



Prevalence of Hypovitaminosis D Among Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease: A Cross-Sectional Study

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Abstract

Background:

Chronic Obstructive Pulmonary Disease (COPD) is a major cause of morbidity and mortality worldwide. Acute exacerbations significantly contribute to disease progression, hospitalizations, and healthcare burden. Vitamin D plays an important role in immune regulation and respiratory health, and its deficiency has been reported frequently among COPD patients.

Objective:

To determine the prevalence of hypovitaminosis D among patients admitted with acute exacerbation of COPD.

Materials and Methods:

This hospital-based cross-sectional study was conducted in the Department of Respiratory Medicine, Regional Institute of Medical Sciences, Imphal, India, from April 2023 to March 2025. A total of 156 patients aged 40 years and above with confirmed COPD exacerbation were included. Serum 25-hydroxyvitamin D [25(OH)D] levels were measured using chemiluminescence immunoassay. Vitamin D status was categorized as deficient (<20 ng/mL), insufficient (20–29 ng/mL), and sufficient (≥30 ng/mL). Data were analyzed using SPSS version 26.

Results:

The mean age of participants was 64.96 ± 10.18 years and 60% were males. Among the study population, 36 patients (23.1%) had vitamin D deficiency and 38 patients (24.4%) had vitamin D insufficiency. Overall, hypovitaminosis D was present in 74 patients, resulting in a prevalence of 47.4%. Vitamin D sufficiency was observed in 82 patients (52.6%).

Conclusion:

Hypovitaminosis D was highly prevalent among patients admitted with acute exacerbation of COPD. Nearly one-half of the study population had either vitamin D deficiency or insufficiency. Routine screening and timely correction of vitamin D deficiency may help improve overall patient care.

Keywords: COPD, Acute Exacerbation, Hypovitaminosis D, Vitamin D Deficiency, Prevalence

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and treatable respiratory disease characterized by persistent airflow limitation

and chronic respiratory symptoms. It remains one of the leading causes of morbidity and mortality worldwide and represents a major public health

challenge, particularly in low- and middle-income countries.^{1,2} Acute exacerbations of COPD contribute significantly to deterioration in lung function, impaired quality of life, increased healthcare utilization, and mortality.³

Vitamin D is traditionally recognized for its role in calcium homeostasis and bone metabolism. However, increasing evidence suggests that vitamin D possesses important immunomodulatory and anti-inflammatory properties.^{4,5} Vitamin D enhances innate immunity through stimulation of antimicrobial peptides such as cathelicidins and defensins and modulates inflammatory responses within the respiratory tract.^{4,6}

Hypovitaminosis D, encompassing both vitamin D deficiency and insufficiency, is highly prevalent globally and has been reported frequently among patients with COPD.⁷ Reduced outdoor activity, limited sunlight exposure, poor nutritional status, advanced age, and chronic systemic inflammation may contribute to lower vitamin D levels in these patients.⁸ Previous studies have reported varying prevalence rates of hypovitaminosis D among COPD patients, particularly during acute exacerbations.^{8,9}

Despite growing interest in the relationship between vitamin D and COPD, data regarding the prevalence of hypovitaminosis D among patients with acute exacerbations remain limited in northeastern India. Therefore, the present study was undertaken to determine the prevalence of hypovitaminosis D among patients admitted with acute exacerbation of COPD.

Objective

To determine the prevalence of hypovitaminosis D among patients admitted with acute exacerbation of COPD.

Materials And Methods

Study Design:
Hospital-based cross-sectional study.

Study Setting:
The study was conducted in the Department of Respiratory Medicine, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India.

Study Duration:
April 2023 to March 2025.

Study Population:
Patients admitted with acute exacerbation of COPD.

Inclusion Criteria:

- Age ≥ 40 years.
- Confirmed diagnosis of COPD according to GOLD 2023 guidelines.
- Patients willing to participate and provide written informed consent.

Exclusion Criteria:

- Bronchial asthma and other obstructive airway diseases.
- Active pulmonary tuberculosis, pulmonary infection, pleural effusion, pulmonary embolism, and pulmonary hypertension.
- Congestive cardiac failure and acute myocardial infarction.
- Patients receiving vitamin D supplementation.
- Disorders affecting vitamin D metabolism or absorption.
- Patients unwilling to participate.

Sample Size:
The sample size was calculated using a previously reported prevalence of vitamin D deficiency of 65% among COPD patients.¹¹ Using the formula $N = Z^2PQ/L^2$ at a 95% confidence level and an allowable error of 7.5%, the minimum sample size was estimated to be 156 patients.

Data Collection:
After obtaining informed consent, demographic details, smoking history, clinical characteristics, and laboratory investigations were recorded. Three milliliters of venous blood were collected under aseptic precautions for estimation of serum 25(OH)D levels.

Vitamin D Assessment:
Serum 25-hydroxyvitamin D levels were measured using a fully automated chemiluminescence immunoassay (CLIA) system. Vitamin D status was classified as:

- Deficient: <20 ng/mL
- Insufficient: $20-29$ ng/mL
- Sufficient: ≥ 30 ng/mL

Statistical Analysis:
Data were analyzed using SPSS version 26. Continuous variables were expressed as mean $\pm$ standard deviation. Categorical variables were expressed as frequencies and percentages. The prevalence of hypovitaminosis D was calculated as the

proportion of patients with either vitamin D deficiency or insufficiency.

Ethical

The study was approved by the Research Ethics Board, Regional Institute of Medical Sciences, Imphal (Approval No. A/206/REB-Comm(SP)/RIMS/2015/1064796/2023 dated 30 September 2023).

