controls, newly diagnosed OCD patients had decreased vitamin D levels. The pathogenesis of OCD and the severity of the disorder may be correlated with vitamin D levels. Since sunshine affects vitamin D, more research in various seasons and geographical locations is required to confirm or refute our findings.

7. Declaration of Patient's Consent

The authors confirm that they have all necessary patient permission records in their control. The patient(s) has/have consented in the form for the publication of his/her photos and other clinical data in the journal. The patients are aware that although every attempt will be made to hide their identity and that their names and initials will not be published, anonymity cannot be ensured.

8. Source of Funding

None.

9. Conflicts of Interest

There are no conflicts of interest.

References

1. DeLuca HF. DeLuca HF Overview of general physiologic features and functions of vitamin D. *Am J Clin Nutr*. 2004;80(6 Suppl):80–96.
2. Adam Y, Meinlschmidt G, Gloster AT, Lieb R. Obsessive-compulsive disorder in the community: 12-month prevalence, comorbidity and impairment. *Soc Psychiatry Psychiatr Epidemiol*. 2012;47(3):339–49.
3. Boileau B. A review of obsessive-compulsive disorder in children and adolescents. *Dialogues Clin Neurosci*. 2011;13:401–11.
4. Westenberg HGM, Fineberg NA, Denys D. Neurobiology of Obsessive-Compulsive Disorder: Serotonin and Beyond. *CNS Spectr*. 2007;12:14–27.
5. Koo MS, Kim EJ, Roh D, Kim CH. Role of dopamine in the pathophysiology and treatment of obsessive-compulsive disorder. *Expert Rev Neurother*. 2010;10(2):275–90.
6. Kariuki-Nyuthe C, Gomez-Mancilla B, Stein DJ. Obsessive compulsive disorder and the glutamatergic system. *Curr Opin Psychiatry*. 2014;27(1):32–7.
7. Dell'Osso B, Nestadt G, Allen A, Hollander E. Serotonin-norepinephrine reuptake inhibitors in the treatment of obsessive-compulsive disorder: A critical review. *J Clin Psychiatry*. 2006;67(4):600–10.
8. Bloch MH, Landeros-Weisenberger A, Kelmendi B, Coric V, Bracken MB, Leckman JF, et al. A systematic review: antipsychotic augmentation with treatment refractory obsessive-compulsive disorder. *Mol Psychiatry*. 2006;11(7):622–32.
9. Parker GB, Brotchie H, Graham RK, Vitamin D. Practice parameter for the assessment and treatment of children and adolescents with obsessive-compulsive disorder . *J Am Acad Child Adolesc Psychiatry*. 2012;51(1):98–113.
10. Eyles DW, Burne TH, Mcgrath JJ, Vitamin D. Vitamin D, effects on brain development, adult brain function and the links between low levels of vitamin D and neuropsychiatric disease. *Front Neuroendocrinol*. 2013;34(1):47–64.
11. Mccann JC, Ames BN. Is there convincing biological or behavioral evidence linking vitamin D deficiency to brain dysfunction? *FASEB J*. 2008;22(4):982–1001.
12. Brown J, Bianco JI, Mcgrath JJ, Eyles DW. 1,25-dihydroxyvitamin D3 induces nerve growth factor, promotes neurite outgrowth and inhibits mitosis in embryonic rat hippocampal neurons. *Neurosci Lett*. 2003;343(2):139–43.
13. Holick MF. Vitamin D and brain health: The need for vitamin D supplementation and sensible sun exposure. *J Intern Med*. 2015;277(1):90–3.
14. Cui X, Pertile R, Liu P. Vitamin D regulates tyrosine hydroxylase expression: N-cadherin a possible mediator. *Neuroscience*. 2015;304:90–100.
