

ORIGINAL RESEARCH

Correlation Between Vitamin D Status And Allergies In Children Of 2 To 10 Years Of Age

Dr. Shyamali¹, Dr. Mridu Gupta², Dr. Narinder Kaur³, Dr. Manmeet Kaur⁴, Dr. Sangeeta Gupta⁵

¹JR Department of Physiology, GMC Amritsar

²Professor & Head, Department of Physiology, GMC Amritsar

³Professor, Department of physiology, GMC Amritsar

⁴Professor & Head, Department of paediatrics, GMC Amritsar

⁵Assistant Professor, Department of Physiology, GMC Amritsar

Corresponding author: Dr. Sangeeta Gupta

Assistant Professor, Department of Physiology, GMC Amritsar Email: drsangeeta80@gmail.com

Received: 21 June 2024

Accepted: 19 July 2024

Abstract:

AIM: Determine the vitamin D levels in children of already diagnosed case of allergies in age group of 2 to 10 years.

• To determine the correlation between vitamin D status and allergies in children of age group of 2 to 10 years.

Materials & Method: It is a cross-sectional study. The subjects were recruited from BEBE NANKI MOTHER & Child Care Center attached to government medical college Amritsar. 200 subjects in age group of 2 to 10 years diagnosed with allergies were included. Patients with age group less than 2 years & more than 10 years & those on drugs like rifampicin, isoniazid, ketoconazole were excluded from study. 25-hydroxy vitamin D (25(OH)D) was analysed from enzyme linked immunoassay in human serum or plasma. Informed written consent was obtained from the subjects from the institution before commencing the study. The results were analysed statistically using student "t" test.

Results: All the data is expressed as mean \pm SD. The 'P' value was evaluated which suggested a negative association between vitamin D status and Allergies in children.

Conclusion: The present study suggested that there is negative association between vitamin D status and allergies.

INTRODUCTION

The prevalence of allergic disease has increased dramatically in recent decades. This trend is described as "the epidemic of the 21st century". Allergy is defined as various conditions caused by hypersensitivity of the immune system to typically harmless substances in the environment. It is the outcome of a combination between unique genetic vulnerability and exposure to outside influences.

Twin studies have yielded estimate of the genetic contribution to allergy illness ranging from 36 to 79%, with a heritability of roughly 50%.¹

While genetic factors undoubtedly contribute to the development of allergy disorders. Due to the extremely early onset of allergy disorders, the developing immune system is particularly vulnerable to changes in the environment, and primary intervention measures must be developed in order to alleviate this unmatched burden.²

Approximately 20% to 30% of total population in India suffers from at least one allergic disease. The prevalence of allergic diseases is higher in Northern States of India.

Eczema, or atopic dermatitis, is a recurring chronic inflammatory skin condition present in 10-20% of children and 1-3% of adults worldwide.³ It occurs more frequently in urban, higher socioeconomic families in industrialised nations.⁴ Morbidity from eczema can be high, particularly for young children.

Quality of life is diminished for both the child and their family due to pruritus (itch), recurrent skin infections, diminished educational progress through school absence, daily treatment regimens and parental stress.⁵ Sleep disturbance during eczema exacerbations may mediate increased discipline problems and attention deficit hyperactivity disorder (ADHD).⁶ Vitamin D is potentially involved in eczema aetiology.

It has been suggested that vitamin D regulates immunological response, which could be a potential treatment target for this allergy illness.

Skin barrier function and secretion of antimicrobial peptides are inhibited in eczema through the down regulation of the Th2-driven immune response.⁷

The vitamin D form that is active, 1-25 (OH) 2D₃, stimulates keratinocytes to produce antimicrobial peptides in the epidermis, which support the integrity of the permeability barrier by reducing the colonization of germs like *Staphylococcus aureus*.⁸

Along with a clear genetic basis in allergic disease, environmental factors, including early neonatal nutrition, may have an important influence on allergy development and, thus, present an opportunity to prevent or delay the onset of the disease.⁹ Among the fat-soluble vitamins is vitamin D. In nature, it is contained in large quantities in fish oil, liver, egg yolk, and less in some other products of animal origin. For a man, the main way to obtain it is by endogenous synthesis.¹⁰ Among many places, the brain, eyes, heart, β cells of pancreatic islets, muscles, adipose tissue, parathyroid glands, adrenal glands, and nearly all immune system cells were discovered to contain VDR.¹¹ They are known to produce pleiotropic effects in body. Numerous scientific research have examined the relationship between vitamin D insufficiency and the development of various diseases, including allergic disorders, as well as the potential advantages of supplementing with the vitamin in order to treat these diseases. In living things, vitamin D is found primarily in two forms: D2 (ergocalciferol) and D3 (cholecalciferol). Vitamin D3 is produced internally as a by-product of the photochemical conversion of 7-dehydrocholesterol in human skin, which is also naturally present in oily fish.