Considerations:

Results

A total of 156 patients admitted with acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD) were included in the study. Complete clinical and laboratory data were available for all participants.

The mean age of the study population was 64.96 ± 10.18 years, with ages ranging from 42 to 98 years. All participants were aged 40 years or older. Males constituted 60% (n=94) of the study population, while females accounted for 40% (n=62), resulting in a male-to-female ratio of 1.5:1.

Regarding smoking status, ex-smokers represented the largest group, accounting for 51.28% (n=80) of participants. Current smokers constituted 41.67% (n=65), while only 7.05% (n=11) had never smoked.

Dyspnea was the most common presenting symptom and was reported by 72.4% (n=113) of patients. Fatigue was present in 55.8% (n=87), while cough was reported by 45.5% (n=71) of participants.

The assessment of vitamin D status revealed that 82 patients (52.6%) had sufficient serum vitamin D levels (≥ 30 ng/mL). Vitamin D insufficiency (20–29 ng/mL) was observed in 38 patients (24.4%), while vitamin D deficiency (< 20 ng/mL) was found in 36 patients (23.1%).

Overall, hypovitaminosis D, defined as either vitamin D deficiency or insufficiency, was identified in 74 out of 156 patients, resulting in a prevalence of 47.4%.

Discussion

The present hospital-based cross-sectional study was conducted to determine the prevalence of hypovitaminosis D among patients admitted with acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD). A total of 156 patients were included in the study. The findings revealed that hypovitaminosis D, defined as vitamin D deficiency or

insufficiency, was present in 47.4% of patients with COPD exacerbations.

The mean age of the study population was 64.96 ± 10.18 years, and males constituted 60% of the participants. Similar demographic findings have been reported in previous studies by Persson et al.⁹ and Pant P et al.¹⁰, which showed that COPD predominantly affects older adults.

In the present study, vitamin D deficiency was observed in 23.1% of patients, while 24.4% had vitamin D insufficiency. Overall, nearly one-half of the patients had hypovitaminosis D. Comparable findings have been reported by Thakuria et al.¹¹, who observed vitamin D deficiency in 64.86% of COPD patients with exacerbations. Janssens et al.⁸ also reported a high prevalence of vitamin D deficiency among COPD patients, particularly in advanced disease stages.

The high prevalence of hypovitaminosis D in COPD patients may be attributed to reduced outdoor activity, limited sunlight exposure, advanced age, poor nutritional status, chronic systemic inflammation, and prolonged use of corticosteroids.⁴ In addition, vitamin D plays an important role in immune regulation and enhances the production of antimicrobial peptides that help protect against respiratory infections.⁴

The present study has certain limitations. Being a single-center cross-sectional study, the findings cannot establish a causal relationship between vitamin D deficiency and COPD exacerbations. Factors such as dietary vitamin D intake, body mass index, seasonal variation, and sunlight exposure were not assessed.

Despite these limitations, the study demonstrates that hypovitaminosis D is common among patients admitted with COPD exacerbations. Early identification and correction of vitamin D deficiency may be beneficial in the comprehensive management of COPD patients.

Conclusion

The present study demonstrated that hypovitaminosis D is common among patients admitted with acute exacerbation of Chronic Obstructive Pulmonary Disease (COPD). Of the 156 patients studied, 47.4% had hypovitaminosis D, including 23.1% with vitamin D deficiency and 24.4% with vitamin D insufficiency.

These findings indicate that nearly one out of every two patients with COPD exacerbation has suboptimal vitamin D levels. Considering the important role of vitamin D in immune function and respiratory health, routine assessment of vitamin D status may be beneficial in patients presenting with COPD exacerbations.

Further multicentric studies with larger sample sizes are required to better understand the clinical significance of hypovitaminosis D in COPD and to evaluate the potential benefits of vitamin D supplementation in this patient population.

Recommendations

1. Routine screening for vitamin D status should be considered in patients admitted with COPD exacerbations.
2. Patients identified with hypovitaminosis D should receive appropriate evaluation and management according to standard guidelines.
3. Larger multicentric studies are needed to assess the impact of vitamin D deficiency on COPD outcomes and the role of vitamin D supplementation in reducing disease burden.
4. Public health measures promoting adequate sunlight exposure, balanced nutrition, and awareness regarding vitamin D deficiency may help reduce the prevalence of hypovitaminosis D among COPD patients.

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Table 1. Baseline Characteristics of Study Participants (n = 156)

Characteristic	Value
Age (years)	64.96 ± 10.18
Gender	
Male	94 (60.0%)
Female	62 (40.0%)
Smoking Status	
Current Smoker	65 (41.67%)
Ex-Smoker	80 (51.28%)
Never Smoker	11 (7.05%)
Presenting Symptoms	
Dyspnea	113 (72.4%)
Fatigue	87 (55.8%)
Cough	71 (45.5%)

Table 2. Vitamin D Status among Patients with COPD Exacerbation (n = 156)

Vitamin D Status	Number (%)
Deficient (<20 ng/mL)	36 (23.1%)
Insufficient (20–29 ng/mL)	38 (24.4%)
Sufficient (≥30 ng/mL)	82 (52.6%)
Total	156 (100%)

Table 3. Prevalence of Hypovitaminosis D among Patients with COPD Exacerbation (n = 156)

Vitamin D Category	Number (%)
Hypovitaminosis D*	74 (47.4%)
Normal Vitamin D Status	82 (52.6%)

Vitamin D Category	Number (%)
Total	156 (100%)

*Hypovitaminosis D includes both vitamin D deficiency (<20 ng/mL) and insufficiency (20–29 ng/mL).