15. Kaneko I, Sabir MS, Dussik CM, Whitfield GK, Karrys A, Hsieh JC. 1,25-Dihydroxyvitamin D regulates expression of the tryptophan hydroxylase 2 and leptin genes: implication for behavioral influences of vitamin D. *FASEB J*. 2015;29(9):4023–35.
16. Garcion E, Sindji L, Montero-Menei C, Andre C, Brachet P, Darcy F. Expression of inducible nitric oxide synthase during rat brain inflammation: regulation by 1,25-dihydroxyvitamin D3. *Glia*. 1998;22(3):282–94.
17. Atmaca M, Tezcan E, Kuloglu M, Ustundag B. Plasma nitrate values in patients with obsessive-compulsive disorder. *Psychiatry Clin Neurosci*. 2005;59:621–3.
18. Behl A, Swami G, Sircar SS, Bhatia MS, Banerjee BD. Relationship of possible stress-related biochemical markers to Oxidative/Antioxidative status in obsessive-compulsive disorder. *Neuropsychobiology*. 2010;61:210–4.
19. Ritu G, Gupta A. Vitamin D deficiency in India: prevalence, causalities and interventions. *Nutrients*. 2014;6(2):729–75.
20. Celik G, Tas D, Tahiroglu A, Avci A, Yüksel B, Çam P, et al. Vitamin D Deficiency in Obsessive-Compulsive Disorder Patients with Pediatric Autoimmune Neuropsychiatric Disorders Associated with Streptococcal Infections: A Case Control Study. *Noro Psikiyatr Ars*. 2016;53(1):33–7.
21. Esnafoglu E, Yaman E. Vitamin B12, folic acid, homocysteine and vitamin D levels in children and adolescents with obsessive compulsive disorder. *Psychiatry Res*. 2017;254:232–7.
22. Yazıcı KU, Yazıc IP, Ustundag B. Vitamin D levels in children and adolescents with obsessive compulsive disorder. *Nord J Psychiatry*. 2018;72(3):173–8.
23. Marazziti D, Barberi FM, Fontenelle L, Buccianelli B, Carbone MG, Parra E, et al. Decreased vitamin D levels in obsessive-compulsive disorder patients. *CNS Spectr*. 2023;28(5):606–13.
24. American Psychiatric Association (APA). Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Washington DC: American Psychiatric Association; 2013.
25. First MB, Williams JBW, Karg RS. Structured Clinical Interview for DSM-5 Disorders, Clinician Version (SCID-5-CV). United States: American Psychological Association; 2017.
26. Elbir M, Topbaşö ALP, Bayad S, Kocabaş T, Topak OZ, Çetin Ş. Adaptation and Reliability of the Structured Clinical Interview for DSM-5-Disorders - Clinician Version (SCID-5/CV) to the Turkish Language. *Turk Psikiyatri Derg*. 2019;30(1):51–6.
27. Goodman W, Price L, Rasmussen S, Mazure C, Fleischmann R, Hill C, et al. Yale-Brown Obsessive Compulsive Scale (Y-BOCS). *Arch Gen Psychiatry*. 1989;46:1006–11.
28. Karamustafalıoğlu K, Üçışık A, Ulusoy M. Yale-Brown Obsesyon-Kompulsiyon Derecelendirme Ölçeği'nin Geçerlilik ve Güvenilirlik Çalışması Bursa; 1993.
29. Armstrong DJ, Meenagh GK, Bickle I, Lee AS, Curran ES. Finch MB Vitamin D deficiency is associated with anxiety and depression in fibromyalgia. *Clin Rheumatol*. 2007;26:551–4.

30. Józefowicz O, Rabe-Jabłońska J, Woźniacka A, Strzelecki D. Analysis of vitamin D status in majör depression. *J Psychiatr Pract*. 2014;20:329–37.
31. Terock J, Hannemann A, Auwera SVD, Janowitz D, Spitzer C, Bonk S, et al. Posttraumatic stress disorder is associated with reduced vitamin D levels and functional polymorphisms of the vitamin D binding-protein in a population-based sample. *Prog Neuropsychopharmacol Biol Psychiatry*. 2020;96:109760.
32. Parker GB, Brotchie H, Graham RK, Vitamin D. Vitamin D and depression . *J Affect Disord*. 2017;208:56–61.

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