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A Study of Vitamin D Levels and its Correlation with Asthma in Children Aged 2-12 Years

[1]T. Radhakishan, [2]Balabadra Sravanthi, [3]Shabbeer Ahmed and [4]Arshad Quadri

[1]*Department of Paediatrics, Niloufer Hospital, Osmania Medical College, Hyderabad, India*
[2]*Department of Paediatrics, Gandhi Medical College, Sangareddy, India*
[3]*Department of Paediatrics, Government Medical College, Sangareddy, India*
[4]*Department of Pharmacology, Gandhi Medical College, Sangareddy, India*

ABSTRACT

The non- transmissible illness of pneumonia affects people all over the world and has serious negative effects on both young people's and adolescents' medical care, including high morbidity as well as, in extreme situations, fatality. Worldwide, there is evidence of vitamin D insufficiency in various groups, including children. The vital significance that vitamin D plays in immunoregulation as well as its association with hypersensitivity like asthma needs to be studied. The goals of this study were to look at the relationship between blood levels of vitamin D and the severity of asthma in children. This was an analytical cross sectional study. The present study was conducted from This study was designed and executed out at the Institute of Child and Women Health, Niloufer Hospital, Hyderabad. About 80 children with asthma attending Out-patient and In-patient Departments of Niloufer Hospital. After meeting the eligibility requirements, the individuals were accepted into the investigation. A written permission has been obtained from the guardians. A thorough clinical examination and a detailed history taking were performed. Vitamin D levels were estimated using chemiluminescent method. Routine clinical investigations related to the study were done and analysed. The usual equations SPSSv. About 21 were used for analysing statistics. A statistically significant difference was defined as a $p<0.05$. A significant number of the attendees included male. About 25% (20 patients) of the population had Intermittent asthma, 57.5% (46 patients) had mild persistent asthma and 17.5% (14 patients) had moderate persistent asthma. Majority from the mild persistent group 25 patients had 2 exacerbations and 12 patients had 3 exacerbations. About 10% of the intermittent group, 43.5% of the mild persistent group and 57.1% of the moderate persistent group had deficient vitamin D levels. 65% of the intermittent group, 24% of the mild persistent group and 28% of the moderate persistent group had insufficient vitamin D levels. About 5% of the intermittent group, 15% of the mild persistent group and 2% of the moderate persistent group have enough quantities of Vitamin D. According to our findings, there is a high frequency of Vitamin D inadequacy and impairment in asthmatics. Also the severity of asthma is better correlated with more deficient levels.

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Key Words
Vitamin D, asthma, children, Pediatrics

Corresponding Author
T. Radhakishan,
Department of Paediatrics, Niloufer Hospital, Osmania Medical College, Hyderabad, India

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INTRODUCTION

Pneumonia is a widespread noncommunicable illness with serious social implications for people of all ages, including substantial death and disability in serious instances. While children have a greater likelihood of developing symptoms of asthma, adults have a higher sickness and death rate. Paediatric asthma is prevalent in boys, whereas adult-onset asthma is greater in women and this sex difference in prevalence reverses around youth, implying that sex hormones may have an influence in the origin of asthma.

The condition has grown into one of the most common diseases in the world, posing a huge public health concern. Though there exists proof that the origin of asthma is multifaceted, modifying variables in the environment like pollutants in the atmosphere, dietary modifications, pollutants, advancements in sanitation and wellness and modifications to life may underpin the increased prevalence of asthma[1].

According to the global approach for Asthma Management and Prevention Report, asthma can be defined based on pathology and its functional consequences, i.e., "Asthma is a long-lasting inflammatory condition of the airways in which many cell types play a role, particularly mast cells, eosinophils and T lymphocytes". Asthma is a chronic lung disease that results in reversible airway obstruction, cellular infiltration and airway inflammation. The interaction between genes and surroundings and also the triggering of cells in the immune system's innate as well as adaptive functions, all contribute to the response. Treatment with medicine consists of two types of medications: Inhalant corticosteroids, which are used as a regular supervisor and beta-adrenergic agonists, which are used for airway dilation. The basic etiological process was that allergen exposure, particularly in infancy, caused irrelevant sensitisation and that continuing administration ended in bronchitis via the onset of erythrocyte airway inflammation, bronchial hyper responsiveness (BHR) and bidirectional breathing restriction[2].

A lack of vitamin D has been reported in various communities around the world, including youngsters. A lack of vitamin D has occurred despite fortification of foods in some Westernised nations, ingestion of vitamin supplements containing vitamin D and in sun-rich locations of the world. This means that when nations follow an American habits, they will spend less time outside and more time within.

