https://doi.org/10.29309/TPMJ/2023.30.04.7379

The Professional Medical Journal
www.theprofesional.com
2023, Volume, 30 Issue, 04

ORIGINAL ARTICLE

Frequency of Vitamin D deficiency in children with recurrent chest infections.

Jahanzeb Khan Afridi[1], Rahida Karim[2], Shumaila Khan[3], Huma Gul[4], Gul-e-Lala[5], Tahir Ahmad[6]

Article Citation: Afridi JK, Karim R, Khan S, Gul H, Gul-e-Lala, Ahmad T. Frequency of Vitamin D deficiency in children with recurrent chest infections. Professional Med J 2023; 30(04):478-483. https://doi.org/10.29309/TPMJ/2023.30.04.7379

ABSTRACT... Objective: To ascertain how frequently children with recurrent chest infections are vitamin D deficient. **Study Design:** Cross Sectional Study. **Setting:** Department of Pediatrics Hayatabad Medical Complex HMC Peshawar. **Period:** 10th August 2021 to 10th February 2022. **Material & Methods:** The study included 103 children with recurrent chest infections, including both males and females. Lithium heparin plasma separator test tubes were used to take 3-5 ml of blood from the vein, and the samples were then sent right away to the hospital's lab for assessment of the vitamin D level. **Results:** The age range of research participants was 1 to 5 years, with a mean age of 3.80 years. The gender split among patients was 33% female to 67% male. 60.2% of the patients had vitamin D deficiency. **Conclusion:** It has been found that vitamin D deficiency is substantially more common in children with recurrent respiratory tract infections.

Key words: Children, Recurrent Respiratory Infections, Vitamin D Deficiency.

INTRODUCTION

Dealing with children who have recurrent respiratory infections (RRI) presents challenges for pediatricians on a daily basis in their clinical work. Recurrent respiratory infections are often diagnosed using the following criteria: There are more than six respiratory infections in year, more than one upper airway infection every month, and more than three lower airway infections between September and April each year.[1] Recurrent respiratory infections are exceedingly costly for society and families, and they have a significant influence on the pharmaco-economy.[1]

There have been several factors identified as potential promoters and/or causes of recurrent respiratory infections, including age (owing to a relative immaturity of the immune system), early nursery school attendance, air pollution, passive smoking, low socioeconomic status, and atopy.[2]

Due to the diversity of subtypes and the large number of viruses in environment, viral infections may potentially raise the risk of developing recurrent respiratory infections.[3] Despite the likelihood of bacterial super-infections, viral infections are more common. The misuse or overuse of antibiotics leads to the development of antibiotic resistance.[3,4] Furthermore, biofilm frequently results in antibiotic failure, and 25–45% of children with severe recurrent respiratory tract infections require surgical intervention.[5]

The biologically active form of vitamin D is 1,25-dihydroxyvitamin D3 [1,25(OH)2D3], also known as the "sunshine vitamin," since it is primarily synthesised from skin-derived precursors by the action of ultraviolet B (UVB) radiation on 7-dehydrocholesterol. 6 Fish liver oils, fortified cereals, dairy products, oily fish, and fortified cereals all contain smaller amounts of vitamin D.[6]

Vitamin D supplements have been suggested as a promising respiratory tract infections prevention strategy for children since numerous studies have

1. MBBS, FCPS, Associate Professor Peadiatric, Hayatabad Medical Complex.
2. MBBS, FCPS, Associate Professor Peadiatric, Hayatabad Medical Complex.
3. MBBS, TMO Peadiatric, Hayatabad Medical Complex.
4. MBBS, FCPS, Specialist Registrar Peadiatric, Hayatabad Medical Complex.
5. MBBS, FCPS, Specialist Registrar Peadiatric, Hayatabad Medical Complex.
6. MBBS, FCPS, Trainee Registrar Peadiatric, Hayatabad Medical Complex.

