

## Vitamin D in Pediatric Asthma and Allergic Rhinitis: Benefits beyond Skeletal Health

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### Abstract

Deficiency of Vitamin D in the Indian subcontinent is emerging as a major non-infectious epidemic. To correlate vitamin D deficient children with the asthma and allergic rhinitis classification and pulmonary function tests. We studied 66 children with asthma and allergic rhinitis between 6 to 12 years of whom 33 cases were administered Vitamin D and 33 controls who were not given Vitamin D. The ethical committee approval was taken. It was a prospective, randomised and comparative study. Data was analysed using mean, standard deviation and paired-t test. The study revealed 42 (63.6%) males and 24 (36.4%) females. The Asthma classification depicted mild persistent in 37 (56.1%) followed by intermittent 16 (24.2%) and moderate persistent 12 (18.2%). Maximum cases of allergic rhinitis were moderate persistent 42 (63.6%). The Children who received vitamin D had significant improvement of Forced Expiratory Volume in the first second (FEV<sub>1</sub>, p=0.000), Forced Vital Capacity (FVC, p=0.005), FEV<sub>1</sub>: FVC% (p=0.002) and Peak Expiratory Flow Rate (PEFR, p=0.000). The control group showed significant improvement in the PEFR parameter (p= 0.0077). The case group showed marked improvement in the lung functions. Adherence to the duration of therapy for a period of 10 weeks with Vitamin D is mandatory.

**Keywords:** Rhinitis; Vital; Allergic

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### Introduction

Asthma and Allergic rhinitis is a cause for major public health concern worldwide [1]. There have been recent studies on the benefits of administering Vitamin D (VD) in childhood asthma and allergic rhinitis [2]. VD has a role in both the innate and adaptive immune responses [3], hence clinicians have focused on its impact in atopic conditions. It also decreases exacerbations, improves pulmonary functions, enhances steroid responsiveness thereby improving quality of life [4]. VD has emerged as an innovative, simple, add-on to the mainstream therapy [5]. In our study, we have assessed the Pulmonary function (PFT) test values before and after VD administration along with inhaler therapies.

### Materials and Methods

#### Aims and objectives

To study the vitamin-D levels in children with asthma and allergic rhinitis and to correlate with

- Classification
- PEFR (Peak Expiratory Flow Rate)

- FEV<sub>1</sub> (Forced Expiratory Volume in One second)
- FVC (Forced Vital Capacity)
- FEV<sub>1</sub>: FVC%

We studied 66 children with asthma and allergic rhinitis between 6 to 12 years of whom 33 cases were administered Vitamin D and 33 controls who were not given Vitamin D. The ethical committee approval was taken. It was a prospective, randomised and comparative study. Data was analysed using mean, standard deviation and paired-t test.

Based on the GINA (Global Initiative for Asthma) AND ARIA (Allergic Rhinitis and its impact on Asthma) guidelines, the patients were classified and serum 25(OH) Vitamin-D levels were sent to a standardized laboratory. VD deficiency was defined as levels <20 ng/ml, and insufficiency with levels between 20-30 ng/ml. Thereafter PEFR was measured in children between 6-12 years of age. Oral vitamin D 60,000IU once a week was administered for 10 weeks and the PFT were monitored.

#### Inclusion criteria:

- Children below the age of 12 years

- 2) All asthmatic children with deficient vitamin D levels
- 3) No clinical findings of Protein Energy Malnutrition
- 4) No history of recent administration of Vitamin-D

**Exclusion criteria:**

- 1) Parents/ care- givers not consenting to the study
- 2) Children with protein energy malnutrition
- 3) Children having a normal Vitamin D level

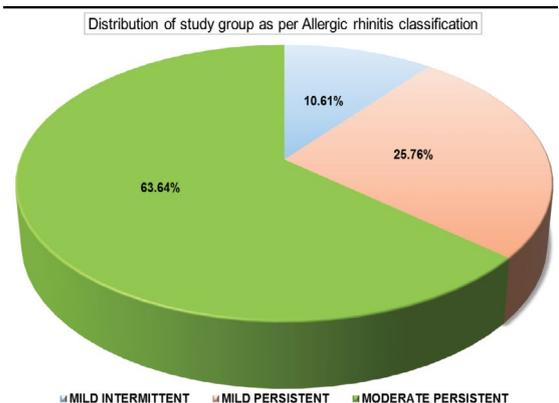
**Results**

The study revealed 42 (63.6%) males and 24 (36.4%) females (Figure 1).

