



Serum vitamin d levels and its relation with severity of childhood asthma in children of 1-12 years

Kalyan Babu G¹, Vijay Kumar B², Praveen Kumar Sindhur³

¹ Post Graduate, Department of Paediatrics, K.V.G Medical College and Hospital, Sullia, Karnataka, India

² Professor and HOD, Department of Paediatrics, K.V.G Medical College and Hospital, Sullia, Karnataka, India

³ Professor, Department of Paediatrics, K.V.G Medical College and Hospital, Sullia, Karnataka, India

Abstract

Objective: To study the association between Vitamin D levels and the severity of asthma and the frequency of asthma exacerbations

Design: cross sectional study

Setting: tertiary care hospital

Participants: A cross sectional study was undertaken in children with asthma attending Out-patient and In-patient Department of Paediatrics in K.V.G. Medical College, Sullia. During the period 1st December 2018 to 30th November 2019.

Results: Vitamin D deficiency was found in 54% of the asthmatic children and 17% had insufficient levels. Deficient Vitamin D levels were found in 41% of children with intermittent asthma, 58% of children with mild persistent asthma and 56% of children with moderate persistent asthma where as insufficient levels of Vitamin D were found in 18% of the children with intermittent asthma, 16% with mild persistent asthma and 19% with moderate persistent asthma. Vitamin D deficiency/insufficiency was associated with increased frequency of exacerbations of asthma, longer duration of illness and also associated with higher AEC levels which are a marker of allergy and inflammation

Conclusions: A high prevalence of Vitamin D deficiency and insufficiency was found in asthmatic children studied. On statistical analysis, no correlation was found between Vitamin D deficiency and severity of asthma. But Vitamin D deficiency was associated with increased frequency of exacerbations and was more common in children having illness of longer duration. Vitamin D deficiency was also associated with raised AEC levels thereby proving its immunomodulatory role.

Keywords: asthma; Vitamin D; allergy; absolute eosinophil count; allergic rhinitis; triggers

Introduction

Asthma is the most common chronic illness of childhood, like many other chronic disorders, childhood asthma is likely to have an impact on the social and emotional aspects of lives of the children and their families [16]. Out of nearly 200 million asthmatics worldwide, approximately 15 million are in India [1]. Prevalence of bronchial asthma is over 5% in children in our country and the burden is constantly increasing [14]. Poorly controlled asthma is associated with significant morbidity and socio-economic problems like absenteeism from school and a poor quality of life [2]. Bronchial asthma impairs not only respiratory function, but also physical, social and emotional components of life [15]

Vitamin D may have a role in asthma due to its wide-ranging effects on airway epithelium, bronchial smooth muscle, and immune cells central to the pathogenesis of asthma [1]. Information on association between vitamin D and level of control of asthma in children is scarce [17].

The exact cause of asthma remains unknown and likely has its origins in complex interactions among multiple genetic and environmental factors [16]. There is evolving evidence that there is increased severity of the disease and poorer response to medication in Vitamin D deficient asthmatics [9]. Common risk factors for both asthma and Vitamin D deficiency, such as an urbanized, westernized lifestyle, race and obesity, along

with increasing evidence of the immunomodulatory effects of Vitamin D [18], have led to a hypothesized link between the rising asthma prevalence and low Vitamin D levels [10]

Materials and methods

This cross sectional study included 50 children having asthma diagnosed based on the National Heart, Lung, and Blood Institute (NHBLI), National Asthma Education and Prevention Program, Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma, between the ages of 1 and 12 years, admitted to the wards or attending the outpatient of Department of Pediatrics at K.V.G. Medical College, Sullia

Inclusion Criteria

Children with asthma aged 1 year to 12 years diagnosed according to the National Asthma Education and Prevention Program (NAEPP), Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma [3].

Exclusion Criteria

Children with other co-morbidities like heart disease, tuberculosis, epilepsy, liver disease, chronic lung disease and (PEFR) and spirometry were done wherever possible renal disease Consent was taken from the Parents, detailed history taken using a structured questionnaire, clinical examination done and the parents were advised to maintain an asthma diary

that was evaluated during regular follow ups. Following investigations were done: complete blood count (CBC), erythrocyte sedimentation rate (ESR), absolute eosinophil count (AEC), and nasal smear cytology, chest x-ray, Peak Expiratory Flow Rate

Results

41% of children with intermittent asthma, 58% with mild persistent asthma and 56% of children with moderate persistent asthma had Vitamin D deficient levels. 18% of children with intermittent asthma, 16% with mild persistent asthma and 19% of children with moderate persistent asthma had Vitamin D insufficient levels. Pearson's Chi-square Test has shown no significant correlation between severity of Asthma and Vitamin D levels. It was found that more number of exacerbations was found in children with low.

Table 1

Admission	Deficient	Insufficient	Sufficient
0	1	1	1
1	3	2	5
2	10	4	4
3	7	1	3
4	2	0	1
5	2	1	0
6	1	0	1
10	0	1	0

(P value= 0.048, significant).

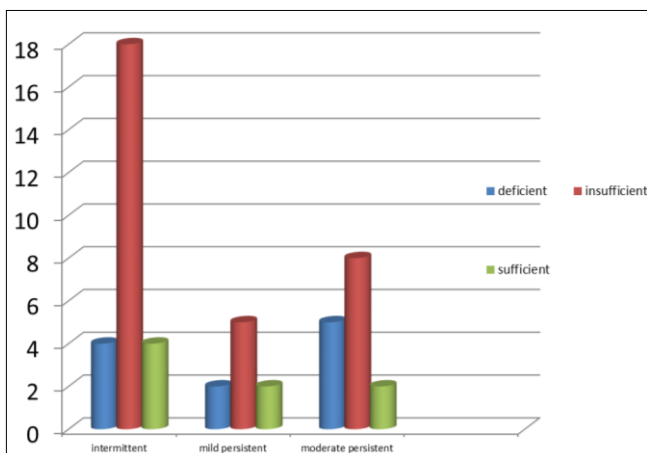
Table showing Vitamin D status and Exacerbations Vitamin D levels and a significant negative correlation was found between Number of exacerbations of asthma with the Vitamin D levels using the independent sample t test.

