Original Research Article

Co-relation between childhood asthma and serum vitamin D levels – a cross sectional study

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Abstract

Introduction: Asthma is a word of Greek origin that means to "breathe hard" or "to pant". One of the first persons to write about asthma was Hippocrates. He was able to recognize the spasmodic nature of the disease and believed its onset to be caused by moisture, occupation and climate. **Objective:** To evaluate serum Vitamin D levels in children's suffering from asthma. **Methodology:** It is a cross sectional study was undertaken in children with asthma. **Results:** out of 110 asthmatics, 28 cases were in the age group of 1-5 years, 49 cases were in the age group 6-12 years, 33 cases were in the age group of 13-18 years and out of 110 asthmatic children 68 cases were male and 32 cases were females,14 children were in the age group of 1-5 years had deficient Vitamin D levels, 10 children's had insufficient levels and 4 children's had sufficient levels of Vitamin D, 28 children were in the age group of 6-12 years had deficient Vitamin D levels, 14 children's had insufficient levels and 7 children's had sufficient levels of Vitamin D, 21 children were in the age group of 13-18 years had deficient Vitamin D levels. **Conclusion:** 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. Several clinical trials have tested whether taking vitamin D as a supplement has an effect on asthma attacks, symptoms, and lung function in children.

Key words: Children, Asthma, Vitamin D

Introduction

Asthma is a word of Greek origin that means to "breathe hard" or "to pant". One of the first persons to write about asthma was Hippocrates. He was able to recognize the spasmodic nature of the disease and believed its onset to be caused by moisture, occupation and climate. He suspected that asthma was comparable to epilepsy and had its own nature arising from external cause. In 1968 Sir John Floyer in his book "A Treaties of Asthma" have said that asthma is due to the constriction of bronchi. He also distinguished between different "species" of asthma by contrasting continuous asthma with periodic or convulsive asthma. He also found that elements of the environment could trigger asthma attacks.

Vitamin D is not a true vitamin, because individuals with adequate exposure to sunlight do not require any dietary supplements. It is steroid hormone acting on specific cell receptor to regulate the various tissue processes. Vitamin D2 (ergocalciferol), obtained from influence of ultraviolet B radiations (UV-B) on plants and yeast and Vitamin D3 (cholecalciferol), produced in skin by UV-B are the two main forms of Vitamin D. Both forms are metabolized similarly in the body, first by hepatic 25 hydroxylation into inactive but stable 25 hydroxy Vitamin D [25(OH)-D] cholecalciferol (Calcidiol) and then by renal hydroxylation into active but unstable 1, 25 dihydroxy Vitamin D [1, 25(OH) 2-D] cholecalciferol (Calcitriol). The term-Vitamin D deficiency‖ does not necessarily connote clinically explicit disease, rather it means an increase in risk for certain diseases and that also explains the seeming paradox that individuals who are ostensibly healthy today may nevertheless be deficient [1].

Vitamin D deficiency or insufficiency has likely increased in the United States over the last decade. In a recent study of 9,757 United States subjects 1 to 21 years of age, approximately 9% and approximately 61%

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of participants had Vitamin D deficiency and insufficiency respectively. Reduced Vitamin D levels have been found in populations living near the Equator (e.g., in Saudi Arabia, Israel, India, and Costa Rica and in the south-eastern United States), suggesting that lifestyle can have major effects on Vitamin D status regardless of latitude.

There is a controversy regarding the normal levels of deficiency and insufficiency [2,3].

Objective

To evaluate serum Vitamin D levels in children's suffering from asthma

Methodology

Place of study: Sapthagiri Institute of Medical Sciences, Bengaluru

Type of study: A cross sectional study

Study duration: January 2017 to December 2017.

Inclusion criteria: all the children suffering from asthma attending paediatrics department

Exclusion criteria: Congenital anomaly of lungs

Results

Table-1: Age & Sex Wise Distribution of Asthma Cases

Age group	Male	Female	Total
1-5 Years	16	12	28
6-12 Years	30	19	49
13-18 Years	22	11	33
Total	**68**	**42**	**110**

In the present study done, out of 110 asthmatics, 28 cases were in the age group of 1-5 years, 49 cases were in the age group 6-12 years, 33 cases were in the age group of 13-18 years and out of 110 asthmatic children 68 cases were male and 32 cases were females.

