e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2025; 17(1); 1031-1036

Original Research Article

Cross Sectional Study of Vitamin D Deficiency and Insufficiency in Hospitalized COPD Patients

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Received: 25-10-2024 / Revised: 23-11-2024 / Accepted: 26-12-2024

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Conflict of interest: Nil

Abstract:

Introduction: Vitamin D sources originate from skin after exposure to ultraviolet rays, dietary resources, and supplementation. The role of vitamin D in the respiratory infections prevention and treatment (particularly tuberculosis) has already been well-established. There has been a dramatic increase in the prevalence of vitamin D deficiency around the world. There is association of Vitamin D insufficiency with increased risk and severity of respiratory infections. The high prevalence of osteoporosis and osteopenia in COPD patients may be an indication of a link between Vitamin D deficiency and COPD. Vitamin D can be beneficial in reducing exacerbations when taken in adequate amount and for a prolonged period of time.

Aims: To find out the vitamin D deficiency and insufficiency in Hospitalized COPD patients. Main objective of the study was to compare different parameters including intensity of symptoms in COPD between vitamin D deficiency/ insufficiency group and that of Vit. D sufficient group in Hospitalized COPD patients.

Materials and Method: This Institution based cross sectional observational study was done in patients admitted in the Department of Respiratory Medicine, CNMCH, Kolkata with a diagnosis of COPD or a presumptive diagnosis of COPD with acute exacerbations(AE) and fulfilling the inclusion criteria was studied from April 2020 to September 2021 (18 months duration)were included in this study.

Result: In our study the mean age in Vit. D deficient and insufficient patients were about 54 years. 51.7% patients were Vit. D deficient and 16.7% were Vit D. insufficient. Vit. D deficient patients were mostly male (93.5%) and insufficient were all female (100%). in Vit. D deficiency group, 54.8% patients had habit of smoking. It was found that most patients (Total 96.7%) among Vit. D deficiency were having CAT Score 9 and 10. It was found in our study that Vit. D deficient patients were having mean CAT Score of 9.61 and insufficient patients had 7.2, whereas in Vit D sufficient group, mean CAT Score was 7.7. Most patients (Total 93.5%) among Vit. D deficiency were having mMRC Score 3 and 4, with mean mMRC Score of 3.54. Vit. D deficient patients were all (100%) having GOLD Stage III and most insufficient patients were having GOLD Stage II (80%). Vit. D deficient patients were having mean FEV1 of 39.67 and insufficient patients had mean FEV1 of 60.5, whereas in Vit D sufficient group, it was 82.52.

Conclusion: In COPD patients severe vitamin D deficiency was related to more severe disease exacerbations. The patients with COPD admitted for exacerbation are a risk group for vitamin D deficiency and insufficiency, which is associated with worse disease characteristics.

Keywords: Vit D deficiency, COPD, Acute exacerbation.

Introduction

Vitamin D sources originate from skin after exposure to ultraviolet rays, dietary resources, and supplementation [1] The role of vitamin D in the respiratory infections prevention and treatment (particularly tuberculosis) has already been well-established [2,3,4,5]. There has been a dramatic increase in the prevalence of vitamin D deficiency around the world [6, 7]. There is association of Vitamin D insufficiency with increased risk and severity of respiratory infections.[8] The high prevalence of osteoporosis and osteopenia in COPD patients may be an indication of a link

between Vitamin D deficiency and COPD.[9] Vitamin D can be beneficial in reducing exacerbations when taken in adequate amount and for a prolonged period of time.[10] According to 12 site Burden of Obstructive Lung Disease (BOLD) study, the average prevalence of COPD(stage 2 and above) is 10.1%[11] In India, the magnitude of this problem is not uncommon. Vitamin D deficiency is common in Kashmir (Indian administered) [12]. There is not enough data to determine whether the results from these studies are applicable to specific subgroups of patients such as COPD patients admitted for exacerbation. In the recent years, the growing interest of the role of 25-hydroxyvitamin D (25(OH)D) in lung diseases is emerging.

