

## STUDY OF VITAMIN D LEVEL IN PATIENTS WITH BRONCHIAL ASTHMA

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### Abstract

**Background:** Bronchial asthma is one of the most common chronic diseases. In India, bronchial asthma has 66% frequency of reported exacerbations. Vitamin D has action on pro-inflammatory mediators and smooth muscle function and proliferation, which has direct relevance for lung function in asthma. Present study was conducted to know prevalence of vitamin D deficiency among asthma patient and to know the relation of blood level of vit D with severity, control and exacerbation of asthma among adult. **Materials and Methods:** The present study was conducted in Department of Medicine, C. U. Shah Medical College, Surendranagar. All the consecutive adult patients with bronchial asthma of any severity presented to the Department of General Medicine at C. U. Shah Medical College & Hospital, Surendranagar were included in the study. Asthma was diagnosed and classified according to the Global Initiative for Asthma. The values of slow vital capacity (VC), forced expiratory volume in one second (FEV1), and the FEV1/VC% ratio, were used as markers of airway patency. Patients were divided into groups based on the control of the disease into well controlled, partly controlled, and uncontrolled, according to the GINA 2016. BMI was calculated from the height and weight measurement. **Results:** Out of all 100 patients, 53% were male and 47% were female. Majority of patients were belongs to age group of 41 to 50 year. Mean serum concentration of vitamin D found  $17.3 \pm 5.7$  ng/dl among all asthma patients. Out of all asthma patients, 18% had severe asthma, 25 (25%) had moderate asthma and 57 (57%) had mild asthma. Mean serum concentration of vitamin D found decreasing with increasing severity of asthma. There was a significant association between Vitamin D levels and FEV1% predicted. **Conclusion:** Prevalence of vitamin D deficiency found common among asthma patients. The severity, control status and no. of exacerbation of asthma found associated with vitamin D level of asthma patients.

## INTRODUCTION

Asthma is a serious public health problem throughout the world, with an estimated 300million affected individuals.<sup>[1,2]</sup> Asthma has significant genetic and environmental components, but since its pathogenesis is not clear, much of its definition is descriptive. Based on the functional consequences of airway inflammation, an operational description of asthma is as follow.<sup>[3]</sup>

“Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyper responsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread, but variable, airflow

obstruction within the lung that is often reversible either spontaneously or with treatment.”

The occurrence and development of asthma is influenced by various factors, incorporating genetic, environmental, and ethnic factors, as well as socioeconomic status. A subgroup of asthmatics was shown to manifest a decreased response to standard therapy and experience poorer lung function and more frequent exacerbation. Asthma exacerbations represent the major cause of morbidity and mortality in patient.<sup>[4]</sup> Asthma exacerbations are classified as severe when they require treatment with systemic corticosteroids and/or when they result in emergency department attendance, hospitalization, or death.<sup>[5]</sup> Common precipitants of asthma exacerbation include acute respiratory infections and exposure to allergens and particulates.<sup>[6]</sup> It is necessary to reduce frequency of asthma exacerbation to improve quality of life of patient It is also necessary to know factors affecting it.

Vitamin D is a fat-soluble vitamin that is important to the body by balancing calcium and bone, innate and adaptive immunity, and homeostasis of many organs.<sup>[7,8]</sup> There is a large volume of research highlighting the anti-inflammatory effects of vitamin D on the adaptive immune system,<sup>[9,10]</sup> but limited research as to the effects of vitamin D on the human bronchial epithelium. In the last decades, the prevalence of asthma in the general population has been increasing, as well as the recognition of vitamin D deficiency and insufficiency.<sup>[7]</sup> Asthma and vitamin D deficiency recognize multiple common risk factors such as high latitude, poor diet, obesity, dark skin pigmentation, industrialization, and winter season.<sup>[11-16]</sup> Vitamin D from food or dermal synthesis is inactive and requires enzymatic conversion to become active.

Vitamin D insufficiency is defined as a 25 (OH)D level less than 30 ng/mL. Vitamin D deficiency is defined as 25 (OH)D levels below 20 ng/mL, with a resultant consistent elevation of PTH and reduction in intestinal calcium absorption. People living in tropical countries are exposed to the sun and usually have high levels of vitamin D. However, studies in tropical countries have found the prevalence of vitamin D deficiency to be about 30 to 50%.<sup>[18,19]</sup> Prevalence of vit D deficiency has been reported from 69% to 82% in Indian population.<sup>[20,21]</sup> In South Asia, almost all the days are sunny, which helps vitamin D production. However, still, there is a high prevalence of vitamin D deficiency in these countries due to other underlying factors such as lack of proper diet, inadequate calcium intake, social culture and customs that require the elderly, children and females to be confined in the house, limiting their exposure to sunlight.

