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Original Research Article

A clinical study to determine the relationship between serum vitamin D levels and severity of asthma

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ABSTRACT

Background: Vitamin D deficiency has been rediscovered as a public health problem worldwide. Few studies have shown that vitamin D deficiency is associated with asthma severity. The objective of present work was to study the serum vitamin D levels and its relationship with asthma severity in children.
Methods: A prospective cohort study of 100 children with asthma between the age group of 5 to 15 years and age and sex matched 40 healthy controls who had come to Indira Gandhi Institute of Child Health, Bengaluru was done. These children's serum vitamin D levels were estimated and correlated with asthma severity.
Results: A total of 100 children with asthma and 40 healthy age and sex matched controls were evaluated. The study group had lower vitamin D (34.95 ng/ml) levels as compared to the control group (57.94 ng/ml) which was statistically significant ($p<0.05$). 68.4% children had significantly low vitamin D levels and severe form of asthma (p value <0.001). There was also a marked rise in absolute eosinophil count in those who had low vitamin D levels (56.6%) (p-value <0.0001).
Conclusions: Vitamin D deficiency is an important risk factor for asthma severity. It modifies the immune system and reduces the inflammation. In the present study, low serum vitamin D levels were significantly correlated with severe form of asthma. There was a significant rise in the absolute eosinophil count in those who exhibited deficiency of vitamin D.

Keywords: Children, Serum vitamin D levels, Severity of Asthma

INTRODUCTION

Childhood Asthma is a chronic respiratory disease characterized by heightened airway inflammation, airway hyper responsiveness and airflow obstruction in response to specific triggers. It is also one of the leading causes of morbidity in children. While the specific mechanisms responsible for asthma are not well understood, genetic predisposition and changing environmental factors associated with urban lifestyle may be responsible for the increased prevalence of this disorder.

Vitamin D deficiency has been rediscovered as a public health problem worldwide. Improving vitamin D status holds promise in primary prevention of asthma, in decreasing exacerbations of the disease.[1]

Many studies have shown that low serum vitamin D levels were associated with asthma and recent data indicate that increased serum concentration of vitamin D was associated with decrease in exacerbation of asthma and higher percent-predicted forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC).[2]

Hence, the present study was conducted to find out the relationship between serum vitamin D levels and the asthma severity.

METHODS

A prospective cohort study was carried out for a period of 12 months from September 2013 to August 2014. The study protocol was approved by the Institutional ethics committee. One hundred children between the age group of 5 to 15 years presenting with symptoms and signs of asthma to inpatient and outpatient departments of Indira Gandhi Institute of Child Health, Bengaluru, India formed the study group. Forty age and sex matched healthy children formed control group.

Detailed history and examination were recorded in a systematically designed proforma. Asthma severity was assessed and classified based on the parameter of Global Initiative for Asthma (GINA) guidelines.[3]

Apart from the routine investigations, including absolute eosinophil count, spirometry and management, these children's vitamin D levels were estimated and correlated with asthma severity. Serum vitamin D was estimated in the age and sex matched healthy control group.

Inclusion criteria

All patients in the age group of 5 to 15 years with signs and symptoms of asthma as per GINA guidelines were included in the study.

Exclusion criteria

Children less than 5 years and children who had taken vitamin D preparations in the recent past (<4 weeks) were excluded from the study.

Statistical analysis

All the data were analyzed with 95% confidence interval. Continuous variables were expressed in terms of mean with standard deviation. Categorical variables were expressed in terms of frequencies and percentages. Associations were calculated between relevant parameters using chi square test. A probability value of less than 0.05 was considered significant. The data was entered into Microsoft Excel sheet and analyzed using statistical program for social sciences (SPSS) version 18.

RESULTS

A total of 100 children with signs and symptoms of asthma were enrolled in the study and 40 age and sex matched healthy children were selected as control group.

Majority of the study group were between the age group of 5-10 years (60%; n=60). Males predominated over females in the ratio of 3:2.

The study group had lower vitamin D levels when compared to the control group. The mean vitamin D level in the study group was 34.95 ng/ml and in the control group was 57.94 ng/ml which was statistically significant (P <0.05) as shown in Table 1.