The present study was conducted to assess the occurrence of Vit D deficiency in COPD patients. Main objective of the study was to compare different parameters including intensity of symptoms in COPD between vitamin D deficiency/ insufficiency group and that of Vit. D sufficient group in Hospitalized COPD patients.

Material and Methods

It was an Institution based cross sectional observational study in the Dept of Respiratory Medicine, Calcutta National Medical College, and Kolkata. From April 2020 to September 2021 with 60 no. of patients and all were admitted in the Department of Respiratory Medicine, CNMCH with a diagnosis of COPD or a presumptive diagnosis of COPD with acute exacerbations (AE) and fulfilling the inclusion criteria.

Inclusion criteria

- Hospitalized AECOPD or suspected COPD patients with acute exacerbations subsequently confirmed as COPD.
- Patients aged 40 years or older.

Detailed history taking and Clinical examination was done with special emphasis on accessory muscle use, cyanosis, crepitus, and wheeze.

Exacerbations of COPD was assessed clinically by increased dyspnea, increased sputum purulence and volume, together with increased cough and wheeze.

Patients were re-examined 6wks after discharge and stabilization for COPD confirmation, GOLD staging, CAT score and mMRC score.

Blood tests were done. Spirometry was done after 6weeks of discharge and stabilization of patients. Spirometry done by Delphi spirometry machine. Diagnosis of COPD was done by presence of a post-bronchodilator FEV1 /FVC <0.70. CXR (PA)-digital and HRCT thorax were done for all patients.

25-OH Vitamin D Estimation was done after 12 hours of fasting. Vitamin D estimation was done by ELISA with AccuBind (ELISA microwell & reagents) kit. This method is popularly known as antibody-antigen-antibody sandwich ELISA. Machine used for Immunoassay -ADVIA CENTAURE CP.

- Level of vitamin D >30 ng/ml was defined as sufficient
- Level of vitamin D 10-33 ng/ml was defined as insufficient
- Level of vitamin D <10 ng/ml was defined as deficient.

Statistical Analysis:

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples.

Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution. P-value ≤ 0.05 was considered for statistically significant.

Results and Analysis

Table 1: Distribution of mean Age: Vitamin D Group

		Number	Mean	SD	Minimum	Maximum	Median	p-value
Age	Deficiency	31	54.5484	7.6631	41.0000	68.0000	54.0000	0.9755
	Insufficiency	10	53.9000	7.9366	42.0000	66.0000	50.5000	
	Sufficiency	19	54.3158	8.8509	40.0000	68.0000	54.0000	

In Vitamin D Deficiency and Insufficiency Group, the mean Age (mean± s.d.) of patients was 54.5484± 7.6631and 53.9000± 7.9366 respectively. The findings were not statistically significant (p=0.9755).

Table 2: Distribution of Vitamin D Group

Vitamin D Group	Frequency	Percent
Deficiency	31	51.7%
Insufficiency	10	16.7%
Sufficiency	19	31.7%
Total	60	100.0%

In our study, 31 (51.7%) patients were Deficiency in Vitamin D,10 (16.7%) patients were Insufficiency in Vitamin D and 19 (31.7%) patients were Sufficiency in Vitamin D.

Table 3: Association between Sex: Vitamin D Group

Vitamin D Group				
Sex	**Deficiency**	**Insufficiency**	**Sufficiency**	**Total**
Female	2	10	5	17
Male	29	0	14	43
Total	31	10	19	60

Chi-square value: 32.6421; p-value: <0.0001

In Vitamin D Deficiency Group, most [29 (93.5%)] patients were Male and in Insufficiency Group, all patients [10 (100.0%)] were Female. The findings were statistically significant (p<0.0001).

