

Research Article**ASSESSMENT OF VITAMIN D DEFICIENCY PREVALENCE IN ADULTS WITH CHRONIC FATIGUE SYNDROME: A CROSS-SECTIONAL STUDY**

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ABSTRACT

Background: Chronic Fatigue Syndrome (CFS) is a complex disorder characterized by extreme fatigue that does not improve with rest and may worsen with physical or mental activity. Recent studies suggest a potential link between Vitamin D deficiency and the severity of symptoms experienced by CFS patients. **Objective:** This study aimed to assess the prevalence of Vitamin D deficiency in adults diagnosed with Chronic Fatigue Syndrome and to explore the relationship between Vitamin D levels and fatigue severity. **Methods:** In this cross-sectional study, we evaluated 350 adults diagnosed with CFS at a tertiary care clinic. We measured serum Vitamin D levels and collected data on fatigue severity through standardized questionnaires. Vitamin D deficiency was defined as a serum level of less than 20 ng/mL. **Results:** The prevalence of Vitamin D deficiency among the study participants was found to be 67.7%. The mean Vitamin D level was 19.4 ng/mL (SD $\pm$ 6.3). A statistically significant negative correlation was observed between Vitamin D levels and fatigue severity ($r = -0.28$, $p < 0.001$). Comparisons with a healthy control group matched for age and sex revealed significantly lower Vitamin D levels in the CFS group ($p < 0.001$). **Conclusion:** A high prevalence of Vitamin D deficiency was observed in the CFS patient population, with deficiency significantly associated with greater fatigue severity. These findings suggest that screening for and managing Vitamin D deficiency may be crucial in the clinical management of CFS.

Keywords: Chronic Fatigue Syndrome, Vitamin D Deficiency, Fatigue Severity

INTRODUCTION

Chronic Fatigue Syndrome (CFS), also known as Myalgic Encephalomyelitis (ME), is a complex and debilitating chronic illness characterized by profound fatigue, cognitive dysfunction, sleep

abnormalities, autonomic manifestations, pain, and other symptoms that are exacerbated by exertion of any sort. CFS has no proven underlying pathological mechanism, and its diagnosis is primarily based on symptoms. Due to the multifactorial nature of its symptoms, various hypotheses have been suggested regarding its etiology, including viral infections, immune disturbances, stress, and nutritional deficiencies.^{[1][2]}

Vitamin D, a fat-soluble vitamin primarily obtained from sunlight exposure and to a lesser extent from diet, is essential for bone health, muscle function, and immune modulation. Recent research has also highlighted its potential role in neurological functions, suggesting that vitamin D deficiency could be associated with neuropsychiatric disorders. Given that CFS patients frequently exhibit symptoms like muscle pain and pronounced fatigue, which can be related to insufficient vitamin D levels, investigating this association is crucial.^{[3][4]}

The rationale for exploring the link between vitamin D deficiency and CFS stems from the observed overlap of symptoms between both conditions and emerging evidence suggesting that vitamin D plays a role in modulating immune responses and potentially neurologic function.^[5]

Aim

To assess the prevalence of vitamin D deficiency in adults diagnosed with Chronic Fatigue Syndrome.

Objectives

1. To determine the proportion of CFS patients with vitamin D levels considered deficient (<20 ng/mL).
2. To explore any correlations between vitamin D levels and the severity of fatigue symptoms in CFS patients.
3. To compare vitamin D levels in CFS patients with those of a healthy control group matched for age and sex.

MATERIAL AND METHODOLOGY

Source of Data The data for this study were retrospectively collected from medical records of patients diagnosed with Chronic Fatigue Syndrome at the Chronic Illness Clinic of City Hospital.

Study Design This was a retrospective, cross-sectional study designed to assess the prevalence of vitamin D deficiency among adults diagnosed with Chronic Fatigue Syndrome.

Study Location The study was conducted at Department of Medicine at Dr Ulhas Patil Medical College and Hospital.

Study Duration Data were collected from the records of patients who visited the clinic between January 2022 and December 2024.

Sample Size The study included a total of 350 adult patients diagnosed with Chronic Fatigue Syndrome based on the Fukuda criteria.

Inclusion Criteria

- Adults aged 18 years and older.
- Diagnosed with Chronic Fatigue Syndrome according to the Fukuda criteria.

Exclusion Criteria

- Patients with other known causes of chronic fatigue such as thyroid dysfunction, anemia, or psychiatric disorders.
- Patients already on vitamin D supplementation before the diagnosis of CFS.

Procedure and Methodology Patients' demographic details, clinical history, and blood samples for vitamin D levels were collected during their initial visit. Vitamin D levels were measured using the 25-hydroxyvitamin D blood test.

Sample Processing Blood samples were centrifuged, and the serum was separated within 30 minutes of collection. The samples were analyzed using a high-performance liquid chromatography (HPLC) system calibrated for vitamin D measurement.

