

## STUDY OF VITAMIN D STATUS IN COPD PATIENTS OF TELANGANA

V. Gopi Krishna<sup>1</sup>, Kairi Anil<sup>2</sup>, K. Bhanu Priya<sup>3</sup>, Musku Manasa<sup>4</sup>

<sup>1</sup>Assistant Professor, Department of Respiratory Medicine, Gandhi Medical College Secunderabad, Telangana, India.

<sup>2</sup>Assistant Professor, Department of Respiratory Medicine, Government Medical College, Mulugu, Telangana, India.

<sup>3</sup>Assistant Professor, Department of Respiratory Medicine, Gandhi Medical College, Secunderabad, Telangana, India.

<sup>4</sup>Assistant Professor, Department of Respiratory Medicine, Gandhi Medical College, Secunderabad, Telangana, India.

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Corresponding Author:  
**Dr. Musku Manasa,**  
Email: dr.aruna.rajendran@gmail.com

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### Abstract

**Background:** Vitamin D levels play a significant role in maintaining the pathophysiology of the lungs. Its deficiency causes chronic lung diseases like COPD, ILD, asthma, etc. The present study aimed to evaluate the status of vitamin D in patients suffering with COPD and its severity. **Materials and Methods:** A total of 300 (three hundred) COPD patients were studied. A detailed clinical history and examination were done. Dyspnea was graded according to mMRC. BMI, 6-MWT, CXR, ECG, spirometry, and laboratory tests for 25 (OH) vitamin D were carried out to correlate the severity of COPD and vitamin D levels. **Results:** The mean values of the mMRC dyspnea scale, 6-minute walk test, and FEV1% were 2.55 ( $\pm$  0.47), 228.94 ( $\pm$  149.58), and 50.86 ( $\pm$  16.28), respectively. The mean value of vitamin D was 27.84 ( $\pm$  11.45) ng/ml. Comparison of mean serum 25(OH) vitamin D level at different age groups, according to mMRC dyspnea scale, 6 MWT, and ICS therapy, had significant p-values ( $p < 0.001$ ). **Conclusion:** In this study we observed a strong relationship of low vitamin D levels with increased COPD severity and age.

## INTRODUCTION

Chronic obstructive pulmonary disease and chronic respiratory diseases are common causes of mortality and morbidity globally, with impairment of quality of life and costs of living.<sup>[1]</sup> It is observed that attenuating and ameliorating the frequency and severity of COPD varies with the status of vitamin D levels.

Vitamin D (25-OH) is capable of tissue remodeling of lungs, reduction of pro-inflammatory cytokines, and beneficial modulation of both innate and adaptive immune systems.<sup>[2]</sup> It regulates more than 1000 genes and is critical for normal human physiology beyond the skeletal system.<sup>[3]</sup>

Vitamin D deficiency is present in 40%-70% of COPD patients and is of particular interest due to the potential effects of vitamin D on muscle strength and physical performance, as well as exacerbations and lung function decline. Low 25-OH-vitamin D levels are associated with poor lung function and COPD exacerbation outcomes.<sup>[4]</sup> Therefore, there is a need to assess the vitamin D status and severity in COPD patients across various age groups.

## MATERIALS AND METHODS

A multicentric cross-sectional observation study was conducted among various OPDs in Telangana. 300 (three hundred) diagnosed COPD patients aged between 40-85 years were studied.

**Inclusion Criteria:** Patients diagnosed with COPD in the age group between 40-85 years with informed consent in writing were selected.

**Exclusion Criteria:** Patients with lung diseases other than COPD, other systemic diseases (nutritional deficiency, anemia), etc., were excluded from the study.

**Method:** Every patient's clinical history, dyspnea scale (mMRC), and smoking history were determined as current smoker, ex-smoker, and never smoker; socio-economic status and usage of inhaled corticosteroids were recorded; physical examination, 6-MWT, BMI, CXR, ECG, spirometry, and laboratory tests for 25 (OH) vitamin D were carried out.

Serum 25 (OH) vitamin D level was measured by a fully automated antibody-based chemiluminescence (CLIA) assay; serum 25 (OH) vitamin D level was the best marker of body vitamin D status. Spirometry was carried out using the Schiller sensor SP-260. Tests were performed in a sitting position before and

15 minutes after 400 mcg salbutamol was given via nebulizer with a nose clip. Three to four trials were given. Best of all, trials were included where expiration continued for > 6 seconds with an acceptable flow volume loop. FEV1 and FEV1/FVC parameters were used to diagnose COPD, where FEV1% predicted were used in the study for severity of COPD.