After entering the bloodstream, vitamin D (as both D2 and D3) is hydroxylated twice: once in the liver by vitamin D-25-hydroxylase (CYP2R1) to produce 25-hydroxyvitamin D [25(OH) D, calcidiol], and once more, primarily in the kidneys, by D-1 α hydroxylase (CYP27B1) to produce the active form of vitamin D-1, 25-dihydroxyvitamin D [1,25 (OH)2D]. Nevertheless, CYP27B1 is expressed in numerous other organs outside the kidneys. As a result, various human organs can produce the active form of vitamin D. Target tissues are exposed to calcitriol through certain VDR receptors, which are transcription factors.¹²

One well-known and significant source of vitamin D is skin production. Its effectiveness can be diminished by as much as 95–98% following the topical application of a 30 SPF sunscreen.¹³

The serum 25-hydroxyvitamin D concentration is used to calculate the body's supply of vitamin D. Compared to 1.25 (OH) D (4–6 h), this hepatic metabolite of vitamin D has a longer half-life (about three weeks). Its synthesis is not controlled by the metabolism of calcium and phosphate, and its serum concentrations can reach over a thousand-fold greater levels.¹⁴

Table: 1 presents the accepted standards for vitamin D concentrations.¹⁵

Vitamin D Concentration Range	Serum 25 (OH) D Concentration	
	nmol/L	ng/mL
Severe deficiency	<25	<10
Deficiency	25–50	10–20
Insufficiency (suboptimal level)	>50–70	>20–30
Optimal level	>75–200	>30–80
Toxic level	>250	>100

Vitamin D acts on VDR, which is expressed on a range of immune cells, including B cells, T cells, dendritic cells, and macrophages, to have immunomodulatory effects on allergen-induced inflammatory pathways. Numerous of these cells, including dendritic cells and activated macrophages, can convert circulating 25OHD into physiologically active vitamin D. Immune cells can quickly raise local vitamin D levels, extrarenal expression of CP27B, which may be necessary to influence adaptive immune responses.¹⁶

Vitamin D has demonstrated the capacity to impede Th1- and Th2-type reactions by inhibiting the synthesis of IFN- γ produced by IL-12, IL-4, and IL-4-induced expression of IL-13.¹⁷ Given that the balance between Th1 Th2 influences the pattern of immune response, this ability may be significant.

MATERIALS AND METHODS

This study was carried out in the Research laboratory of the Department of Physiology in collaboration with the department of Paediatrics, Government Medical College, Amritsar. The study period was from January 2023 to January 2024. The approval of the Ethical committee was obtained. The study was cross sectional in nature.

STUDY SUBJECTS:

- A total of 200 subjects of age group between 2 to 10 years of both sex was included in the study.

INCLUSION CRITERIA:

1. Children of age group 2 to 10 years of both sex was included in the study.
2. Pre-diagnosed with different type of allergic conditions.

3. Diagnosis was based on.
4. Medical History of Allergy
5. Skin Prick Test
6. According to European standard (wheal, more than or equal to 3mm diameter)¹⁹ will show positive for allergy.
7. Blood Antigen Antibody Test.

EXCLUSION CRITERIA:

1. Age group less than 2 years and more than 10 years.
2. Patients taking drugs affecting vitamin D metabolism like Rifampicin, Isoniazid, Ketoconazole & Phenytoin.
3. Patients suffering from bowel disease with malabsorption of vitamin D.
4. Current consumption of vitamin D.
5. Any chronic medical disease like tuberculosis, diabetes mellitus and hypertension

METHOD FOR THE STUDY:

A cross-sectional sample of 200 children of 2 to 10 years from BEBE NANKI MOTHER AND CHILD CARE CENTRE attached to Government Medical College Amritsar. 25-hydroxy vitamin D (25{OH}D) was analysed from enzyme linked immunoassay in human serum or plasma. Caregivers were given a survey describing the child demographic factors known to affect vitamin D status and medical history of allergic diseases. Predictors of vitamin D deficiency (25{OH}D) less than 30 ng/ml was identified and its correlation with allergies was studied.

REFERENCE RANGE:

25-OH vitamin D concentration	ng/ml
Very severe vit D deficiency	≤ 5
severe vit D deficiency	5-10
Moderate vit D deficiency	10-20
Mild vit D deficiency	20-30
Optimal vit D deficiency	30-70
Overdose, but not toxic	70-150
Vitamin D intoxication	≥ 150

STATISTICAL ANALYSIS:

At the end of the study, the correlation of frequency, proportion, mean ±SD of the continuous and categorical data was analysed.

RESULTS:

The present study was conducted in the department of physiology in collaboration with the Department of Paediatrics, Government Medical College, Amritsar. Out of 200 patients 79 were of Asthma (39.5%), 47 (23.5%) were of Allergic rhinoconjunctivitis, 48(24.0 %) were of Atopic Dermatitis, & Food Allergy cases were 26 (13.0%).