Table 4: Association between Smoking status: Vitamin D Group

Vitamin D Group				
Smoking Status	**Deficiency**	**Insufficiency**	**Sufficiency**	**Total**
No	14	10	9	33
Yes	17	0	10	27
TOTAL	31	10	19	60

Chi-square value: 9.8414; p-value: 0.0073

In Vitamin D Deficiency Group, 17 (54.8%) patients had habit of Smoking and in Sufficiency Group, 10 (52.6%) patients had habit of Smoking. The findings were statistically significant (p=0.0073).

Table 5: Association between CAT score: Vitamin D Group

Vitamin D Group				
CAT Score	**Deficiency**	**Insufficiency**	**Sufficiency**	**Total**
6	0	0	2	2
7	0	8	5	13
8	1	2	8	11
9	10	0	4	14
10	20	0	0	20
TOTAL	31	10	19	60

Chi-square value: 58.8017; p-value:<0.0001

In Vitamin D Deficiency Group, most patients were having CAT score 9 and 10. In Insufficiency Group, most patients were having CAT score 7. These findings were statistically significant (p<0.0001).

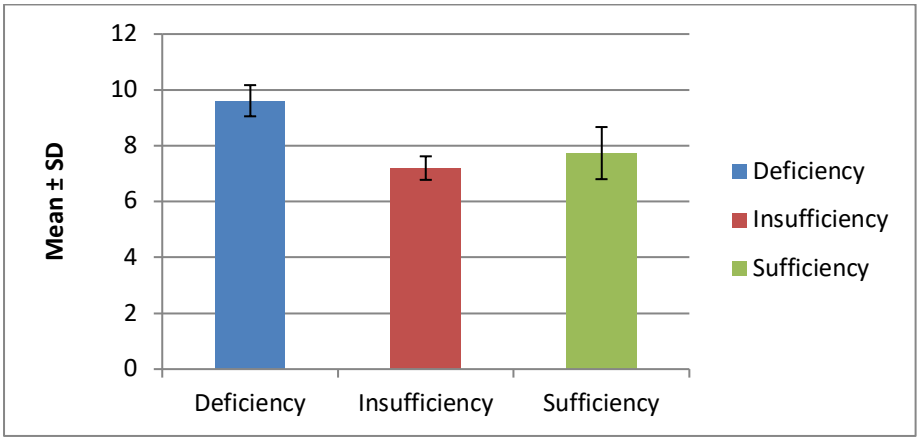

Figure 1: Distribution of mean CAT score: Vitamin D Group

In Vitamin D Deficiency Group, the mean CAT score (mean± s.d.) of patients was 9.6129± .5584, in Insufficiency Group, 7.2000± .4216 and in Vitamin D Sufficiency Group it was 7.7368± .9335. Distribution of mean CAT score with Vitamin D Group was statistically significant (p<0.0001).

Table 6: Association between mMRC: Vitamin D Group

Vitamin D Group				
mMRC	**Deficiency**	**Insufficiency**	**Sufficiency**	**TOTAL**
1	0	0	10	10
2	2	8	9	19
3	10	2	0	12
4	19	0	0	19
TOTAL	31	10	19	60

Chi-square value: 60.5628; p-value: <0.0001

In Vitamin D Deficiency Group, most patients were having mMRC 3 (32.2%) and mMRC 4 (61.2%). Association of mMRC with Vitamin D Group was statistically significant (p<0.0001).