Vitamin D receptors (VDR) are expressed by a variety of immune cell types, notably stimulated cells such as T cells, B cells, macrophages and dendritic cells. Vitamin D has recently been shown to reduce IL-17 (Interleukin-17) synthesis, which is related with asthma. Th2 (T-Helper 2) cells are inhibited by vitamin D, which suppresses the synthesis of mediators such as IL-4, IL-5, IL-13 and IgE (Immunoglobulin E) by lymphocytes, mast cell lines and erythrocytes.

MATERIALS AND METHODS

Nature of investigation: A descriptive longitudinal approach.

Number of the study population: 80 asthmatic children.

Inclusion criteria: Individuals between from two to twelve years of age with asthmatic assessed using the Expert Panel's Report Guidelines for the Diagnosis and Management of Asthma from the National Asthma Education and Prevention Programme (NAEPP).

Exclusion criteria: Children with other co-morbidities like heart disease, children who are diagnosed with tuberculosis or with a past history of tuberculosis, children with chronic lung diseases like cystic fibrosis, recurrent pneumonias, bronchiectasis, interstitial lung disease, children with chronic liver diseases and children with epilepsy and the investigation exempted people with kidney problems.

Methodology: Arents provided informed approval, an extensive medical record was obtained utilising an organised survey, a medical checkup was performed and the parents had to agree to keep an asthma diary, which was examined at regular follow-ups. Technique of using inhalers with a spacer was evaluated in each visit and corrected if wrong. Venous blood sample (2 mL) was collected and after serum separation, all of the specimens have been sent to be analysed. Twenty five plasma hydroxy Vitamin D levels were done using chemiluminescent method (C.L.I.A), Model-Advia Centaur XPT by SIEMENS manufacturer. Routine clinical investigations related to the study were done and analysed.

Interpretation of results-serum Vitamin D levels:

- **Normal:** 30-100 ng mL^{-1}
- **Incompetent:** 21-29 ng mL^{-1}
- **Scarce:** 0-20 ng mL^{-1}

Statistical analysis: The standard formulae SPSS v21. (Statistical Package for Social Sciences) in Windows Dos version were used for the use of statistics. Both percentages and frequencies were used to represent categorical data. The mean and standard deviation were used to describe continuous data. For information that is categorical, the Chi square test was utilised as a test of significance. To examine the relationship between two continuous variables, Pearson correlation was used. Statistical significance was defined as a $p<0.05$.

Ethical approval: Prior to the start of the trial, the Institutional Ethics Committee issued its approval.

OBSERVATIONS AND RESULTS

Age and gender distributions: Out of 80 asthmatic children, 28.7% (23 participants) referred to the age range 2-5 years while most of the participants 71.3% (57 patients) belonged to age group of 6-12 years. As for the gender distribution of the participants, 42 patients were males, whereas the rest 38 were females (Table 1).

Distribution of severity of asthma: Out of the total asthmatics, 25% (20 patients) of the population had Intermittent asthma, 57.5% (46 patients) had mild persistent asthma and 17.5% (14 patients) had moderate persistent asthma (Table 2).

Exacerbations: In the study population, majority from the mild persistent group 25 patients had 2 exacerbations and 12 patients had 3 exacerbations. p-value was computed to be 0.001 which is significant for this study (Table 3).

Vitamin D status: In the total population, 37.5% (30 patients) had deficient serum vitamin D Levels, 35% (28 patients) had insufficient levels and 27.5% (22 patients) had sufficient levels (Table 4).

Vitamin d status vs severity of asthma: About 10% of the intermittent group, 43.5% of the mild persistent group and 57.1% of the moderate persistent group had deficient Vitamin D levels. About 65% of the intermittent group, 24 % of the mild persistent group and 28% of the moderate persistent group had insufficient vitamin D levels. About 5% of the intermittent group, 15% of the mild persistent group and 2% of the moderate persistent group had sufficient vitamin D levels. p-value was calculated to be 0.007 which is significant for this study (Table 5).

Vitamin D status and exacerbations: Majority of the exacerbations were in the deficient group (30 patients) followed by insufficient group (28 patients) followed by sufficient group (22 patients) (Table 6).

DISCUSSIONS

The primary result of the cross sectional study of 80 asthmatic children is the relationship of asthma severity to plasma vitamin D levels.

Age wise: In the study, 28.7% of the 80 asthmatics were aged 2-5 years, while 71.3% were aged 6-12 years. The study population's median aged is 7.58 years old with standard deviation of 3.2 which were similar to the study done by John Brehm *et al*.[3].