Table 1: Comparison of mean vitamin D levels between study and control group.

	Study group			Control group		
	N	**Mean**	**SD**	**N**	**Mean**	**SD**
Males	60	33.31	19.79	18	60.46	14.92
Females	40	37.40	15.95	22	55.89	15.59
Total	100	34.95	18.37	40	57.94	15.07

Table 2: Comparison of vitamin D level with severity of asthma in the study group.

Asthma severity	No. of patients	%	Mean vitamin D (ng/ml)
Intermittent	25	25	47.64
Mild persistent	37	37	34.96
Moderate persistent	30	30	28.55
Severe persistent	8	8	19.22
Total	100	100	37.95

Table 2 and 3 shows the comparison of vitamin D level with severity of Asthma. Out of the 100 children with asthma, 75% had persistent asthma and 25% had intermittent asthma.

Table 3: Association between severity of asthma and vitamin D levels.

Severity of asthma	Total	Vitamin D levels	
		≤30	**>30**
Less Severe	62	15 (24.2%)	47 (75.8%)
More Severe	38	26 (68.4%)	12 (31.6%)
Total	100	41 (41%)	59 (59%)

χ^2=17.27; P <0.001**

The mean level of vitamin D was 47.64ng/ml in intermittent asthma and 19.22ng/ml in severe persistent asthma. The children with severe asthma (68.4%) had lower levels of serum vitamin D (<30ng/ml) which was statistically significant (P<0.001**).

Table 4 shows the association between serum vitamin D levels and Absolute Eosinophil Count. This study clearly indicates that lower the serum vitamin D levels (<30ng/ml), higher the Absolute eosinophil count (AEC) (>400) which was statistically significant (P<0.0001). This correlates with the fact that the decrease in vitamin D levels increases the chances of allergy there by indicating that, there must be a definite correlation between Asthma and vitamin D.

Table 4: Association between vitamin D levels and AEC levels in study group.

AEC levels	Total	Vitamin D Levels (ng/ml)	
		≤30	>30
≤400	31	2 (6.5 %)	29 (93.5%)
>400	69	39 (56.6%)	30 (43.5%)
Total	100	41 (41%)	59 (59 %)

χ^2=20.147, P<0.0001

Table 5: Comparison of total number of cases studied with distribution of age and sex.

Studies	Brehm et al[4]	HGE et al[5]	SA et al[6]	CG et al[7]	Present study
Place	Costa Rica	Egypt	Iran	New Delhi	Bengaluru
Year	2001-2006	2011-2012	2010-2011	2011-2012	2013-2014
No. of subjects	616	50	100	20	100
Age group (years)	7.6-10.5	4-15	6-18	7-12	5-15
Males	370	36	62	15	60
Females	246	14	38	5	40

Table 6: Severity of asthma and vitamin D status.

Severity of asthma	Intermittent	Mild persistent	Moderate persistent	Severe persistent
	No. of children, vitamin d (ng/ml)			
AEM et al[8]	6 (61.8)	26 (52.9)	23 (45.7)	5 (31.1)
BM et al[9]		54 (18.68)	53 (16.42)	155 (14.33)
Present study	25 (48.3)	37 (34.5)	30 (30.3)	8 (19.3)

DISCUSSION

Across various studies available worldwide, it has been observed that vitamin D deficiency indeed has some correlation with severity of asthma.

Table 5 shows the comparison of total number of cases studied with distribution of age and sex. In most of the studies the predominant children with Asthma belongs to the age group of 5-15 years.[4-6] Boys were affected more commonly than girls. This could be due to the fact that children belonging to this age and sex group were more exposed to environmental pollution.

Table 6 shows the severity of asthma and vitamin D status. The present study has shown definite relationship between low vitamin D levels and severity of asthma which is statistically significant (p value <0.001). The results are in concordance with the study by Abd EI Menem et al and B Menon et al.[7,8] It is reported that in Asthmatic children low vitamin D levels have been associated with increased exacerbation and poor Asthma control.