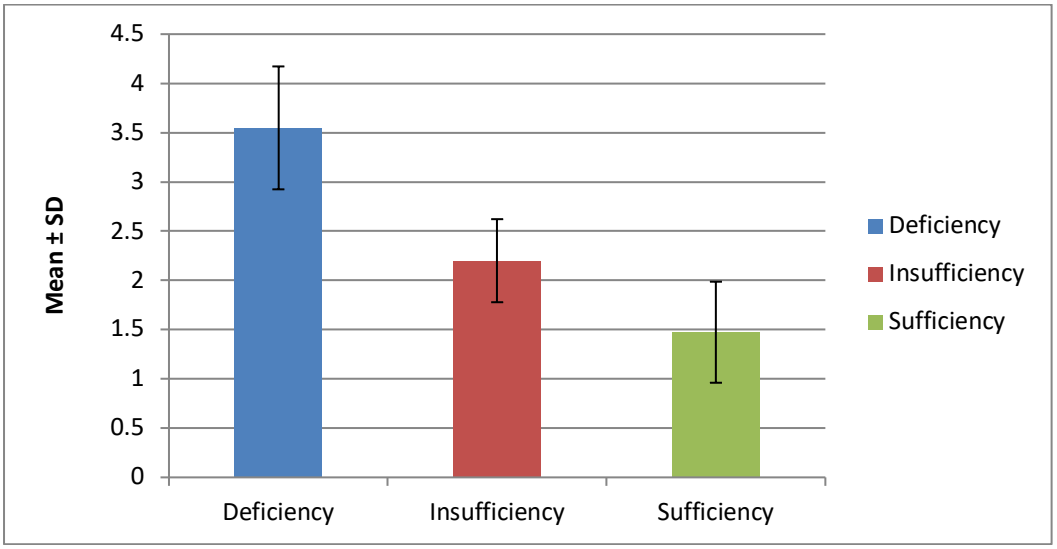

Figure 2: Distribution of mean mMRC: Vitamin D Group

In Vitamin D Deficiency Group, the mean mMRC (mean± s.d.) of patients was 3.5484±.6239, in Insufficiency Group, it was 2.2000± .4216 and in Sufficiency Group, it was 1.4737± .5130. Distribution of mean mMRC with Vitamin D Group was statistically significant (p<0.0001).

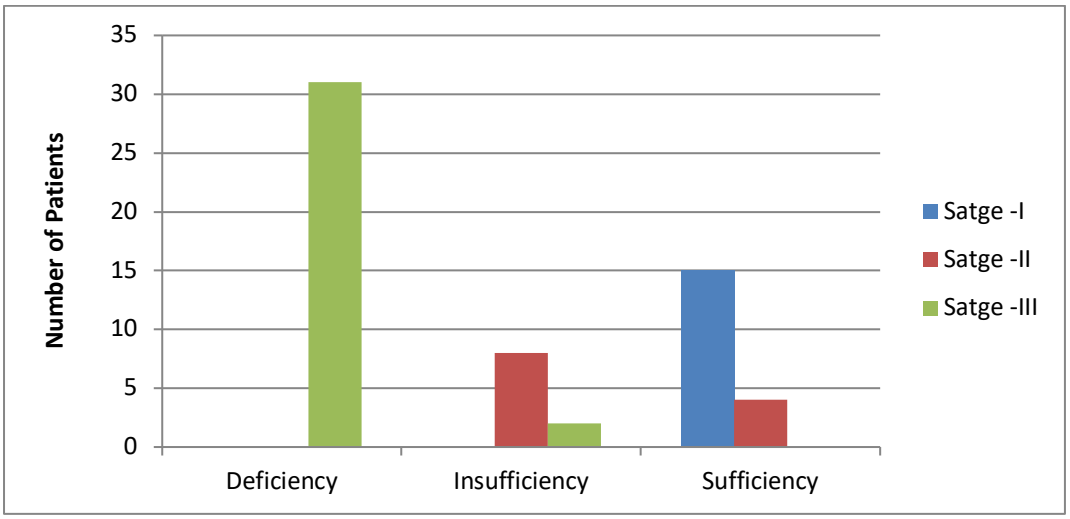

Figure 3: Association between GOLD staging: Vitamin D Group

Chi-square value: 80.6699; p-value: <0.0001. In Vitamin D Deficiency Group, all patients [31 (100.0%)] were GOLD Stage III. In Insufficiency Group, 8 (80.0%) patients were GOLD Stage - II. Association of GOLD staging with Vitamin D Group was statistically significant (p<0.0001).

