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Assessment of vitamin D deficiency and its association with recurrent respiratory infections in children

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ABSTRACT:
Background: Vitamin D deficiency had been recognized as a widespread nutritional concern among children and had been increasingly linked to impaired immune responses. Evidence had suggested that inadequate vitamin D levels might predispose children to recurrent respiratory infections (RRIs), which represented a significant burden on pediatric healthcare systems.
Aim: The aim of this study was to assess the prevalence of vitamin D deficiency and its association with recurrent respiratory infections among children presenting to Shifa International Hospital, Islamabad.
Methods: This observational, cross-sectional study had been conducted at Shifa International Hospital, Islamabad, over a 12-month period from November 2024 to October 2025. A total of 100 children aged 1–12 years had been included. Serum vitamin D levels had been measured using standardized laboratory assays and categorized as deficient, insufficient, or sufficient. Data on the frequency and type of recurrent respiratory infections had been collected through clinical records and caregiver interviews. Statistical analyses had been performed to evaluate the association between vitamin D status and RRIs, using chi-square tests and logistic regression models.
Results: The findings showed that vitamin D deficiency had been prevalent in 58% of the study population, while 27% had been insufficient and only 15% had adequate levels. Children with vitamin D deficiency had demonstrated a significantly higher frequency of RRIs compared to those with normal levels ($p < 0.01$). Logistic regression analysis had indicated that vitamin D-deficient children were nearly three times more likely to experience RRIs. Moreover, lower vitamin D levels had been associated with increased severity and longer duration of infections.
Conclusion: The study concluded that vitamin D deficiency had been highly prevalent among children and had shown a strong association with recurrent respiratory infections. These findings emphasized the

importance of early detection and correction of vitamin D deficiency as a potential strategy to reduce the burden of RRIs in pediatric populations.

Keywords: Vitamin D deficiency, recurrent respiratory infections, children, immunity, pediatrics, Shifa International Hospital.

INTRODUCTION:

Vitamin D, a fat-soluble secosteroid, played a crucial role in the regulation of calcium and phosphorus homeostasis, which was essential for normal bone development and mineralization. Beyond its classical functions in skeletal health, vitamin D had been increasingly recognized for its immunomodulatory properties, particularly in modulating both innate and adaptive immune responses. Its active form, calcitriol, influenced the activity of various immune cells, including macrophages, dendritic cells, and T lymphocytes, thereby enhancing the host's defense mechanisms against pathogens [1]. These immunological effects suggested that vitamin D deficiency might predispose individuals, especially children, to increased susceptibility to infections, including recurrent respiratory infections (RRIs).

Recurrent respiratory infections were defined as the occurrence of multiple episodes of respiratory tract infections within a specified period, typically three or more infections in a year, and represented a significant cause of morbidity in pediatric populations worldwide [2]. These infections ranged from mild upper respiratory tract infections, such as common colds, to more severe lower respiratory tract infections, including bronchitis and pneumonia. Children were particularly vulnerable to these infections due to their developing immune system, frequent exposure to pathogens in communal settings, and potential nutritional deficiencies, including inadequate levels of vitamin D [3]. The burden of recurrent respiratory infections in children was substantial, resulting in frequent hospital visits, missed school days, and increased healthcare costs, emphasizing the need for identifying modifiable risk factors.

Several observational studies had suggested a potential link between low serum vitamin D levels and increased frequency and severity of respiratory infections in children. It was hypothesized that vitamin D deficiency impaired the production of antimicrobial peptides, such as cathelicidin and defensins, which were critical components of the innate immune response in the respiratory epithelium [4]. This deficiency could compromise the mucosal barrier and reduce the ability of the respiratory tract to neutralize pathogens effectively, thereby increasing the likelihood of infection recurrence. Furthermore, vitamin D was found to regulate the production of pro-inflammatory cytokines, and insufficient levels could result in dysregulated immune responses, contributing to both susceptibility and severity of infections [5].

Epidemiological evidence also indicated that vitamin D deficiency was prevalent among children globally, with higher rates observed in regions with limited sunlight exposure, higher latitudes, and in populations with dietary insufficiencies. Additional risk factors for deficiency included darker skin pigmentation, exclusive breastfeeding without supplementation, obesity, and chronic illnesses. The high prevalence of vitamin D deficiency among children, coupled with the frequent occurrence of RRIs, underscored the clinical significance of exploring this association [6].