Vitamin D is a potent modulator of the immune system and is involved in regulating cell proliferation and differentiation. It reduces inflammation and makes the airways healthier by building better airways, making day to day symptoms better for children with asthma and making it less likely to get an asthma attack for children with asthma.[9]

Table 7 shows the comparison of vitamin D levels and Absolute Eosinophil Count. The present study shows a significant correlation with low vitamin D level with high Absolute Eosinophil Count which is statistically significant (P Value <0.001). It is in accordance with the study done by Bener A et al.[10]

Eosinophils contain inflammatory enzymes, generate leukotrienes and express a wide variety of pro inflammatory cytokines. Increase in Eosinophils correlates with severity of asthma. Vitamin D deficiency has immune modulatory effects by reducing interleukin-10 secreting T regulatory cells. Vitamin D deficiency also contributes to disease severity by worsening eosinophilic inflammation and airway remodelling.[11]

Table 7: Comparison of vitamin D levels and absolute eosinophil count.

Study	Mean vitamin D	Mean Absolute eosinophil count
MSE et al[11]	22	496.5
Present study	33.1	537

Limitation

The study population is too small to conclude and the results cannot be extrapolated to the entire population. Interventional follow up study by supplementing vitamin D in those Asthmatic children with low vitamin D levels in a large population would prove the cause-effect relationship.

CONCLUSION

Asthma is the most common respiratory illness in childhood. It is a complex disease influenced by both genetic and environmental factors. Vitamin D deficiency is an important risk factor for asthma severity. It modifies the immune system to reduce the inflammation. Therefore, children with sufficient vitamin D status will have less chance of acute asthma exacerbation and less severe form of asthma.

In the present study, low serum vitamin D levels were significantly correlated with severe form of asthma. Therefore, it is wise to recommend vitamin D supplementation to Asthmatic children. A healthy dose of sunshine.

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REFERENCES

1. Liu AH, Covar RA et al. Childhood Asthma: In: Kleigman, Stanton, St Geme, Schor, (eds.) Nelson Text Book of Pediatrics. 20th Ed. Philadelphia: Elsevier; 2015:1095-1115.
2. Zhang R, Naughton DP. Vitamin D in health and disease: current perspectives. Nutrition J. 2010 Dec 8;9(1):65.
3. Maosoli M, Fabian D, Holt S, Beasley R. Global initiative for asthma (GINA) Program. The global burden of asthma: executive summary of the GINA dissemination committee report. Allergy. 2004;59:469-78.
4. Brehm JM, Celedon JC, Sotos-Quiros ME, Avila L, Hunninghake GM, Fomo E et al. Serum vitamin D levels and markers of severity of childhood asthma in Costa Rica. Am J Respir Crit Care Med. 2009;179:765-71.
5. Elnadya HG, Foudac EM, Elsheikha OM, ElAlameeya IR, Elshafied AI, Sherifa LS et al. Serum vitamin D level as a predictor of bronchial asthma in egyptian children. J Arab Soc Med Res. 2013;8:67-75.
6. Alyasin S, Momen T, Kashef S, Alipour A, Amin R. The Relationship between serum 25 hydroxy vitamin D levels and asthma in children. Allergy Asthma Immunol Res. 2011;3(4):251-5.
7. El-Menem MA, Al-Aziz MA, El-Guindy WM, El Banna NA. Frequency of vitamin d deficiency among asthmatic egyptian children. Egypt J Pediatr Allergy Immunol. 2013;11(2):69-73.
8. Menon B, Kaur C, Nema G. Evaluation of vitamin d in asthma and it's correlation with lung function. ERJ. ERS. 2013;47:4700.
9. Poon AH, Mahboub B, Hamid Q. Vitamin D deficiency and severe asthma. Pharmacol Ther. 2013;140(2):148-55.
10. Bener A, Ehlayel MS, Tulic MK, Hamid Q. Vitamin D deficiency as a strong. Int Arch Allergy Immunol. 2012;157(2):168-75.
11. Vasiliou JE, Lui S, Walker SA, Chohan V, Xystrakis E, Bush A et al. Vitamin D deficiency induces Th2 skewing and eosinophilia in neonatal allergic airway disease. Allergy J. 2014;69(10):1380-9.

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