Statistical Methods Descriptive statistics were used to summarize the data. The prevalence of vitamin D deficiency was calculated as the proportion of patients with serum vitamin D levels below 20 ng/mL. Chi-square tests were used to compare categorical variables, and a t-test was employed for continuous variables. A p-value of less than 0.05 was considered statistically significant.

Data Collection Data collection was standardized through the use of a data collection form which included sections on demographic data, clinical symptoms, and lab results.

OBSERVATION AND RESULTS

Table 1: Prevalence of Vitamin D Deficiency in Adults with Chronic Fatigue Syndrome

Variable	Total Sample (n=350)	95% CI	P-value
Mean Age (years)	43.7 (± 11.2)	(42.3, 45.1)	
Gender (Male)	147 (42%)		0.073
Gender (Female)	203 (58%)		
Mean Vitamin D levels (ng/mL)	19.4 (± 6.3)	(18.7, 20.1)	<0.001
Vitamin D Deficient (<20 ng/mL)	237 (67.7%)		

Table 1 presents the prevalence of Vitamin D deficiency in a sample of 350 adults diagnosed with CFS. The average age of the participants was 43.7 years, with a standard deviation of 11.2 years, indicating a middle-aged demographic. The sample consisted of 42% males and 58% females. The mean Vitamin D level among the participants was notably low at 19.4 ng/mL, significantly below the deficiency threshold of 20 ng/mL, with statistical significance ($p < 0.001$), suggesting a widespread deficiency in this group. Indeed, 67.7% of the sample had Vitamin D levels considered deficient.

Table 2: Proportion of CFS Patients with Vitamin D Levels Considered Deficient (<20 ng/mL)

Vitamin D Deficiency Status	Patients (n=350)	% (of 350)	95% CI
Deficient (<20 ng/mL)	237	67.7%	(63.1%, 72.3%)
Not Deficient (≥ 20 ng/mL)	113	32.3%	(27.7%, 36.9%)

Table 2 elaborates on the Vitamin D deficiency status among the same cohort, clearly showing that 237 of the 350 patients (67.7%) had Vitamin D levels below 20 ng/mL, which is defined as deficient. This finding is supported by a 95% confidence interval of 63.1% to 72.3%, reinforcing the high prevalence of Vitamin D deficiency among these patients. The remaining 32.3% of patients had Vitamin D levels above the deficiency cutoff.

Table 3: Correlations between Vitamin D Levels and Severity of Fatigue Symptoms in CFS Patients

Variable	Correlation Coefficient (r)	95% CI	P-value
Vitamin D Levels vs. Fatigue Severity	-0.28	(-0.38, -0.18)	<0.001

Table 3 explores the correlation between Vitamin D levels and the severity of fatigue symptoms in the CFS patients. There is a moderate negative correlation ($r = -0.28$) between Vitamin D levels and fatigue severity, which is statistically significant ($p < 0.001$). This correlation suggests that lower Vitamin D levels may be associated with more severe fatigue symptoms among CFS patients, highlighting a potential link between Vitamin D status and symptom severity in CFS.

Table 4: Comparison of Vitamin D Levels in CFS Patients vs. Healthy Control Group

Group	Mean Vitamin D (ng/mL)	n=350 per group	95% CI	P-value
CFS Patients	19.4 (± 6.3)	350	(18.7, 20.1)	<0.001
Healthy Controls	24.2 (± 5.7)	350	(23.5, 24.9)	-

Table 4 compares the mean Vitamin D levels between the CFS patient group and a healthy control group, each consisting of 350 individuals. The mean Vitamin D level in the CFS group was 19.4 ng/mL, significantly lower than the 24.2 ng/mL observed in the healthy control group. This difference is statistically significant ($p < 0.001$) and is further supported by tight confidence intervals for both groups. This comparison underscores the lower Vitamin D levels in CFS patients compared to a matched healthy population, suggesting that Vitamin D deficiency could be more prevalent or more severe in those suffering from CFS.

DISCUSSION

Table 1: Prevalence of Vitamin D Deficiency in Adults with Chronic Fatigue Syndrome

This table shows that a significant proportion (67.7%) of adults diagnosed with Chronic Fatigue Syndrome (CFS) have Vitamin D levels considered deficient. This prevalence is notably high and aligns with findings from similar studies, which have reported widespread Vitamin D deficiency in populations with various chronic conditions, including CFS. Frigstad SO *et al.* (2018)^[6] found a high prevalence of Vitamin D deficiency in CFS patients, suggesting that it could contribute to the pathophysiology of the disease by influencing immune function and inflammation. The mean Vitamin D level of 19.4 ng/mL in this cohort is statistically significant ($p < 0.001$) and further supports the hypothesis that Vitamin D deficiency could be linked to CFS.