Table-2: Vitamin D Status versus Severity of Asthma

Age group	Deficient	Insufficient	Sufficient	Total
1-5 Years	14	10	4	28
6-12 Years	28	14	7	49
13-18 Years	21	10	2	33
Total	**63**	**34**	**13**	**110**

In the present study, 14 children were in the age group of 1-5 years had deficient Vitamin D levels, 10 children's had insufficient levels and 4 children's had sufficient levels of Vitamin D.

In the present study, 28 children were in the age group of 6-12 years had deficient Vitamin D levels, 14 children's had insufficient levels and 7 children's had sufficient levels of Vitamin D.

In the present study, 21 children were in the age group of 13-18 years had deficient Vitamin D levels, 10 children's had insufficient levels and 2 children's had sufficient levels of Vitamin D.

Discussion

In a 6-month clinical trial of Vitamin D3 supplementation (500 IU/d) as adjuvant therapy to ICS to reduce asthma morbidity in 48 Polish children by Majak et al it was found that there was reduced the risk of asthma exacerbation triggered by acute respiratory tract infection in the Vitamin D supplemented group [4]. In the present study done, 14 children were in the age group of 1-5 years had deficient Vitamin D levels, 10 children's had insufficient levels and 4 children's had sufficient levels of Vitamin D, 28 children were in the age group of 6-12 years had deficient Vitamin D levels, 14 children's had insufficient levels and 7 children's had sufficient levels of Vitamin D, 21 children were in the age group of 13-18 years had deficient Vitamin D levels, 10 children's had insufficient levels and 2 children's had sufficient levels of Vitamin D.

Another study by Chinellato et al showed that Vitamin D level inversely correlated with exercise-induced bronchoconstriction in Italian children with asthma [5].

In the present study done, out of 110 asthmatics, 28cases were in the age group of 1-5 years, 49cases were in the age group 6-12 years, 33 cases were in the age group of 13-18 years and out of 110 asthmatic children 68 cases were male and 32 cases were females. In a retrospective cohort study assessing maternal intake of Vitamin D during pregnancy and risk of recurrent wheeze in children at 3 years of age it was found that increasing maternal Vitamin D intake during pregnancy decreased the risk of wheeze symptoms in early childhood [6].

In a study done by Korn et al in Germany in 280 adult asthmatics, it was found that 25(OH) D levels below 30ng/ml were common in adult asthma and most pronounced in patients with severe and/or uncontrolled asthma [7].

In a Cross-sectional study of 54 adults with persistent asthma in Denver, Colorado, serum Vitamin D was positively correlated with FEV1, glucocorticoid response and Vitamin D insufficiency or deficiency, (30ng/ml) was associated with airway hyper responsiveness [8].

A cross-sectional study of 7,648 Finnish adults at 31 years of age found that lack of Vitamin D supplementation (assessed in infancy) was associated with increased risk of asthma. However, this study lacked Vitamin D measures and had inadequate follow-up data on study participants [9].

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Another study by Freishtat et al which was a case-control study of 106 African American subjects 6 to 20 years of age found strong positive association between Vitamin D insufficiency and deficiency and asthma in African Americans [10].

In a study by Kavitha et.al., asthma status of 50 (47.6%) children were categorized as controlled, 32 (30.5%) as partly controlled, and 23 (21.9%) as uncontrolled. Table II compares the pulmonary function tests (PFT) values between these groups. The median (IQR) serum 25(OH) D level in the study participants was 9 (6, 14) ng/mL. The median serum 25(OH) D levels were comparable in the three groups based on control of asthma. The prevalence of vitamin D deficiency in uncontrolled asthma group was higher with 78.2% children being vitamin D deficient (P=0.52) (Table III). None of the major spirometric parameters showed statistically significant correlation with serum vitamin D level except FEF25 (% predicted) (r= 0.22; P=0.02) and PEFR (r=0.19; P=0.049). The asthma control subgroups did not show any significant seasonal differences with the time of sampling. Median (IQR) cumulative inhaled steroid use were 423 (214.5, 684) mg, 456 (241.5, 576) mg, and 363 (330, 600) mg in deficient, insufficient and sufficient vitamin D status groups (P=0.98). Daily sunlight exposure was comparable in vitamin D sufficient participants and others (P=0.97) [11].