Correspondence Address:
Dr. Rahida Karim
Department of Peadiatric
Hayatabad Medical Complex.
rahidakarim@yahoo.com

Article received on: 09/12/2022
Accepted for publication: 10/02/2023

linked vitamin D deficiency to an increased risk of RTIs.[7]

Children with recurrent chest infections had an 84.6% prevalence of vitamin D insufficiency, per the Chandrashekhara T, et alstudy.[8]

Vitamin D deficiency is more common in infants who are exclusively breastfed, preterm infants, newborns who do not receive vitamin D supplements, and kids from lower socioeconomic families. This study was carried out to determine the frequency of vitamin D insufficiency in kids with recurrent chest infections in our general community.

OPERATIONAL DEFINITION

Respiratory Infection

A chest X-ray showed patchy consolidation in one or both lungs, which was described as happening when a child reported having a temperature of less than 101°F (measured with a thermometer), a fast respiratory rate (defined as greater than 50 breaths per minute in children under 1 year olds or greater than 40 breaths per minute in children 1 to 5 years old), and both. (Everyone is here.)

Recurrent Chest Infections

It was defined as any one of following in history.
>6 respiratory infection per year
>1 respiratory infection per month involving upper airways from September to April
>3 respiratory infection involving lower airways

Vitamin D Deficiency

It was defined as Vitamin D value <20 ng/ml by laboratory test.

MATERIAL & METHODS

From 10 August 2021 to 10 February 2022, a cross-sectional study was conducted in the Pediatrics Department of the Hayatabad Medical Complex in Peshawar. The study lasted for six months, and non-probability consecutive sampling was used. 103 children with recurrent chest infections were included in the sample using the WHO sample size programme, which had a 95% confidence level, 7% margin of error, and an estimated frequency of 84% for vitamin D deficiency.[8]

The study included all kids between the ages of 1 and 5 years, of either gender, who had a history of recurrent chest infections as defined by the operational definition.

Children who are currently receiving vitamin D supplements, those on anticonvulsant medication, anti-tuberculous medication, or receiving treatment with glucocorticoids were not included in the study. Congenital lung problems, congenital heart disease, and skeletal disorders in children were also excluded from the study.

Patients who satisfied the inclusion criteria from the pediatrics department at the Hayatabad Medical Complex in Peshawar were included in the study after gaining ethics council approval (HMC-QAD-F-00). The patient's parents were fully told about their child's participation in the experiment, and their informed consent was obtained by outlining the study's advantages to them. Basic demographic information included things like age, gender, and residential status.

Three to five milliliters of blood were extracted from the vein using a lithium heparin plasma separator test tube, and they were sent immediately away to the hospital's laboratory.

The data were analyzed using a statistical analysis tool (IBM-SPSS-version 23). Frequencies and percentages for qualitative characteristics such gender, place of residence, and vitamin D deficiency were calculated. The mean and SD were given for numerical factors like age. The factors utilized to categorize vitamin D deficiency were age, gender, and place of residence. An indication of statistical significance was determined by a p-value of 0.05 when the post-stratification chi-square test was applied.

RESULTS

Age range in this study was from 1 to 5 years with mean age of 3.805±1.09years as shown in Table-I.

Male patients were 67% and females were 33%

as shown in Table-I.
Frequency and percentage of patients according to residential status are shown in Table-II.

Vitamin D deficiency was observed in 60.2% patients as shown in Table-III.

Stratification of Vitamin D deficiency with respect to age, gender and residential status are shown in Tables-IV, V and VI respectively.

Gender	Frequency (%)
Male	69 (67%)
Female	34 (33%)
Total	103 (100%)

Table-I. Frequency and %age of patients according to gender n=103

Residential Status	Frequency (%)
Rural	62 (60.2%)
Urban	41 (39.8%)
Total	103 (100%)

Table-II. Frequency and %age of patients according to residential status n=103

Vitamin D Deficiency	Frequency (%)
Yes	62 (60.2%)
No	41 (39.8%)
Total	103 (100%)

Table-III. Frequency and %age of patients according to Vitamin D Deficiency n=103

Age (years)	Vitamin D Deficiency		P-Value
	Yes	No	
1-3	21(60%)	14(40%)	0.977
4-5	41(60.3%)	27(39.7%)	
Total	62(60.2%)	41(39.8%)	

Table-IV. Stratification of Vitamin D Deficiency with respect to age.