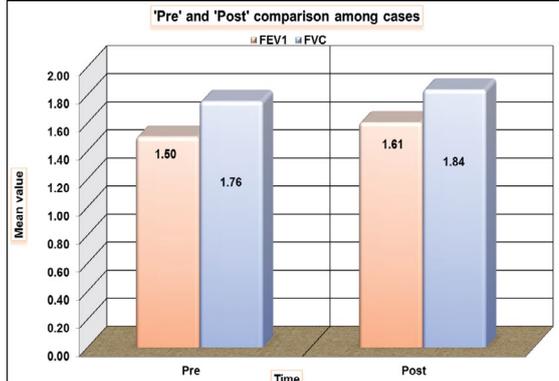
The Asthma classification depicted mild persistent in 37 (56.1%) followed by intermittent 16 (24.2%) and moderate persistent 12 (18.2%) and a single case of severe persistent 1 (1.5%) (Figure 2).

Maximum cases of allergic rhinitis were moderate persistent 42 (63.6%) followed by mild persistent 17 (25.8%) and mild intermittent 7 (10.6%) (Figure 3).

Children who received vitamin D had significant IMPROVEMENT



**Figure 3** Distribution of study group as per Allergic rhinitis classification.



**Figure 4** 'Pre' and 'post' comparison among cases.

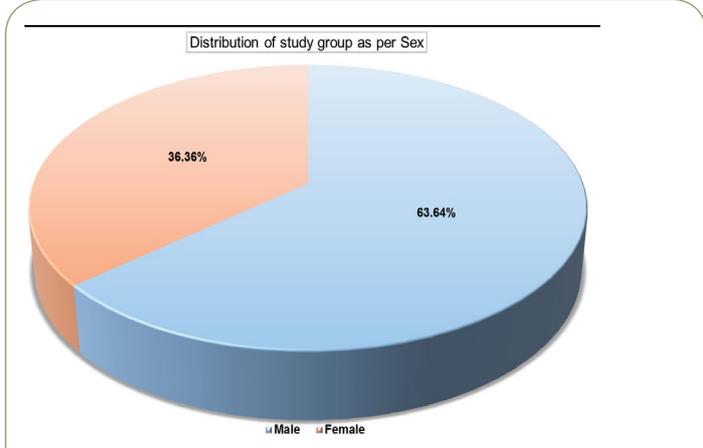
of Forced Expiratory Volume in the first second (FEV1, p=0.000), Forced Vital Capacity (FVC, p=0.005), FEV1: FVC % (p=0.002) and Peak Expiratory Flow Rate (PEFR, p=0.000). The control group showed significant improvement in the PEFR parameter (p=0.0077) (Figures 4-7).

**Discussion**

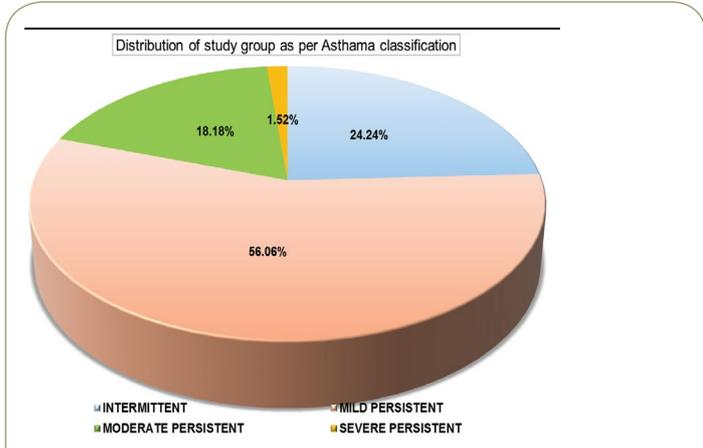
VD has an immune-modulatory effect [6], assists in fetal lung maturation, and regulates airway smooth muscle cell proliferation and differentiation [7].