Duration of study was from November 2023 to December 2024.

**Statistical Analysis:** Various characteristic features of patients, comparison of Vit. D levels, various age groups, grades of mMRC dyspnea, mean values of 6MWT, and users and non-users of ICS therapy were studied with ANOVA tests and t-tests. The statistical analysis was carried out using SPSS software.

## RESULTS

**Table 1: Characteristic features of patients with COPD**

- Total numbers of patients are 300: 27.84 ( $\pm$  11.45) mean value of vit. D ng/ml, 2.55 ( $\pm$  0.47) mean value of mMRC dyspnea. In the 6-minute walk test, the mean value was 50.80 ( $\pm$  16.2).
- FEV1% predicted mean value was 50.86 ( $\pm$  16.28), with 98 (32.6%) smokers, 168 (56%) ex-smokers, and 34 (11.3%) non-smokers. COPD status: 14 (8%) mild, 97 (32.3%) moderate, 130 (43.3%) severe, and 49 (16.3%) very severe.

**Table 2: Mean serum 25(OH) vitamin D levels in different age groups**

- In 40-59 years: 77 patients had a mean value of vit D of 31.04 ( $\pm$ 17.02).
- In 60-69 years of age, 130 patients had a mean value of vit D of 31.28 ( $\pm$  16.36).
- In 70-79 years of age, 19.90 ( $\pm$  11.76) was the mean value of vitamin D.
- In > 80 years, 26 patients had a mean value of vit. D of 23.12 ( $\pm$  10.30). ANOVA F value was 2.21 and  $p < 0.001$  (p value was highly significant).

**Table 3: Mean value of vitamin D according to MRC dyspnea grade among COPD**

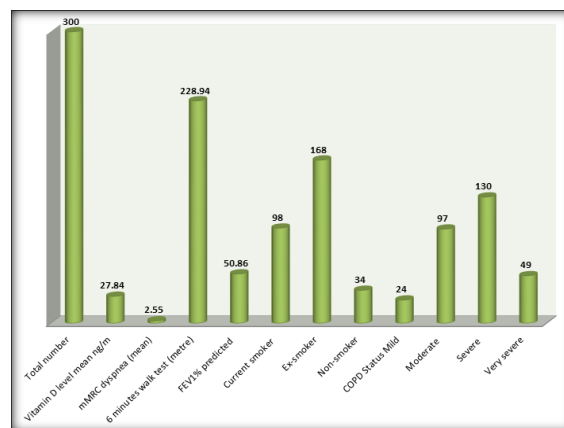
- In grade I of mMRC Dyspnea: 36 patients had a mean value of vitamin D of 54 ( $\pm$  11.65).
- In grade II: 87 patients had 36.90 ( $\pm$ 10.7) mean value of vit D.
- In grade III: 105 patients, 24.8 ( $\pm$  9.4) was the mean value of vit. D.
- In grade-IV: 72 patients had 14.16 ( $\pm$  6.02), which was the mean value of vit. D. F value was 172.5, and  $p < 0.001$ .

**Table 4: Comparison of mean value of vitamin D levels according to the 6-minute walk test among COPD patients**

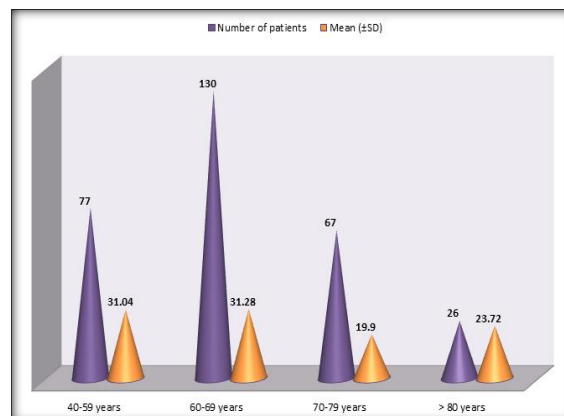
- 400 meters had 52 patients, and their mean value of vitamin D was 48.72 ( $\pm$  9.08).
- 399-300 meters had 45 patients; their mean value of vit. D was 39.08 ( $\pm$  8.30).

- 299-200 meters had 109 patients; their mean value of vit. D was 20.19 ( $\pm$ 4.08).
- In < 99 meters, there were 62 patients; their mean value of vit. D was 11.09 ( $\pm$  4.80). The F value was 290.7, and  $p < 0.001$ .