Gender	Vitamin D Deficiency		P-Value
	Yes	No	
Male	38(55.1%)	31(44.9%)	0.130
Female	24(70.6%)	10(29.4%)	
Total	62(60.2%)	41(39.8%)	

Table-V. Stratification of Vitamin D deficiency with respect to gender.

Residential Status	Vitamin D Deficiency		P-Value
	Yes	No	
Rural	40(64.5%)	22(35.5%)	0.270
Urban	22(53.7%)	19(46.3%)	
Total	62(60.2%)	41(39.8%)	

Table-VI. Stratification of Vitamin D deficiency with respect to residential status.

DISCUSSION

According to the study, a greater proportion of kids with recurrent respiratory infections are also vitamin D deficient. In accordance with our findings, Wayse et al. (2004) found that subclinical vitamin D deficiency was a significant risk factor for lower respiratory tract infections in Indian children under the age of five.[9] Children with chronic cough had mean vitamin D levels of 13.76 4.81 ng/mL, children with recurrent respiratory infections had mean levels of 11.97 4.04 ng/mL, and children in the control group had mean levels of 31.91 18.79 ng/mL, according to zdemir et al. (2016). These variations have statistically significant differences. As a result, children who lack vitamin D are more likely to experience recurring respiratory infections and chronic cough.[10]

According to a recent study from Telangana, India[11], vitamin D levels have been connected to recurrent respiratory infections. Zhang et al. recently noted the connection between vitamin D deficiency and recurrent respiratory infections in China[12] (2015-2018). Researchers have looked into the underlying mechanisms behind the link between vitamin D and respiratory infections. Vitamin D may have an impact on the immune system, and insulin-like growth factor 1 increases immunoglobulin synthesis and release. Vitamin D can also promote the development and differentiation of T and B lymphocytes. Additionally, research has revealed that low CD4+ and CD3+ levels, which are susceptible to vitamin D therapy, were associated with vitamin D deficiency. Immunoglobulin IgA, IgM, and IgG levels also rose after vitamin D supplement therapy. Vitamin D has been found to improve humoral immunity and reduce the occurrence of respiratory tract infections.[13] Muscle weakness, particularly in the diaphragm and intercostal muscles, is thought

to be brought on by vitamin D deficiency. This possibly makes it more difficult to get rid of the secretions from the respiratory system and encourages infections[14]. In their literature review on the connection between vitamin D deficiency and respiratory infections, Esposito and Lelii found that it raises the risk of childhood tuberculosis, bronchiolitis, and recurrent otitis media. They came to the conclusion that preventing some respiratory tract infections would be affordable and effective if vitamin D levels were kept high enough.[15] Literature from all across the world has supported the association between vitamin D deficiency and respiratory infections.[16,17,18]

Vitamin D is important in the pneumonia that is obtained in the community. It is common knowledge that pathogen infection and immune dysfunction both contribute to community-acquired pneumonia. Given that vitamin D has a significant impact on immune functions, the amount of D may be a risk factor for community acquired pneumonia. The connection between vitamin D and community-acquired pneumonia has been carefully studied up to this point. When compared to newborns with normal vitamin D levels, those with low vitamin D levels in vivo had a six-fold increased risk of acquiring lung infections by the time they turn one, according to the US Centers for Disease Control and Prevention (CDC).[19] Giving infants with pneumonia aged 1 to 36 months a single high dose of vitamin D3 (100,000 IU) almost eliminated the chance of recurrence within 3 months, according to another random control-case study.[20]