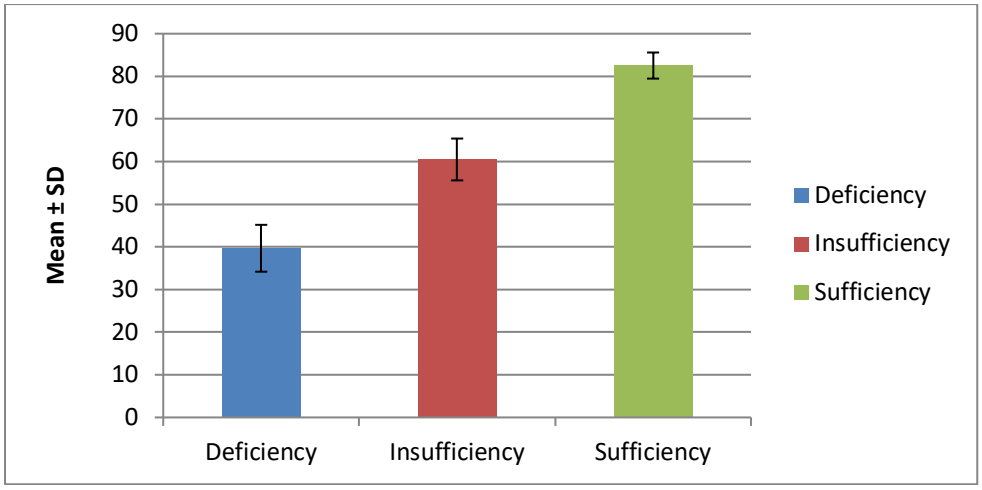

Figure 4: Distribution of mean FEV1: Vitamin D Group

In Vitamin D Deficiency Group, the mean FEV1 (mean± s.d.) of patients was 39.6774± 5.4917. In Insufficiency Group 60.5000± 4.9046 and in Sufficiency Group, it was 82.5263± 3.0617. Distribution of mean FEV1with Vitamin D Group was statistically significant (p<0.0001).

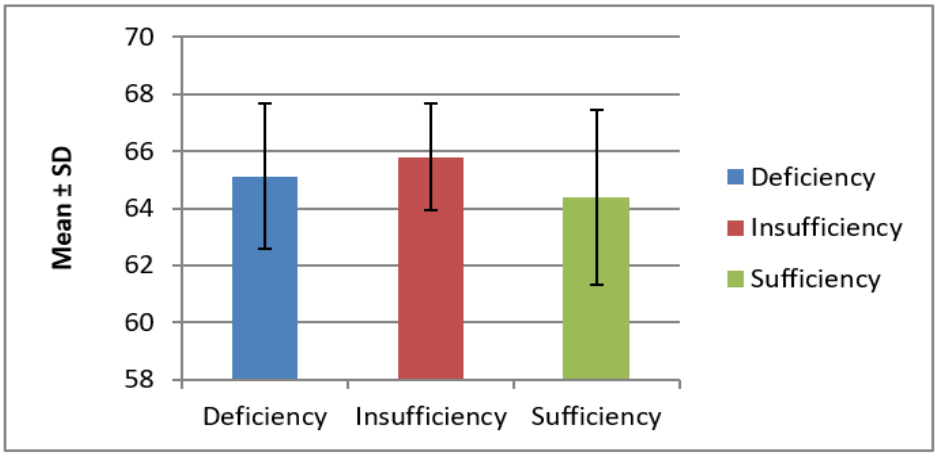

Figure 5: Distribution of mean FEV1/FVC: Vitamin D Group

In Vitamin D Deficiency Group, the mean FEV1/FVC (mean± s.d.) of patients was 65.1290± 2.5527, in Insufficiency group 65.8000± 1.8738 and in Sufficiency Group, it was 64.3684± 3.0589.The findings were not statistically significant (p=0.3585).

