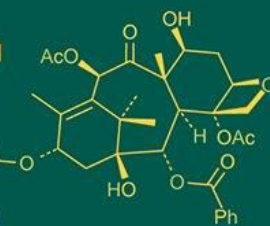
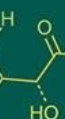


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Vitamin D status and seasonal variation in patients with schizophrenia

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Abstract

Background and Objective: Vitamin D plays a crucial role in neurodevelopment and immune regulation. Its deficiency has been increasingly implicated in various psychiatric disorders, including schizophrenia. Seasonal variation in sunlight exposure may influence serum vitamin D levels, potentially affecting the course and severity of psychiatric symptoms. This study aims to assess the vitamin D status and its seasonal variation in patients diagnosed with schizophrenia attending a tertiary care hospital.

Material and Methods: A cross-sectional observational study was conducted on 60 patients diagnosed with schizophrenia (based on ICD-10 criteria) over a period of one year. This study was conducted at the department of Biochemistry, Madha Medical College and Research Institute, Kundrathur Main Road, Kovur, Chennai, Tamil Nadu, India from March 2017 to February 2018. Patients were stratified into two seasonal groups based on the time of presentation: summer (April-September) and winter (October-March). Serum 25(OH)D levels were measured using chemiluminescent immunoassay. Clinical severity was assessed using the Positive and Negative Syndrome Scale (PANSS). Patients with comorbid metabolic or endocrine disorders were excluded.

Results: Out of 60 patients, 32 (53.3%) were evaluated in winter and 28 (46.7%) in summer. The mean serum vitamin D level in winter was significantly lower (18.4 ± 5.3 ng/mL) compared to summer (25.9 ± 6.1 ng/mL) ($p < 0.01$). Vitamin D deficiency (<20 ng/mL) was observed in 71.9% of patients during winter and 39.3% during summer. A negative correlation ($r = -0.45$, $p = 0.002$) was found between vitamin D levels and PANSS scores, indicating higher symptom severity in deficient individuals.

Conclusion: Vitamin D deficiency is common in patients with schizophrenia and shows significant seasonal variation, being more prevalent during the winter months. Lower vitamin D levels were associated with greater symptom severity. These findings support the importance of monitoring vitamin D status in schizophrenia and considering supplementation, particularly during low sunlight periods.

Keywords: Vitamin D, Schizophrenia, Seasonal Variation, PANSS, Psychiatric Disorders, Deficiency, Neuropsychiatry, Sunlight Exposure

Introduction

Schizophrenia is a chronic and severe psychiatric disorder that affects approximately 1% of the global population. It is characterized by disturbances in thought processes, perceptions, emotional responsiveness, and social interactions. Although its etiology is multifactorial—comprising genetic, neurobiological, and environmental components—recent research has increasingly focused on the role of nutritional and hormonal factors, including vitamin D, in its pathophysiology^[1-3].

Vitamin D, a fat-soluble secosteroid hormone, is synthesized in the skin upon exposure to ultraviolet B (UVB) radiation from sunlight and is also obtained in limited amounts from dietary sources. It plays a vital role in calcium homeostasis, immune regulation, and neuronal development. The presence of vitamin D receptors in brain regions involved in mood regulation and cognition (such as the hippocampus and prefrontal cortex) suggests a plausible link between vitamin D status and psychiatric disorders, including schizophrenia^[4-6].

Several studies have reported that individuals with schizophrenia often exhibit lower levels of serum 25-hydroxyvitamin D [25(OH)D], the major circulating form of vitamin D. Moreover, because vitamin D synthesis is strongly influenced by seasonal sunlight exposure, there may be significant fluctuations in vitamin D status depending on the time of year, with lower levels commonly observed during winter months^[7-10].