Vitamin D may play two different roles in the development of community-acquired pneumonia. (1) The active form of vitamin D, 25-(OH)2D3, interacts with the vitamin D receptor (VDR) to produce an effect. When VDR is activated, antibacterial peptides that fight viral and bacterial infections can be expressed.[21] The ability of these tissues to clear inflammatory substances was compromised due to the denaturation, cornification, and proliferation of the mucous membrane epithelia of the respiratory tract brought on by the reduction in VDR level in vivo caused by vitamin D deficiency, which resulted in an accumulation of un-neutralized proinflammatory media, damaged pulmonary tissues, and blocked gas exchange.[2] Infectious respiratory diseases including tuberculosis and community-acquired pneumonia are strongly tied to the immunomodulatory characteristics of vitamin D, which are now known to be highly necessary and can directly influence human innate immunity and adaptive immunity.[22] Vitamin D levels are significantly down regulated in critically sick patients with acute severe pneumonia or sepsis and are associated with prognosis.[23] The pulmonary endothelial cells have the ability to activate vitamin D from its inactive state and encourage the production of antibacterial peptides in order to combat infection in the event of a pulmonary infection.[24] Additionally, inadequate vitamin D levels are a recognized independent risk factor for pneumonia and are closely related to lung function damage.[25] Therefore, the level of vitamin D in the body affects both the severity of community-acquired pneumonia and the emergence of pulmonary disorders. The prevalence and severity of community acquired pneumonia may be reduced by vitamin D supplementation.

The study's shortcomings include the hospital-based small sample of data and the lack of a cause-and-effect relationship in the study's methodology. For a deeper understanding, the topic requires more in-depth studies with sound design.

CONCLUSION

There were a noticeably higher percentage of participants who were vitamin D deficient among children with recurrent respiratory infections. Vitamin D levels in children should be examined and promptly treated in order to better treat the issue of recurring respiratory tract infections.

REFERENCES

1. Ameli F, Brocchetti F, Mignosi S, Tosca MA, Gallo F, Ciprandi G. **Recurrent respiratory infections in children: A study in clinical practice.** Acta Biomed. 2020; 91(4):e2020179.

2. de Benedictis FM, Bush A. **Recurrent lower respiratory tract infections in children.** BMJ. 2018; 362:k2698.

3. Li J, Song X, Yang T. **A systematic review of antibiotic prescription associated with upper respiratory tract infections in China.** Medicine. 2016; 95(19):e3587.

4. Alexandrino AS, Santos R, Melo C. **Caregivers' education vs rhinopharyngeal clearance in children with upper respiratory infections: Impact on children's health outcomes.** Eur J Pediatr. 2017; 176(10):1375-83.

5. Regli A, Becke K, von Ungern-Sternberg BS. **An update on the perioperative management of children with upper respiratory tract infections.** CurrOpinAnaesthesiol. 2017; 30(3):362-7.

6. Tuckey RC, Cheng CYS, Slominski AT. **The serum vitamin D metabolome: What we know and what is still to discover.** J Steroid Biochem Mol Biol. 2019; 186:4-21.

7. Saeed BQ, Jairoun AA, Ashraf Khamis A, Hatim Abdelrahim L, AbobakrAljomhi A, Adrees AO, et al. **Vitamin D deficiency and insufficiency among university students: Prevalence, risk factors, and the association between vitamin D deficiency and episodes of respiratory tract infections.** Risk ManagHealthc Policy. 2021; 14:2733-41.

8. Chandrashekhara T, Pampana S. **Prevalence of vitamin D deficiency in children with lower respiratory tract infection.** Int J ContempPediatr. 2019; 6:1041-5.