There has been a growing interest in the potential role of Vitamin D in asthma management, because it might help to reduce upper respiratory infections that can lead to exacerbations of asthma. Observation from various studies suggested that lower 25(OH)D levels were associated with worse glucocorticoid responsiveness, greater exacerbation frequency, worse lung function and substantially more severe asthma symptoms.<sup>[22-25]</sup> Still study regarding Vitamin D and asthma is limited in India especially among adults. So, present study was conducted to know prevalence of vitamin D deficiency among asthma patient and to know the relation of blood level of vit D with severity, control and exacerbation of asthma among adult.

## MATERIALS AND METHODS

The present study was conducted in Department of Medicine, C. U. Shah Medical College, Surendranagar. All the consecutive adult patients with bronchial asthma of any severity presented to the Department of General Medicine at C. U. Shah Medical College & Hospital, Surendranagar were included in the study. Subjects were selected up to desired sample size of 100 achieved.

Prior approval from the institute's ethics committee and written informed consent from patients were taken.

### Inclusive Criteria

- Patients having Bronchial Asthma
- Informed consent given

### Exclusive Criteria

- Patients with COPD, Chronic kidney disease, chronic liver disease, hyperparathyroidism, lymphomas, chron's disease, cealiac disease and other autoimmune diseases

Then complete medical history including information related to treatment taken, number of acute asthma exacerbations throughout the year prior to enrolment in the study were taken. General and local chest examination was carried out followed by chest x-ray (PA) and routine laboratory investigations.

Asthma was diagnosed and classified according to the Global Initiative for Asthma (GINA).<sup>3</sup> Patients were diagnosed according to the clinical manifestations of asthma (cough, wheezing, shortness of breath, and exercise intolerance) and confirmed by spirometry. Lung function tests were measured using the spirometry. The values of slow vital capacity (VC), forced expiratory volume in one second (FEV1), and the FEV1/VC% ratio, were used as markers of airway patency. VC and FEV1 were expressed either as absolute values or as percent of the predicted value<sup>26</sup> Each subject performed at least three spirometry manoeuvres and the highest values were chosen. Serum vitamin D levels of all study subjects were assessed in venous blood sample by Chemiluminescent Immune Assay method. Patients were divided into groups based on the control of the disease into well controlled, partly controlled, and uncontrolled, according to the GINA 2016. BMI was calculated from the height and weight measurement.

### Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

## RESULTS AND DISCUSSION

Patients who fulfill inclusive criteria were selected up to desired sample size of 100.

**Table 1: Distribution of patients according to sex (N=100)**

Age (in years)	Frequency	Percentage
Male	53	53%
Female	47	47%
Total	100	100%

In present study out of all asthma patient, 53 (53%) were male and (47%) were female.

**Table 2: Distribution of participants according to age-group (N=100)**

Age (in years)	Frequency	Percentage
<30	13	13%
30-40	19	19%
41-50	34	34%
51-60	26	26%
>60	8	8%
Total	100	100%

Mean age: 44.4±11.4 years

In present study mean age of asthma patients was a 44.4±11.4 year. Majority of patients were belongs to age group of 41 to 50 year followed by 26 (26%) were belong to age group of 51 to 60 year. Thirty two (32%) of patients had age less than 40 year and same number of patients had age greater than 50 year.

Prevalence of smoking among patients was 48%. Habit of smoking found more among male (83%) patient than female (8.6%).

In present study mean serum concentration of vitamin D found 17.3±5.7 ng/dl among all asthma patients. The mean vitamin D concentrations found variable among different study conducted among different part of world. Sutherland E et al<sup>27</sup> (USA), Gupta et al<sup>28</sup> (UK), Korn S et al<sup>29</sup>(Germany) found high mean con. (25-34ng/dl) than present study, while study conducted by Awasthi et al<sup>30</sup> (India), Havan M et al<sup>31</sup>(Turkey), Kang Q et al<sup>32</sup>(China) found mean con. (18-20) nearer to present study.

