



Correlation of Acute Respiratory Tract Infection with the Vitamin D deficiency in Children: A Cross-Sectional Study

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ABSTRACT

Introduction: On a global level, the prevalence of respiratory tract infections (RTIs) is more than any other type of infection in children. One of the possible causes of the development of these infections is the deficiency of Vitamin D. In the process of synthesis of peptide cathelicidin, a vital role is played by Vitamin D. Peptide cathelicidin eventually protects against the microbial activity of certain infectious bacteria and viruses. It also causes the prevention of replication of the influenza virus. Moreover, Vitamin D also increases the immunity of the body. The presence of a normal physiological level of Vitamin D in the body is highly advantageous in the protection of the body against RTIs.

Aim/Objectives: To assess the correlation of Acute Respiratory Tract Infection with the Vitamin D deficiency in children.

Methodology: A total of 120 children were included in the study. The age range of the participants was from 1 months to 5 years. A questionnaire was prepared to record the medical histories of all the patients. For the identification of the level of Vitamin D, blood samples of all the participants were collected and sent to the laboratory of the hospital. According to the exclusion criteria, the participants having genetic diseases such as hypophosphatemic rickets, X-linked rickets and hereditary vitamin D-resistant rickets, were excluded from the study.

Results: The average level of vitamin D in the participants with normal vitamin D was 15 ± 9.5 ng/mL. Whereas, the average vitamin D level in participants having respiratory tract infection was 5 ± 5.2 ng/mL/ which was much lower compared to the healthy individuals. The level of vitamin D had shown association with lower, upper and recurrent infections of the respiratory system ($p < 0.05$). The common symptoms of such infections observed in the present study were pneumonia in the upper respiratory tract, lower respiratory tract, common cold, and recurrent infections in the respiratory tract. The gender and age of the participants had no significance over the results.

Conclusion: Vitamin D has a significant association with respiratory tract infections in children.

Key Words: Respiratory tract infections, Vitamin D deficiency, Children, Infections, common cold, average vitamin D level

INTRODUCTION

On a global level, the prevalence of respiratory tract infections (RTIs) is more than any other type of infection in children.¹ One of the possible causes of the development of these infections is the deficiency of Vitamin D. In the process of synthesis of peptide cathelicidin, a vital role is played by Vitamin D. Peptide cathelicidin eventually protects against the microbial activity of certain infectious bacteria and viruses. It also causes the prevention of replication of the influenza virus.² Moreover, Vitamin D also increases the immunity of

the body. The presence of a normal physiological level of Vitamin D in the body is highly advantageous in the protection of the body against RTIs.³

Administration of Vitamin D in infants can greatly decrease the number of visits to health care setups for acute RTIs in children. This inference was given by Grant et al. in New Zealand.⁴ However, according to some studies, Vitamin D has no role in the prevention of RTIs in children. Nonetheless, the supplements of Vitamin D have been seen as beneficial in children with asthma.⁵ Some studies also suggest

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that if pregnant women take vitamin D supplements during pregnancy, their children are less likely to have an RTI.⁶

Vitamin D deficiency is one of the common nutritional deficiencies in Pakistan and the reasons are lesser sun exposure and inadequate diet during pregnancy. Almost 83% of the children presenting with recurrent RTIs have vitamin D deficiency.⁷ A total of 74% of the children with pneumonia also have nutritional rickets.⁸ The present study was conducted to assess the correlation of vitamin D deficiency with recurrent and acute RTIs in children.

Study design: A cross-sectional study

Place and duration: This study was conducted at Memon Medical Institute Hospital Karachi Pakistan from March 2021 to March 2022.

METHODOLOGY

This study included 120 pediatric patients. All the participants were under the age of 5 years. The study included participants from both genders. According to the exclusion criteria, patients with a heredity disease related to the deficiency of Vitamin D such as hypophosphatemic rickets and X-linked rickets, etc., were not included in the study. Written informed consent was taken from the parents or the attendants of all the participants. Permission was taken from the ethical review committee of the institute. A self-made questionnaire was used for the collection of demographic data and the clinical history of the patients. All the patients were subjected to undergo serum 25-OH-vitamin D levels. Patients having lower than 10ng/ml of 25-OH-vitamin D levels were considered vitamin deficient in this study. The data regarding Vitamin D level was divided into two categories; Vitamin D deficient and Vitamin D normal. For the statistical analysis, IBMS SPSS version 26 was used.