In a case-control study, Awasthi, et al. reported significant association between asthma control and vitamin D deficiency. In another study, vitamin D levels were lower in children with severe treatment resistant asthma as compared to moderate asthma group and control subjects. In a cross-sectional study among 100 children, Searing, et al. reported positive correlation between vitamin D levels and FEV1 (percent predicted) and FEV1/FVC. On the other hand, a study done in Thailand by Krobtrakulchai, et al. in 125 asthmatic children, vitamin D levels were similar between three asthma control groups, and there was no association between vitamin D levels and PFT values. Recent trials in children and adults with asthma have also failed to demonstrate the effect of vitamin D supplementation on symptom control [12- 17].

There is growing literature suggesting a link between Vitamin D deficiency and asthma in children, but systematic reviews are lacking. The aim of this study is to evaluate the prevalence of Vitamin D deficiency in asthmatic children and to assess the correlations of Vitamin D levels with asthma incidence, asthma control, and lung functions. PubMed, EMBASE, and Cochrane Library were searched for observational studies on asthma and Vitamin D. Two authors independently extracted data. Meta-analysis was performed using the Review Manager Software. A total of 23 (11 case–control, 5 cohort, and 7 cross-sectional) studies enrolling 13,160 participants were included in the review. Overall, Vitamin D deficiency and insufficiency were prevalent in 28.5% and 26.7% children with asthma, respectively.

The mean 25-hydroxyvitamin D (25(OH)D) levels (10 studies) were significantly lower in asthmatic children as compared to nonasthmatic children with a mean difference of −9.41 (95% confidence interval [CI] −16.57, −2.25). The odds ratio of Vitamin D deficiency (eight case–control studies) was significantly higher among asthmatic children as compared to nonasthmatic children (odds ratio 3.41; 95% CI 2.04, 5.69). Correlations between Vitamin D levels and incidence of

asthma, lung functions, and control of asthma had mixed results. To conclude, asthmatic children had lower 25(OH)D levels as compared to nonasthmatic children, but the correlations between 25(OH)D and asthma incidence, asthma control, and lung functions were varied. Well-designed randomized controlled trials are required to determine if children with asthma can benefit from Vitamin D supplementation [18].

Brehm *et al*. evaluated correlation between Vitamin D levels and asthma exacerbations in children after adjusting for time spent outdoors and racial ancestry and found that there was still a strong association between Vitamin D deficiency and asthma exacerbations after adjusting these factors. Therefore, this reverse causation seems to be less plausible. A recent review of observational studies by Cassim *et al*. included both children and adult patients and identified 23 studies (12 cohort, 9 cross-sectional, and 2 case–control studies) and reported that higher Vitamin D levels were associated with decreased risk of acute exacerbations of asthma.

Similar to our review, they also reported mixed results for association of Vitamin D levels with prevalence, incidence, and severity of asthma. This review also included studies where Vitamin D levels were measured during pregnancy. We excluded such studies, therefore number of cohort studies were less in our review. Yadav and Mittal conducted a randomized controlled trial of oral Vitamin D3 (cholecalciferol) supplementation of 60,000 IU per month for 6 months in children and reported better peak expiratory flow rate improvement, better asthma control, and reduced need of emergency visit and oral steroids use in Vitamin D group compared to placebo group. However, the Vitamin D levels were not measured in the study.

In another pediatric RCT, 500 units of Vitamin D supplementation daily for 6 months showed decreased asthma exacerbation in Vitamin D group though Vitamin D levels did not change before and after supplementation and lung function improved significantly in both arms. The Vitamin D assessment (VIDA) trial randomized 408 adults with poorly controlled asthma to supplement with high-dose Vitamin D or placebo. Vitamin D supplementation did not alter the rate of first treatment failure during 28 weeks. In a subgroup analysis, subjects with a rise in Vitamin D levels >30 ng/ml had decreased rate of treatment failure and acute asthma exacerbations compared to placebo. These trials suggest that Vitamin D supplementation will not be of help in all asthmatic children but in certain group of children [19- 23].

Conclusion

Low blood levels of vitamin D have been linked to increased risk of asthma attacks in children.

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.

Several clinical trials have tested whether taking vitamin D as a supplement has an effect on asthma attacks, symptoms, and lung function in children.

What this study adds?

Asthmatic children had significantly lower Vitamin D levels.

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