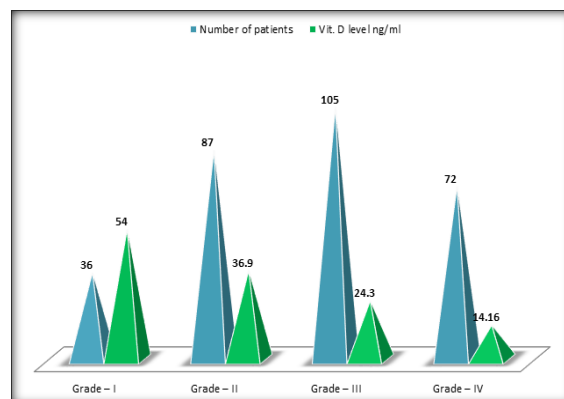
Table 5: Comparative study of inhaled corticosteroid therapy among COPD patients—156 patients were using ICS therapy, and 144 were not using ICS therapy. The mean value of vitamin D users of ICS was 21.45 ( $\pm$  4.15), and the mean value of vitamin D in non-users was 34.63 ( $\pm$  8.3). The t-test was 17.2, and  $p < 0.001$  (the p-value was highly significant).



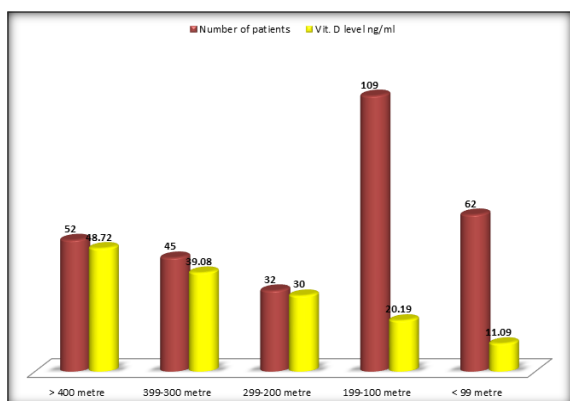
**Table 1: Characteristic features of the patients with COPD**



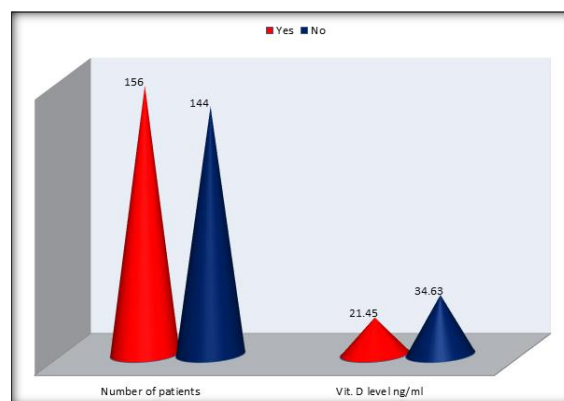
**Table 2: Comparison Mean serum 25 (OH) vitamin D levels in different age groups**



**Table 3: Comparison means vitamin D level according to mMRC Dyspnea grades among COPD**



**Table 4: Comparison of mean values of vitamin D levels according to 6 minutes walk test among COPD**



**Table 5: Comparison of Inhaled corticosteroid (ICS) therapy among COPD**

**Table 1: Characteristic features of the patients with COPD**

Characteristic	Mean or Number
Total number	300
Vitamin D level mean ng/m	27.84 ( $\pm$ 11.45)
mMRC dyspnea (mean)	2.55 ( $\pm$ 0.47)
6 minutes' walk test (metre)	228.94 ( $\pm$ 149.58)
FEV1% predicted	50.86 ( $\pm$ 16.28)
Smoking status	
1. Current smoker	98 (32.6%)
2. Ex-smoker	168 (56%)
3. Non-smoker	34 (11.3%)
COPD Status Mild	24 (8%)
Moderate	97 (32.3%)
Severe	130 (43.3%)
Very severe	49 (16.3%)

**Table 2: Comparison Mean serum 25 (OH) vitamin D levels in different age groups**

Age groups (years)	Number of patients	Mean ( $\pm$ SD)	t test F value	p value
40-59 years	77	31.04 ( $\pm$ 17.82)	2.213	P<0.001
60-69 years	130	31.28 ( $\pm$ 16.36)		
70-79 years	67	19.90 ( $\pm$ 11.76)		
> 80 years	26	23.72 ( $\pm$ 10.50)		

(p<0.001 = p value is highly significant)