Discussion and Analysis

We found in our study (table 1) the mean age in Vit. D deficient and insufficient patients were about 54 years. The study by Bhat MR et al. (2020) (13) showed that 78.8% of the patients between 51 to 65 years age were having low Vit. D level. It was found in our study (Table 2) that 51.7% patients were Vit. D deficient and 16.7% were insufficient. It had dissimilarity with the study by Shabana HA et al [14] (2017) where 56% patients had Vit. D insufficiency, but had similarity with Bhat MR et al. (2020) [13] where total 76.9% patients had low vit D. Our study (Table 3) showed Vit. D deficient patients were mostly male (93.5%) and insufficient were all female (100%). In the study by Bhat MR et al. (2020) [13] also, most patients were male (83.8%). It was found in our study (Table 4), in Vit. D deficiency group, 54.8% patients had habit of smoking and insufficient group had all never smoker. Bhat MR et al. (2020) (13) showed 76.5% had low Vit D level among smokers. In our study (table 5), it was found that most patients (Total 96.7%) among Vit. D deficiency were having CAT Score 9 and 10. It was found in our study (Figure 1), Vit. D deficient patients were having mean CAT Score of 9.61 and insufficient patients had 7.2, whereas in Vit D sufficient group, mean CAT Score was 7.7. Li X. et al.(2020) (15) showed that 5 studies had "demonstrated that there is a statistically significant difference in CAT between those COPD patients treated with vitamin D supplementation and those treated without". Our study showed (Table 6), that most patients (Total 93.5%) among Vit. D deficiency were having mMRC Score 3 and 4. It was found in our study (Figure 2), Vit. D deficient patients were having mean mMRC Score of 3.54 and insufficient

patients had 2.2, whereas in Vit D sufficient group, mean mMRC Score was 1.47. Shabana HA et al [14] (2017) showed that 51.3% patients had mMRC score of 2 or more in Vit. D insufficiency patients. Our study (Figure 3) showed Vit. D deficient patients were all (100%) having GOLD Stage III and most insufficient patients were having GOLD Stage II (80%). Bhat MR et al. (2020) [13] showed that most patients having GOLD stage 2 or more had low Vit. D level. Our study (Figure 4) also showed Vit. D deficient patients were having mean FEV1 of 39.67 and insufficient patients had mean FEV1 of 60.5, whereas in Vit D sufficient group, it was 82.52. Li X. et al.(2020) [15] compared 19 studies and showed that there is "statistically significant difference between the FEV1 of the patients treated with vitamin D supplementation and those treated without". Our study (Figure 5) showed Vit. D deficient patients were having mean FEV1/FVC of 65.12 and insufficient patients had mean FEV1/FVC of 65.8, whereas in Vit D sufficient group, it was 64.36. Li X. et al.(2020) [15] compared 19 studies and showed that " vitamin D in patients with COPD had a statistical significance in FEV1/FVC".

Summary

Most patients having Vit. D deficiency and insufficiency were above 50 years aged, 51.7% patients had Vit. D deficiency, and 16.7% had Vit. D insufficiency. Most patients having Vit. D deficiency had CAT Score 9 and 10 with mean CAT score 9.61where as sufficient group had mean CAT score of 7.7. Most patients having Vit. D deficiency had mMRC score 3 and 4 with mean mMRC score of 3.54, and were having GOLD stage III, had mean FEV1 39.67. Whereas Vit. D sufficient group had mean CAT score 7.7, mean mMRC score of 1.47, mean FEV1 82.52.

Conclusion

In COPD patients, severe vitamin D deficiency was related to more severe disease exacerbations. The patients with COPD admitted for exacerbation are a risk group for vitamin D deficiency and insufficiency, which is associated with worse disease characteristics.

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