Table 2

	Intermittent	Mild persistent	Moderate persistent	Results
Deficient	4	18	4	26
Insufficient	2	5	2	9
Sufficient	5	8	2	15
Total	11	31	8	50

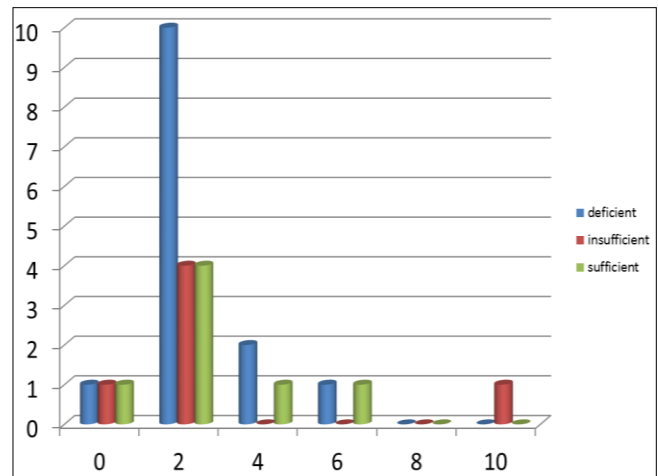
(Pearson's Chi-square 2.36, P value – 0.670, not significant).

Table showing Vitamin D status vs. Severity of Asthma



Above bar graph showing Vitamin D status vs Severity of Asthma There was no significant correlation between the severity of asthma and Vitamin D levels

Fig 1



Above bar graph showing Vitamin D status VS Exacerbations

Fig 2

It shows low Vitamin D levels are found to be associated with prolonged duration of the illness and more number of exacerbations suggesting the role of Vitamin D in asthma exacerbations.

Discussion

The prevalence of Vitamin D deficiency has been increasing worldwide and its deficiency has been postulated to be causative/ contributive in the pathogenesis of various autoimmune, infectious and oncological disorders [11]. Its role in the development, pathogenesis and decreasing the disease severity in asthma is being extensively studied and our study aims to find a relation between the same [12].

The study was conducted among 100 asthmatic children 1-12 years of age admitted to or attending OPD of a tertiary care centre in Sullia. In the study done, out of 100 asthmatics, majority (71%) were in the age group of 6-12 years. Mean age in our study was 7.8 which were similar to the study done by Brehm *et al*⁴ and CAMP study [5]. In the present study majority were males (62%) which were comparable to the other studies mentioned below. In our study, it was found that majority 62% had mild persistent asthma, 22% of children had intermittent asthma, 16% had moderate persistent asthma and none had severe persistent asthma. There was a strong positive correlation between age of the patients and severity of asthma, as the age increased the severity increased. It was also found that as age increased the incidence of persistent asthma increased, which can be explained by the natural course of asthma itself. The severity of asthma was also strongly associated with the number of exacerbations, which might be probably due to the fact that severe asthma might have multiple triggers along with genetic factors that cause increase in the severity and thereby making it difficult to control. There was no significant correlation between gender and severity of asthma in our study.

The various triggers in the asthmatics were dust (90% of children), upper respiratory tract infections (URI) (80% of children), Winter/ rainy season (54% of children), ice creams and bakery products (43% of children), smoke (32% of children), oily food (27% of children), exercise (22% of children). In the study conducted by B have *et al*, URI

accounted for 37%, dust for 7%, winter/rainy season for 8%, ice creams 11% and other food items 9% of triggers. Family history of asthma/atopy was present in 44% of the study population. 54% of the asthmatics had Vitamin D deficiency and 17% had insufficient levels of Vitamin D. Among the children in the age group of 1-5 years, 52% had deficient Vitamin D levels and 13% had insufficient levels. Among the children aged 6-12 years 55% had deficient Vitamin D levels and 18% had insufficient levels. The mean Vitamin D level of the study population was 25.26. The distribution of Vitamin D levels in our study was comparable to the study done by Bener *et al* [6] though other studies done by Brehm *et al* [4], Krotrakulchai *et al* [13] and CAMP study⁷ had lower number of children in the deficient group but higher number in the insufficient group. There was no significant correlation between age or gender of the study population with Vitamin D levels. Sufficient Vitamin D levels are likely associated with decreased risk of severe exacerbations through multiple mechanisms. One mechanism may be through improved response to respiratory infections, since Vitamin D has been shown to induce the production of antimicrobial proteins (AMPs), such as cathelicidin and defensin. Induction of AMPs has been shown to occur at the airway epithelium. In addition to the induction of AMPs, Vitamin D may modulate the inflammatory response to viral infections [5].

In the study it was found that Vitamin D deficiency had a significant correlation with duration of illness in asthmatics. There were no comparable similar studies, but study done by Sutherlands *et al* [8]. Showed that lower Vitamin D levels were associated with decreased response to inhaled corticosteroids thereby increasing the disease severity and control.

Conclusions

Our study has shown a high prevalence of Vitamin D deficiency and insufficiency in asthmatics.

There was no significant correlation between the severity of asthma and Vitamin D levels but low Vitamin D levels are found to be associated with prolonged duration of the illness and more number of exacerbations suggesting the role of Vitamin D in asthma exacerbations.

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