9. Wayse V, Yousafzai A, Mogale K, Filteau S: **Association of subclinical vitamin D deficiency with severe acute lower respiratory infection in Indian children under 5 y.** Eur J Clin Nutr. 2004, 58:563-7. 10.1038/sj.ejcn.1601845

10. Özdemir B, Köksal BT, Karakaş NM, Tekindal MA, Özbek ÖY: **Serum vitamin D levels in children with recurrent respiratory infections and chronic cough.** Indian J Pediatr. 2016, 83:777-82. 10.1007/s12098-015-2010-1

11. Ruhi A, Ananth T: **A study of vitamin-D and nutritional status in recurrent respiratory tract infections in children 1-5 years of age.** Pediatr Rev. 2019, 6:183-8. 10.17511/ijpr.2019.i04.06

12. Zhang J, Sun RR, Yan ZX, Yi WX, Yue B: **Correlation of serum vitamin A, D, and E with recurrent respiratory infection in children.** Eur Rev Med Pharmacol Sci. 2019, 23:8133-8. 10.26355/eurrev_201909_19033

13. Xiao J, He W: **The immunomodulatory effects of vitamin D drops in children with recurrent respiratory tract infections.** Am J Transl Res. 2021, 13:1750-6.

14. Bozzetto S, Carraro S, Giordano G, Boner A, Baraldi E: **Asthma, allergy and respiratory infections: The vitamin D hypothesis.** Allergy. 2012, 67:10-7. 10.1111/j.1398-9995.2011.02711.x

15. Esposito S, Lelii M: **Vitamin D and respiratory tract infections in childhood.** BMC Infect Dis. 2015, 15:487.

16. Laaksi I, Ruohola JP, Tuohimaa P, Auvinen A, Haataja R, Pihlajamäki H, Ylikomi T: **An association of serum vitamin D concentrations & 40 nmol/L with acute respiratory tract infection in young Finnish men.** Am J Clin Nutr. 2007, 86:714-7. 10.1093/ajcn/86.3.714

17. Ginde AA, Mansbach JM, Camargo CA Jr: **Association between serum 25-hydroxyvitamin D level and upper respiratory tract infection in the Third National Health and Nutrition Examination Survey.** Arch Intern Med. 2009, 169:384-90. 10.1001/archinternmed.2008.560

18. Najada AS, Habashneh MS, Khader M: **The frequency of nutritional rickets among hospitalized infants and its relation to respiratory diseases.** J Trop Pediatr. 2004, 50:364-8. 10.1093/tropej/50.6.364

19. Mandell LA, Whitney CG. **Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults.** Clin Infect Dis 2007; 44:S27-72.

20. Manaseki-Holland S, Qader G, et al. **Effects of vitamin D supplementation to children diagnosed with pneumonia in Kabul: A randomized controlled trial.** Trop Med Int Health 2010; 15:1148-55.

21. White JH. **Vitamin D as an inducer of cathelicidin antimicrobial peptide expression: Past, present and future.** J Steroid Biochem Mol Biol 2010; 121:234-8.

22. Williams B, Williams AJ, Anderson ST. **Vitamin D deficiency and insufficiency in children with tuberculosis.** Pediatr Infect Dis J 2008; 27:941-2.

23. Pascale GD, Vallecoccia MS, Schiattarella A, et al. **Clinical and microbiological outcome in septic patients with extremely low 5-hydroxyvitamin D levels at initiation of critical care.** Clin Microbiol Infect 2016; 22:e7-13.

24. Gunville CF, Mourani PM, Ginde AA. **The role vitamin D in prevention and treatment of infection.** Inflamm Allergy Drug Targets 2013; 12:239-45.

25. Lambert AA, Kirk GD, Astemborski J, et al. **A cross sectional analysis of the role of the antimicrobial peptide cathelicidin in lung function impairment within the A-LIVE cohort.** PLoS One 2014; 9:e95099.

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Jahanzeb Khan Afridi	Conceived and designed the analysis.	
2	Rahida Karim	Performed the analysis & wrote the paper.	
3	Shumaila Khan	Data collection.	
4	Huma Gul	Literature review.	
5	Gul-e-Lala	Literature review.	
6	Tahir Ahmad	Data collection.	