Table 1: Research population's chronological and sex distributions

Age groups	Frequency	Percentage
2-5	23	28.7
6-12	57	71.3
Total	80	100.0
Gender		
Female	38	47.5
Male	42	52.5
Total	80	100.0

Table 2: Distribution of Severity of Asthma of study population

Severity of asthma	Frequency	Percentage
Intermittent	20	25.0
Mild persistent	46	57.5
Moderate persistent	14	17.5
Total	80	100.0

Table 3: Exacerbations in relation to Severity of Asthma

	Severity of asthma			
	Intermittent	Mild Persistent	Moderate persistent	Total
Exacerbations				
0	6	0	0	6
1	9	7	3	19
2	2	25	2	29
3	2	12	4	18
4	1	0	3	4
5	0	2	0	2
6	0	0	1	1
10	0	0	1	1
Total	20	46	14	80

Chi square: 55.711, p-value: 0.001 (S)

Table 4: Vitamin D status of the study population

	Frequency	Percentage
Deficient	30	37.5
Insufficient	28	35.0
Sufficient	22	27.5
Total	80	100.0

Sex distribution: In the study, out of 80 asthmatic children 52.5% were males and 47.55% were females. Males are predominantly affected which were comparable to other studies done by Brehm *et al*.[3], Majak *et al*.[4] and Gupta *et al*.[5].

Distribution of severity of asthma: According to the findings of the study, 25% of children had periodic asthma, 57.5% experienced moderate consistent asthma, 17.5% had significant persisting asthma and none had severe asthma that remained chronic. About 25% of the children had intermittent asthma and 75% had persistent asthma. There was no statistically significant relationship between age and sex in relation to severity of asthma in our present study.

Exacerbations and severity: It was found that children with persistent asthma had more number of exacerbations and there was a substantial positive association between the number of exaggerations and the severity of asthma. were found to have an intensely beneficial relationship.

Vitamin D and severity of asthma: Our results were comparable to studies done by Brehm *et al*.[3] Bener *et al*.[6]. The study population's average Vitamin D levels found to be 17.06 with a standard deviation of 10.9 with a significant p = 0.007.

Table 5: Vitamin D class×severity of asthma

		Severity of asthma			
Vitamin D class		Intermittent	Mild persistent	Moderate persistent	Total
Deficient	Count (%)	2 (10.0%)	20 (43.5%)	8 (57.1%)	301 (37.5%)
Insufficient	Count (%)	13 (65.0%)	11 (23.9%)	4 (28.6%)	28 (35.0%)
Sufficient	Count (%)	5 (25.0%)	15 (32.6%)	2 (14.3%)	22 (27.5%)
Total	Count (%)	20 (100.0%)	46 (100.0%)	14 (100.0%)	80 (100.0%)

Chi square: 14.207, p-value: 0.007 (S)

Table 6: Exacerbations in relation to Vitamin D Class

	Vitamin D Class			
Exacerbations	Deficient	Insufficient	Sufficient	Total
0	1	3	2	6
1	4	8	7	19
2	13	9	7	29
3	9	4	5	18
4	2	2	0	4
5	1	0	1	2
6	0	1	0	1
10	0	1	0	1
Total	30	28	22	80

Similar studies: There is a link between serum Vitamin D levels and the level of severity of asthma. Decreased plasma Vitamin D levels have been linked to increased asthma severity and the number of exacerbations. These results were comparable to the studies done by Brehm *et al*.[3], Keet *et al*.[7]. and Lancet meta analysis.

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.

A substantial positive association between levels of vitamin D was discovered in the study and the absolute eosinophil counts. It was in accordance with the Brehm *et al*.[9] that had shown that Vitamin D insufficiency has been linked to bronchospasm and allergic reaction indicators like high AEC. This was in contrast to the CAMP study of Jartti *et al*.[10] which did not prove any relation between the same. Other studies of Chinellato *et al*.[11] and Alyasin *et al*.[12] also concluded that there is a significant association between asthama and vitamin d levels.

CONCLUSION

According to our findings, asthmatics have a significant prevalence of Vitamin D deficiency and insufficiency. Furthermore, the severity of asthma is better connected with higher levels of deficiency. Vitamin D plays a complex role in the immune system and its ability to regulate numerous components of immunity has led to discussion about its potential impact in asthma. As a result, Vitamin D can be utilised as an adjuvant in the treatment of asthma. More research, however, is required to confirm the therapeutic benefits of Vitamin D in asthma control.

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