**Table 3: Comparison means vitamin D level according to mMRC Dyspnea grades among COPD**

mMRC Dyspnea	Number of patients	Vit. D level ng/ml	ANOVA F	p value
Grade – I	36	54 ( $\pm$ 11.65)	172.5	P<0.001
Grade – II	87	36.90 ( $\pm$ 10.7)		
Grade – III	105	24.30 ( $\pm$ 9.1)		
Grade – IV	72	14.16 ( $\pm$ 6.02)		

p value is highly significant (p<0.001)

**Table 4: Comparison of mean values of vitamin D levels according to 6 minutes walk test among COPD**

6 minute walk test 6 (MWT)	Number of patients	Vit. D level ng/ml (Mean $\pm$ SD)	ANOVA F value	p value
> 400 metre	52	48.72 ( $\pm$ 9.08)	290.7	P<0.001
399-300 metre	45	39.08 ( $\pm$ 18.30)		
299-200 metre	32	30.00 ( $\pm$ 7.20)		
199-100 metre	109	20.19 ( $\pm$ 5.23)		
< 99 metre	62	11.09 ( $\pm$ 4.80)		

**Table 5: Comparison of Inhaled corticosteroid (ICS) therapy among COPD**

ICS Therapy	Number of patients	Vit. D level ng/ml (Mean $\pm$ SD)	t test	p value
Yes	156	21.45 ( $\pm$ 4.15)	17.2	P<0.001
No	144	34.63 ( $\pm$ 8.5)		

## DISCUSSION

The characteristic features of patients vitamin D mean level were 27.84 ( $\pm$  11.45), the mMRC mean value was 2.55 ( $\pm$  0.47), and the 6 MWT test meter mean value was 228.9 ( $\pm$  149.5). Mean value of FEV1 predicted: 50.86 ( $\pm$  16.7) 98 (32.6%) current smokers, 168 (56%) ex-smokers, and 34 (11.3%) non-smokers; COPD status: 24 (8%) mild, 97 (32.3%) moderate, 130 (43.3%) severe, and 49 (16.3%) very severe (Table 1). Comparison of mean severe 25 (OH) vit. D levels had a significant p-value ( $p < 0.001$ ) (Table 2). Comparison of vit. D levels according to the mMRC scale at different grades had a significant p-value ( $p < 0.001$ ) (Table 3). Comparison of mean values of vit D in the 6-minute walk test (6 MMT) in different meters had a significant p-value ( $p < 0.001$ ) (Table 4). In comparison of ICS in usage and non-usage of patients, there was a significant p-value ( $p < 0.001$ ) (Table 5). These findings are more or less in agreement with previous studies.<sup>[5,6,7]</sup>

Patients with COPD are at high risk of being vitamin D deficient due to a variety of reasons: aging skin is less effective in producing vitamin D, poor nutrition and outdoor activities, increased catabolism of vitamin D by steroids, and lower storage capacity.<sup>[8]</sup> The normal functioning of both innate and adaptive immunity is dependent on vit-D, such as the maturities of dendritic cells, negative regulation of pro-inflammatory cytokines and chemokines, and maturation and development of T cells, especially Th1 cells.<sup>[9]</sup> Vitamin D is also linked to apoptosis and intracellular adhesions. Increased expression of antimicrobial peptides such as cathelicidin and beta defensins is an important function of vit D to maintain homeostasis.<sup>[10]</sup> Immune cells both have a vitamin D receptor (VDR) and a hydroxylase enzyme and can potentially reduce the pathogenic load of micro-organisms. Vit. D in airway epithelium helps to kill pathogens via TLS and CD 14-dependent mechanisms. The vitamin D receptor (VDR) is an important nuclear hormone receptor, and animal studies have confirmed that VDR has observed lung changes. Similar to COPD and chronic respiratory failure, increased inflammation and up-regulation of various matrix metalloproteinases (MMPs),<sup>[11]</sup> lead to early-onset emphysema and decline in lung functions. Higher exercise capacity and carbon monoxide transfer capacity were associated with higher levels of vitamin D levels.<sup>[12]</sup>

## CONCLUSION

Present study of vitamin D status in COPD. It is observed that vitamin D level is significantly decreased in COPD patients. Such studies must be conducted in a large number of patients in hi-tech respiratory research centers to confirm present significant results because the exact mechanism of vit. D in respiratory units like respiratory bronchioles, alveoli, and surfactant cells remains unclear.

**Limitation of study:** Owing to the tertiary location of the research center, a small number of patients lack the latest techniques, and we have limited findings and results.

- This research work was approved by the ethical committee of Gandhi Medical College, Secunderabad, Telangana-500003.
- No Conflict of Interest
- Self-funding.

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