**Table 3: Prevalence of Vitamin D deficiency among asthma patients (N=100)**

Category (ng/dl)	Frequency	Percentage
Sufficient (≥30)	6	6%
Insufficient (20-29)	17	17%
Deficient (<20)	77	77%
Total	100	100%

The prevalence of vitamin D deficiency among asthma patient found 77%. In present study 17 (17%) of asthma patient had insufficient (20-29ng/dl) serum concentration of vitamin D. Out of all asthma patient, only 6% of patient had sufficient (≥30ng/dl) serum concentration of vitamin D. Ritu G et al who showed that the prevalence of Vitamin D deficiency in Indian population to be 70-100%.<sup>[33]</sup>

Study conducted by Ansari D et al among asthma patients found prevalence of vitamin D deficiency 55.12% and Vitamin D were deficient in 20.48%.<sup>[34]</sup> Kumaraganti S et al found prevalence of vitamin D deficiency among asthma patient 88.2%.<sup>[35]</sup> In some study prevalence found almost similar to our study.<sup>[36,37]</sup>

**Table 4: Distribution of asthma patients as per severity of asthma (N=100)**

Severity of asthma	Frequency	Percentage
Mild	57	57%
Moderate	25	25%
Severe	18	18%
Total	100	100%

In present study out of all asthma patients, 18 (18%) had severe asthma, 25 (25%) had moderate asthma and 57 (57%) had mild asthma. Patient with intermittent asthma were included in mild category for analysis. They were classified based on the level of symptoms, airflow limitation, and lung function variability. Shahin M et al found 20% of patient had

severe asthma followed by 17.1% had moderate asthma.<sup>[38]</sup> This findings are similar to our study. Mean serum concentration of vitamin D found 18.8±5.6ng/dl, 15.4±4.3ng/dl and 15.0±4.9 ng/dl among patient who had mild, moderate and severe asthma respectively. Mean serum concentration of vitamin D found decreasing with increasing severity

of asthma. Difference in mean serum concentration of vitamin D among different category of severity found statistically significant on applying ANOVA test. Study conducted adult asthma patient by Salas M et al found that vitamin D sufficiency was significantly associated with a decreased total number of asthma exacerbations. 39 Some other study also found similar findings.<sup>[40-43]</sup>

More than half of the asthma patient (59%) had well control on asthma while 26 (26%) patients had partial controlled and 15(15%) patient had uncontrolled asthma. Difference in mean serum concentration of vitamin D among different category of asthma control found statistically significant on applying ANOVA test.

**Table 5: Association of serum vitamin D concentration with status of asthma control (N=100)**

Asthma control	S. Vit. D (ng/dl)		P Value
	Mean	SD	
Well controlled (n=59)	19.1	5.3	0.000
Partly controlled (n=26)	16.7	3.5	
Uncontrolled (n=15)	10.9	3.8	

Mean serum concentration of vitamin D found 19.1±5.3 ng/dl, 16.7±3.5 ng/dl and 10.9±3.8 ng/dl among patient who had well, partial and poor control of asthma respectively. Above table shows that patient who had poor control of asthma had low mean serum concentration of vitamin D.

Shahin M et al found serum vitamin D levels in these asthmatic patients were (20.5 ± 7.5, 14.9 ± 5.6 and 10.5 ± 5.2 ng/ml) in subgroups according to asthma control (controlled, partially controlled and uncontrolled asthma respectively) and highly

significant difference (p value < 0.001) in serum vitamin D levels among patients of different subgroups.<sup>[38]</sup> Similar difference found in study conducted by Litonua A et al and Korn S et al.<sup>[42,43]</sup> In present study 32(32%) patients had more than three exacerbation of asthma in last year. Total 28 (28%) patient had two asthma exacerbations in last year. Out of all study subjects, only 9 patient had none exacerbation of asthma in last year. Study setting was tertiary care hospital which might be possible explanation for low frequency in zero asthma exacerbation in last year. Findings.

**Table 6: Association of parameters of pulmonary function test with serum vitamin D concentration as per (N=100)**

Category	Predicted FEV1%		P Value
	Mean	SD	
Sufficient (≥30)	65.7	8.1	0.002
Insufficient (20-29)	61.9	5.9	
Deficient (<20)	57.3	6.7	

Present study reveals significant reduction in pulmonary function. Significant positive correlations were found between the serum vitamin D level and the predicted FEV1. These findings suggest the involvement of vitamin D in lung function and the development of airflow limitation. Similar findings reported by Kumarganti et al. They found mean predicted FEV1% among asthma patient was 54.06% ±15.<sup>[39]</sup> and also found significant association between higher Vitamin D levels and better lung function as measured by FEV1% predicted.<sup>[35]</sup> Moreover, Black and Scragg et al reported that serum vitamin D was positively correlated with FEV1.<sup>[44]</sup>

## CONCLUSION

Prevalence of vitamin D deficiency found common among asthma patients. The severity, control status and no. of exacerbation of asthma found associated with vitamin D level of asthma patients. Further longitudinal studies on the effects of vitamin D supplementation in asthma control would help understanding real life outcomes.

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