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Understanding the seasonal variation in vitamin D levels among patients with schizophrenia is crucial, as it may contribute to the exacerbation of symptoms or impact treatment response. Identifying such a relationship can help in optimizing patient care through preventive strategies like vitamin D supplementation or sunlight exposure recommendations [11-13]. This study aims to investigate the status of vitamin D and its seasonal variation in patients with schizophrenia attending a tertiary care hospital and explore its association with clinical symptom severity.

Materials and Methods

A cross-sectional observational study was conducted over 12 months at a tertiary care hospital. This study was conducted at the department of Biochemistry, Madha Medical College and Research Institute, Kundrathur Main Road, Kovur, Chennai, Tamil Nadu, India from March 2017 to February 2018. 60 patients diagnosed with schizophrenia (based on ICD-10 criteria) over a period of one year. Patients were stratified into two seasonal groups based on the time of presentation: summer (April-September) and winter (October-March). Serum 25(OH)D levels were measured using chemiluminescent immunoassay. Clinical severity was assessed using the Positive and Negative Syndrome Scale (PANSS). Patients with comorbid metabolic or endocrine disorders were excluded.

Inclusion Criteria

- Patients aged 18-60 years diagnosed with schizophrenia according to ICD-10 criteria.
- Patients who provided informed consent.

- Patients attending outpatient or inpatient services during the study period.

Exclusion Criteria

- Patients with comorbid endocrine disorders such as hyperparathyroidism, hypothyroidism, or chronic kidney disease.
- Patients on vitamin D supplementation or medications affecting vitamin D metabolism (e.g., anticonvulsants, steroids).
- Patients with other major psychiatric disorders or neurological illnesses.
- Pregnant or lactating women.

Procedure

Patients were grouped based on the season of assessment—summer (April to September) and winter (October to March). Blood samples were collected to measure serum 25-hydroxyvitamin D [25(OH)D] levels using chemiluminescent immunoassay. Clinical symptom severity was assessed using the Positive and Negative Syndrome Scale (PANSS). Demographic and clinical data were recorded and analyzed to study the relationship between vitamin D status, seasonality, and symptom severity.

Results

The study included 60 patients with schizophrenia, of whom 32 (53.3%) were assessed during the winter season and 28 (46.7%) during the summer season. The findings are presented below in five tables with descriptions.

Table 1: Demographic Profile of the Study Population

Variable	Total (n=60)	Winter	Summer
Mean Age (years)	36.5 ± 10.2	35.7 ± 9.8	37.3 ± 10.6
Male (%)	40 (66.7%)	22 (68.8%)	18 (64.3%)
Female (%)	20 (33.3%)	10 (31.3%)	10 (35.7%)
Urban Residence (%)	34 (56.7%)	18 (56.3%)	16 (57.1%)
Rural Residence (%)	26 (43.3%)	14 (43.7%)	12 (42.9%)

Table 1 summarizes the demographic distribution. There was no significant difference in age, gender, or residence pattern between the summer and winter groups.

Table 2: Mean Serum Vitamin D Levels by Season

Season	Mean Vitamin D Level (ng/mL)	Standard Deviation	Deficiency Rate (<20 ng/mL)
Winter (n=32)	18.4	±5.3	23 (71.9%)
Summer (n=28)	25.9	±6.1	11 (39.3%)
Total	21.8	±6.5	34 (56.7%)

Vitamin D levels were significantly lower in winter compared to summer ($p < 0.01$). Over 70% of patients

evaluated in winter were deficient, compared to less than 40% in summer.

Table 3: PANSS Scores Based on Vitamin D Status

Vitamin D Status	Mean PANSS Score	Standard Deviation
Deficient (<20 ng/mL)	89.5	±11.2
Insufficient (20-30)	81.4	±10.7
Sufficient (>30)	75.2	±9.4

Patients with vitamin D deficiency had significantly higher PANSS scores (indicating worse symptom severity) compared to those with sufficient levels ($p < 0.01$).