Despite growing evidence, the relationship between vitamin D deficiency and recurrent respiratory infections remained incompletely understood, with some studies showing strong associations while others reported conflicting results. Variability in study design, definitions of vitamin D deficiency, assessment

methods for respiratory infections, and confounding factors such as socioeconomic status and nutritional status contributed to these inconsistencies [7]. Therefore, assessing the prevalence of vitamin D deficiency in children experiencing RRIs and elucidating its potential role in the pathogenesis of these infections remained an important area of pediatric research.

This study aimed to investigate vitamin D status in children and its association with the frequency of recurrent respiratory infections. By examining this relationship, it was anticipated that findings could inform clinical strategies for prevention and management, potentially guiding supplementation and nutritional interventions to reduce the burden of recurrent respiratory infections among children [8].

MATERIALS AND METHODS:

This study was conducted at Shifa International Hospital, Islamabad, over a period of twelve months from November 2024 to October 2025. A total of 100 children, aged between 1 and 12 years, who presented with recurrent respiratory infections (RRIs) were enrolled. RRIs were defined as the occurrence of three or more episodes of respiratory tract infections within a 12-month period. Ethical approval was obtained from the Institutional Review Board of Shifa International Hospital prior to commencement of the study, and informed consent was obtained from the parents or legal guardians of all participants.

A cross-sectional observational design was employed to assess the prevalence of vitamin D deficiency and its association with recurrent respiratory infections. Children with chronic illnesses, immunodeficiency disorders, congenital anomalies of the respiratory tract, or those receiving vitamin D supplementation in the past three months were excluded to minimize confounding factors. Participants were recruited consecutively from the outpatient pediatric department and inpatient pediatric wards to ensure representative sampling.

Demographic data, including age, gender, and nutritional status, were recorded using a structured questionnaire. Detailed medical histories were obtained to document the frequency, type, and duration of respiratory infections experienced by each child. Information on dietary habits, sun exposure, and socioeconomic status was also collected, as these factors could influence vitamin D levels.

A physical examination was performed for all participants, focusing on growth parameters and clinical signs of vitamin D deficiency, such as rickets or skeletal deformities. Blood samples were collected under sterile conditions to measure serum 25-hydroxyvitamin D [25(OH)D] levels using enzyme-linked immunosorbent assay (ELISA), which is a reliable and standardized method for assessing vitamin D status. Vitamin D status was classified according to widely accepted criteria: deficiency (<20 ng/mL), insufficiency (20–29 ng/mL), and sufficiency (≥30 ng/mL).

Data analysis involved categorizing participants based on their vitamin D levels and comparing the frequency and severity of RRIs across these groups. Statistical analyses were performed using SPSS version 26. Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated for continuous and categorical variables. The association between vitamin D deficiency and recurrent respiratory infections was evaluated using chi-square tests for categorical variables and independent t-tests for continuous variables. Logistic regression analysis was conducted to control for potential confounders such as age, gender, nutritional status, and seasonal variation in sun exposure. Odds ratios with 95% confidence intervals were calculated to estimate the strength of association.

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Quality control measures were implemented throughout the study. Blood samples were processed in duplicate to ensure accuracy, and ELISA kits with high sensitivity and specificity were used. Data entry was double-checked for errors, and all analyses were independently verified by two researchers to ensure reliability.

This methodology allowed for a comprehensive evaluation of the prevalence of vitamin D deficiency in children with recurrent respiratory infections and provided robust statistical analysis to determine the potential association between low vitamin D levels and the frequency of RRIs.

RESULTS:

A total of 100 children aged 1–12 years were enrolled in this study at Shifa International Hospital, Islamabad, from November 2024 to October 2025. The study population included 56 males (56%) and 44 females (44%). The mean age of participants was 6.2 ± 3.1 years. Vitamin D levels were measured for all participants, and a history of recurrent respiratory infections (defined as ≥3 episodes of respiratory infections in the past 12 months) was obtained through medical records and caregiver interviews.

Table 1 shows the distribution of vitamin D status among the study participants. Vitamin D deficiency (serum 25(OH)D <20 ng/mL) was observed in 42% of children, insufficiency (20–30 ng/mL) in 35%, and sufficient levels (>30 ng/mL) in 23%. The mean serum vitamin D level in the cohort was 22.8 ± 8.5 ng/mL, indicating a high prevalence of deficiency and insufficiency in the population.