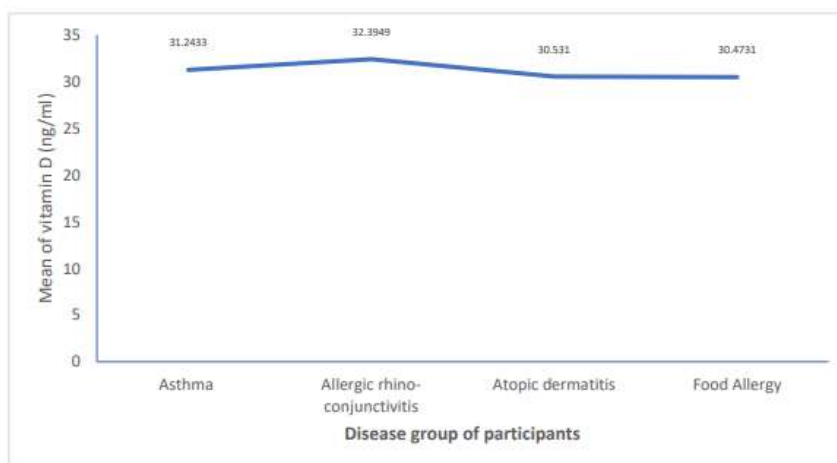
TABLE 1

CORRELATION OF DISEASE GROUP OF PARTICIPANTS WITH VITAMIN D VALUE

Disease group	No. of cases	Vitamin D (ng/ml)	
		Mean	SD
Asthma	79	31.2433	7.53325
Allergic rhino-conjunctivitis	47	32.3949	4.64464
Atopic dermatitis	48	30.5310	6.50293
Food Allergy	26	30.4731	4.97148
Total	200	31.2429	6.39031
p-value		0.478	

P=0.478 (p<0.05 - Significant)

The Mean ± S.D of Asthma with Vitamin D is 31.2433, for Allergic Rhinoconjunctivitis is 32.3949, for Atopic Dermatitis is 30.5310 and for Food Allergy is 30.4731. Non- Significant results were obtained while correlating the disease group with Vitamin D



GRAPH 14: CORRELATION OF DISEASE GROUP OF PARTICIPANTS WITH VITAMIN D VALUE

DISCUSSION:

Vitamin D serves important functions in the immune system. Vitamin D can activate certain regulatory immune system cells that prevent the release of chemicals that cause and worsen allergic diseases. So a deficiency in vitamin D may inhibit this regulatory mechanism, which may worsen or trigger allergic disease

Out of 200 patients 79 were of Asthma (39.5%), 47 (23.5%) were of Allergic rhinoconjunctivitis, 48 (24.0 %) were of Atopic Dermatitis, & Food Allergy cases were 26(13.0%).

In present study while Correlating disease group of participant with Vitamin D Value The Mean ± S.D of Asthma with Vitamin D is 31.2433, for Allergic Rino-conjunctivitis is 32.3949, for Atopic Dermatitis is 30.5310 and for Food Allergy is 30.4731

Non- Significant result were obtained while correlating the disease group with Vitamin D. A similar study was conducted in 2016 by Cairncross C et al, The Relationship between Vitamin D Status and Allergic Diseases in New Zealand Preschool Children. In this study of 1329 children aged between 2 and less than 5 years participated, there was no association between vitamin D status and parental reported prevalence of eczema, atopic asthma or allergic rhino-conjunctivitis.(17)

In another study done in 2022 by Liq, Zhou et.al, on vitamin D supplementation did not reduce the risk of asthma exacerbation in children.64 In another study done on 2015 by Han et al, on serum 25(OH)D concentration and presence of eczema and suggested an inverse association between serum 25(OH)D concentration and presence of eczema(18).

SUMMARY AND CONCLUSIONS:

SUMMARY:

This study was designed as the incidence of allergic condition in northern states of India is higher than other parts of country so this study was undertaken to determine the correlation between vitamin D values and allergies. A total of 200 patients with allergic disease of both the sexes were analysed.

Following results were obtained:

Total cases for Asthma were 79, out of which 28 (42.42%) were female & 51(38.06%) were male.

- Total cases for Allergic rhino-conjunctivitis were 47, out of which 13 (19.70%) were female & 34(25.37%) were male.

- Total cases for Atopic Dermatitis were 48, out of which 18 (27.27%) were female & 30(22.39%) were male.

- Total cases for Food Allergy were 26, out of which 7 (10.61%) were female & 19(14.18%) were male.

On correlating the various allergic group of participants with vitamin D value non-significant results were obtained

CONCLUSION:

Under the light of above obtained results, following conclusion can be withdrawn:

→ Different allergic disease like Asthma, Allergic rhino-conjunctivitis, Atopic Dermatitis & Food allergy was prevalent in both the sexes

→ In the study group of 2 to 10 years having different allergic disease it was seen that vitamin D level was within normal range (30-100ng/ml) in most of the cases, so there was no significant correlation → One of the reason for non significant correlation could be prevalence of more sunlight in this part of region and more exposure of children to sunlight as on average, over 90% of vitamin D is sourced from sun exposure.

→ Further research with more number of studies are needed to be done to determine the correlation of vitamin D and allergies in children of 2 to 10 years of age

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