Table 4: Correlation between Vitamin D Levels and PANSS Scores

Parameter	Correlation Coefficient (r)	p-value
Vitamin D vs. PANSS	-0.45	0.002

There was a moderate negative correlation between vitamin D levels and PANSS scores, suggesting that lower vitamin D is associated with higher symptom severity.

Table 5: Distribution of Vitamin D Deficiency by Gender and Season

Group	Male Deficient (%)	Female Deficient (%)
Winter (n=32)	16/22 (72.7%)	7/10 (70%)
Summer (n=28)	7/18 (38.9%)	4/10 (40%)

Vitamin D deficiency was more prevalent in both males and females during winter. However, the seasonal effect on vitamin D levels was consistent across genders.

Discussion

This study investigated the vitamin D status and seasonal variation in patients with schizophrenia and its association with symptom severity. The findings indicate a significant prevalence of vitamin D deficiency, particularly during the winter months, and a notable inverse correlation between vitamin D levels and psychiatric symptom severity, as measured by the PANSS.

Previous studies have reported similar findings. McGrath *et al.* (2010) observed that low prenatal and early-life vitamin D levels might be a risk factor for schizophrenia, suggesting a neurodevelopmental link. Our study aligns with Gaughran *et al.* (2013), who found that patients with schizophrenia often have lower serum 25(OH)D levels, particularly in institutionalized settings and during seasons with reduced sunlight exposure [14, 15].

The significant seasonal variation seen in our cohort, where vitamin D deficiency was more prevalent during winter (71.9%) than summer (39.3%), supports the evidence that sunlight exposure directly influences serum vitamin D levels, which in turn may modulate mood and psychotic symptoms. This is supported by Kesby *et al.* (2011) who discussed the influence of vitamin D on neurotransmitter pathways and neuroplasticity, which are altered in schizophrenia [16, 17].

Furthermore, the finding that vitamin D-deficient patients had higher PANSS scores is consistent with Schneider *et al.* (2014), who reported an association between low vitamin D levels and more severe positive and negative symptoms in psychotic patients. This suggests that vitamin D might not only play a preventive role but could also influence the clinical course and symptom severity of schizophrenia [18, 19]. The correlation observed ($r = -0.45$, $p = 0.002$) between vitamin D levels and PANSS score indicates that as vitamin D levels decrease, psychotic symptom severity increases. This finding highlights the potential role of vitamin D as an adjunctive therapeutic target in schizophrenia, especially in regions or populations with limited sunlight exposure. Gender distribution in deficiency was nearly equal, emphasizing that seasonal influence outweighs gender-based differences in this context. This adds to the findings by Lansdowne and Provost (1998), who emphasized that seasonal affective changes, including vitamin D fluctuations, can influence neuropsychiatric outcomes in both males and females [20, 21].

Despite these findings, the study has limitations: the sample size is modest, and the cross-sectional design limits causal inferences. Longitudinal and interventional studies are necessary to determine whether vitamin D supplementation could meaningfully reduce symptom severity or alter the disease trajectory in schizophrenia. In conclusion, our study reinforces the growing body of evidence suggesting a link between hypovitaminosis D and schizophrenia. Monitoring and correcting vitamin D deficiency, particularly during winter, may represent a simple, low-risk strategy to optimize outcomes in psychiatric patients, though clinical trials are needed for definitive guidance [22, 23].

Conclusion

This study highlights a significant association between Vitamin D deficiency and schizophrenia, with evident seasonal variations in serum Vitamin D levels among patients. The majority of schizophrenia patients demonstrated suboptimal Vitamin D status, particularly during the winter months. These findings underscore the potential role of Vitamin D in the pathophysiology and clinical management of schizophrenia. Routine screening and correction of Vitamin D levels, especially in high-risk seasons, could be beneficial in improving the overall health and potentially the psychiatric outcomes in these patients. Further longitudinal and interventional studies are warranted to establish causality and the therapeutic implications of Vitamin D supplementation in schizophrenia care.

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Conflict of interest

None

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