Many theories have been proposed to explain the association between VD and steroid responsiveness in asthma. VD acts at the genomic level to modulate the transcription of genes and the ability to adjust the expression of genes involved in the inflammatory process [8]. These mechanisms help in reducing steroid resistance in patients suffering from moderate to severe asthma. Arshi et al. found that patients on inhaler therapy along with VD showed improvement in FEV1 compared to the group of asthmatics on inhaler therapy alone [9].

There have been two recent interesting studies, showing improvement in the lung function over one year in children with vitamin D sufficiency as compared to those with deficient levels [10]. The other study revealed that patients with insufficient



**Figure 1** Distribution of study group as per sex.



**Figure 2** Distribution of study group as per Asthma classification.

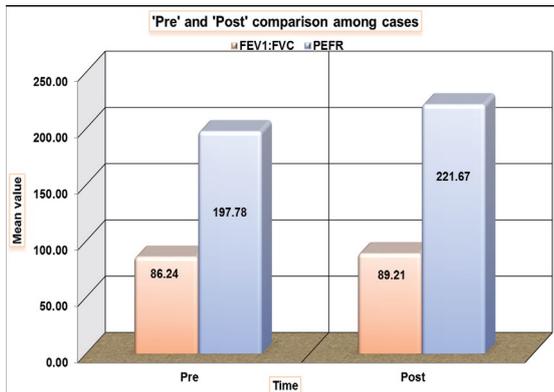


Figure 5 'Pre' and 'post' comparison among cases.

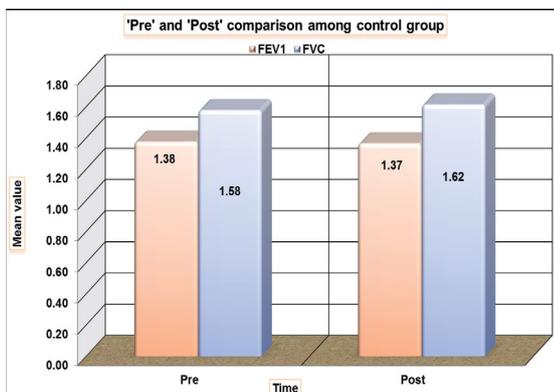


Figure 6 'Pre' and 'post' comparison among control group.

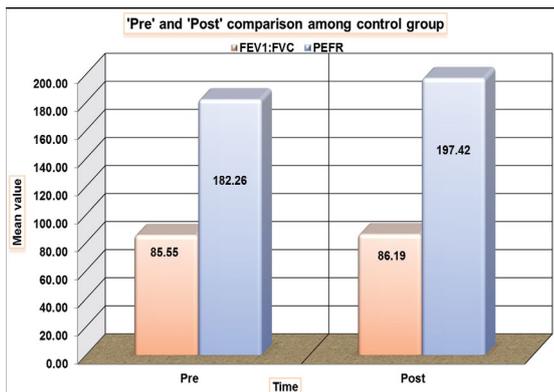


Figure 7 'Pre' and 'post' comparison among control group.

levels had significantly lower FVC and FEV1, as compared to those with sufficient levels [11].

Gupta et al. showed that optimal levels of VD were associated with reduction in exacerbations and optimal asthma control [12].

We assessed, PEFr as a marker for improvement post VD administration in the deficient group, and found a marked improvement, with significant p value- 0.007. A similar observation has been published by Yadav et al. [13].

PEFr is a cost-effective method in diagnosing and monitoring asthmatic patients on therapy. It is inexpensive, easy to perform, simple bed side test [14,15]. We used this parameter for assessing the lung function of deficient patients post VD administration.

Our study revealed, that well-nourished children were also VD deficient, hence screening of all asthma and AR children is essential in a developing country.

However, we need to study, a larger sample size with a control group in order to crystallise the outcomes. We also recommend, diligent follow-up to observe asthma control, compliance and quality of life.

## Conclusion

This study has highlighted, that VD levels could be recommended as one of the biomarkers of asthma and allergic rhinitis control in children. It is definitely beneficial as an add-on to conventional inhaler therapy thereby reducing steroid usage.

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