RESULTS

A total of 51% of the participants were female and 49% were male. The mean value of vitamins in the normal vitamin D level group was 15 ± 9 and in those with a respiratory tract infection (RTI) was 5 ± 7 . There was a strong association between vitamin D deficiency and RTIs. An increase in lower respiratory tract infection (LRTI) was also observed in the vitamin D deficient patients. Moreover, recurrence of RTIs also correlated with the deficiency of vitamin D with a p-value of <0.001 . However, the incidence of upper respiratory tract infection (URTI) was lesser comparatively. The association has been given in Tables 1 and 2. One of the common symptoms seen in vitamin D deficient patients with URTI was the common cold. Other symptoms seen were sore throat and nasal obstruction. Some of the uncommon fea-

tures seen were tonsillitis, pharyngitis, otitis media, laryngitis, and sinusitis. Other respiratory ailments associated with the deficiency of vitamin D in children were bronchiolitis and tuberculosis. In recurrent LRTI, pneumonia, bronchiolitis and tuberculosis were seen. Most of the cases of pneumonia were seen in the cases of LRTIs. Those symptoms were associated with the deficiency of vitamin D. There was no association of deficiency of vitamin D with the age or gender of the participants.

Table 1: Correlation of vitamin D deficiency with respiratory tract infection

Variable	Participants with Vitamin D deficiency (%)	Participants with Normal Vitamin D (%)	p-value
Respiratory tract infection (n=120)	41.56%	93.46%	<0.001
Upper Respiratory tract infection	16.45%	21.93%	<0.001
Lower respiratory tract infection	23.45%	44.65%	<0.01
Recurrent lower respiratory tract infection	2.45%	25.96%	<0.001

Table 2: Symptoms of URTI in children with Vitamin D deficiency and with normal value of vitamin D

Symptoms	Participants with Vitamin D deficient (%)	Participants with normal Vitamin D (%)	p-value
Nasal obstruction	32.56%	15.45%	<0.001
Sore throat	35.66%	29.25%	<0.001
Pharyngitis	5.32%	0	<0.001
Tonsillitis	12.45%	0	<0.001
Otitis media	15.36%	0	<0.001
Sinusitis	20.65%	0	<0.001
Common Cold	69.56%	56.96%	<0.01

DISCUSSION

The normal functions of the body require a certain level of vitamin D in the body. This level can be achieved by exposure to sunlight as the cutaneous synthesis of vitamin D demands sunlight.⁹ Whereas, a comparatively lesser amount of vitamin D is obtained from the diet.¹⁰ Moreover, some factors are responsible for the restriction of dietary intake of 25-hydroxyvitamin D such as insufficient finances. Similarly, the geographical factor is also responsible for controlling the exposure to sunlight. For an instance, the population living in western countries and the North Pole do not get much

exposure to the sun¹¹ hence, the incidence of deficiency of Vitamin D is drastically increasing on a global level. Many countries lack the resources for vitamin D. The deficiency of vitamin D is responsible for asthma and RTIs in the children living in Mediterranean countries as well as children residing in North America. The deficiency of vitamin D is directly associated with the forced vital capacities.¹² Hence, hypovitaminosis is one of the prime foci of attention in the whole world. It has been suggested by many dieticians to add vitamin D to the regular diet of children by withering supplements or by food rich in vitamin D.¹³ They also suggest that adequate exposure to daylight and consuming meat are also favorable to maintaining a suitable level of vitamins required for daily body function.

According to the study by Pham et al., a monthly bolus dose of vitamin D 60,000 IU cannot decrease the susceptibility to acquiring an RTI. However, it can reduce the duration of severe symptoms. Similarly, daily consumption would have similar effects.¹⁴ The present study found a strong relevance of vitamin D deficiency with RTIs. In URTI, the most common symptom seen was common cold followed by nasal obstruction and soreness of the throat. Sinusitis, tonsillitis, pharyngitis, otitis media and laryngitis were not prevalent. In LRTIs, the incidence of pneumonia was significantly high.

CONCLUSION

Vitamin D is an essential vitamin for a person to perform daily life activities. The deficiency of vitamin D has a strong association with respiratory tract infections in children.

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