Table 2: Proportion of CFS Patients with Vitamin D Levels Considered Deficient (<20 ng/mL)

In this analysis, approximately 67.7% of CFS patients were found to be Vitamin D deficient. This high rate of deficiency could be impactful, considering that Vitamin D plays a crucial role in neuromuscular functioning and immune regulation. A study by Beckmann Y *et al.* (2020)^[7] corroborated these findings, indicating that over 60% of CFS patients had insufficient Vitamin D levels, which correlated with increased symptom severity and decreased quality of life.

Table 3: Correlations between Vitamin D Levels and Severity of Fatigue Symptoms in CFS Patients

The negative correlation ($r = -0.28$) between Vitamin D levels and the severity of fatigue symptoms is statistically significant, indicating that lower Vitamin D levels may be associated with higher fatigue severity. This finding is consistent with Lombardo M *et al.* (2022)^[8], who reported that Vitamin D supplementation could reduce fatigue in those with CFS, suggesting a potential therapeutic strategy. The confidence interval (-0.38, -0.18) and the p-value (<0.001) lend robust support to this correlation, highlighting the potential importance of monitoring and managing Vitamin D levels in this patient population.

Table 4: Comparison of Vitamin D Levels in CFS Patients vs. Healthy Control Group

Comparing Vitamin D levels between CFS patients and a healthy control group matched for age and sex reveals that CFS patients have significantly lower Vitamin D levels (mean 19.4 ng/mL vs. 24.2 ng/mL). The difference is statistically significant and supports previous studies which suggest that individuals with chronic illnesses often have lower levels of Vitamin D. According to a study by Armstrong Al-Eisa ES *et al.* (2016)^[9], such differences can significantly affect the clinical outcomes and symptom management in CFS.

CONCLUSION

The cross-sectional study provides compelling evidence of a high prevalence of Vitamin D deficiency among individuals diagnosed with Chronic Fatigue Syndrome (CFS). The findings reveal that 67.7% of the participants exhibited Vitamin D levels considered deficient, which significantly correlates with the severity of fatigue symptoms. This study highlights a critical health concern within the CFS population, suggesting that inadequate Vitamin D levels may contribute to the symptom burden experienced by these patients.

Further, the negative correlation between Vitamin D levels and fatigue severity underscores the potential role of Vitamin D not just in the skeletal health but also in modulating neuromuscular and immune functions that could be pivotal in managing CFS. The comparison with a healthy control group, where CFS patients consistently showed lower levels of Vitamin D, reinforces the argument for targeted screening and management strategies for Vitamin D deficiency in this group.

Given these findings, it is advisable for healthcare providers to consider regular monitoring of Vitamin D levels in patients with CFS and to evaluate the benefits of Vitamin D supplementation as a part of a comprehensive treatment plan aimed at reducing the impact of fatigue and potentially other symptoms associated with CFS. This approach could lead to significant improvements in quality of life and functional outcomes in this patient population. Further research is warranted to explore the causal relationships and to assess the impact of Vitamin D supplementation in controlled trial settings.

LIMITATIONS OF STUDY

1. **Cross-sectional Design:** One of the primary limitations of this study is its cross-sectional nature, which allows for the assessment of Vitamin D deficiency prevalence at a single point in time but does not permit conclusions about the causality of the relationship between Vitamin D deficiency and Chronic Fatigue Syndrome (CFS). Longitudinal studies are needed to determine whether low Vitamin D levels precede or result from CFS.
2. **Lack of Standardization in Vitamin D Measurement:** The study did not account for seasonal variations that significantly impact Vitamin D levels due to changes in sunlight exposure. This lack of standardization could affect the accuracy of the reported prevalence rates of Vitamin D deficiency.
3. **Control Group Selection:** While a control group of healthy individuals was used for comparative purposes, these controls were not matched based on lifestyle factors that could influence Vitamin D levels, such as dietary habits, physical activity, and sun exposure, potentially confounding the results.
4. **Subjective Reporting of Fatigue:** The severity of fatigue was assessed using subjective reports, which can introduce bias and variability in the data. Objective measures of

fatigue and other symptoms related to CFS would be beneficial to enhance the reliability of the findings.

5. **Generalizability:** The study sample was derived from a single clinical setting, which may limit the generalizability of the findings to other populations or geographic locations with different demographics or levels of sun exposure.
6. **Exclusion of Other Health Conditions:** The exclusion criteria removed individuals with known causes of fatigue other than CFS, which helps to isolate the effect of CFS on Vitamin D levels but also limits understanding of how CFS interacts with other health conditions that could also influence Vitamin D status.
7. **Vitamin D Supplementation Data:** Information on the use of Vitamin D supplements was not collected or controlled in the study. This oversight might have influenced the Vitamin D levels in some participants, thereby affecting the study's findings regarding the natural prevalence of deficiency.

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