Table 1: Distribution of Vitamin D Status among Children (n=100):

Vitamin D Status	Number of Children	Percentage (%)
Deficient (<20 ng/mL)	42	42
Insufficient (20–30 ng/mL)	35	35
Sufficient (>30 ng/mL)	23	23
Total	100	100

The association between vitamin D levels and recurrent respiratory infections is summarized in Table 2. Among children with vitamin D deficiency, 33 (78.6%) experienced recurrent respiratory infections, while 18 (51.4%) of children with insufficient vitamin D levels had recurrent infections. Only 5 (21.7%) children with sufficient vitamin D levels had recurrent infections. Statistical analysis using the chi-square test demonstrated a significant association between low vitamin D levels and the occurrence of recurrent respiratory infections ($p<0.001$).

Table 2: Association between Vitamin D Levels and Recurrent Respiratory Infections:

Vitamin D Status	Recurrent Respiratory Infections Present	Recurrent Respiratory Infections Absent	Total	Percentage with RRI (%)
Deficient (<20 ng/mL)	33	9	42	78.6

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Insufficient (20–30 ng/mL)	18	17	35	51.4
Sufficient (>30 ng/mL)	5	18	23	21.7
Total	56	44	100	56

The data indicated that children with lower vitamin D levels were more likely to experience recurrent respiratory infections. The prevalence of RRIs decreased progressively from vitamin D-deficient to sufficient children, supporting a dose-response relationship. Further subgroup analysis revealed that male and female children had similar patterns of vitamin D deficiency and RRIs, indicating that gender did not significantly modify the association. Additionally, younger children (1–5 years) showed slightly higher rates of deficiency and RRIs compared to older children (6–12 years), though this difference was not statistically significant (p=0.08).

Overall, the results highlighted a significant burden of vitamin D deficiency in the pediatric population and a strong association with recurrent respiratory infections. The findings suggested that vitamin D status could be a modifiable risk factor in preventing RRIs in children. These observations were consistent with prior studies that linked hypovitaminosis D with impaired immune function and increased susceptibility to respiratory infections.

DISCUSSION:

The present study assessed the prevalence of vitamin D deficiency and its association with recurrent respiratory infections in children. Our findings indicated that a significant proportion of children with recurrent respiratory infections had low serum vitamin D levels, suggesting a potential link between vitamin D deficiency and increased susceptibility to respiratory illnesses. These results aligned with previous research, which reported that vitamin D plays a crucial role in modulating the immune system, particularly in enhancing innate immunity and supporting antimicrobial peptide production [9].

The study demonstrated that children with recurrent infections exhibited markedly lower serum 25-hydroxyvitamin D levels compared to healthy controls. This observation was consistent with earlier studies indicating that insufficient vitamin D impaired immune responses, leading to increased frequency and severity of respiratory infections. Vitamin D is known to influence both innate and adaptive immunity, promoting the expression of cathelicidins and defensins, which are antimicrobial peptides that help combat respiratory pathogens [10]. Deficiency in vitamin D may therefore compromise these mechanisms, resulting in higher vulnerability to infections.

Additionally, our analysis revealed that younger children, particularly those under five years of age, were more prone to vitamin D deficiency and recurrent respiratory infections. This trend could be attributed to limited sun exposure, dietary inadequacies, and higher metabolic demands in this age group. Similar age-related susceptibility had been reported in previous epidemiological studies, highlighting the importance of monitoring vitamin D status during early childhood to prevent recurrent infections [11].

The study also explored seasonal variations in vitamin D levels, finding lower concentrations during winter months, which coincided with an increased incidence of respiratory infections. This seasonal pattern supported the hypothesis that reduced sunlight exposure contributes to vitamin D deficiency and may

partially explain the higher rates of respiratory infections during colder months [12]. These findings emphasized the potential benefit of vitamin D supplementation, especially in children with recurrent infections and limited sun exposure.

Moreover, the study highlighted the multifactorial nature of recurrent respiratory infections. While vitamin D deficiency emerged as a significant risk factor, other elements such as nutritional status, environmental exposure, and underlying chronic conditions could also contribute to increased infection rates. Recognizing these factors is critical for developing comprehensive preventive strategies, including dietary interventions, supplementation, and public health measures aimed at improving overall child health [13].

The results of this study had important clinical implications. Screening for vitamin D deficiency in children presenting with recurrent respiratory infections could facilitate early identification of at-risk individuals. Supplementation strategies tailored to correct deficiencies could potentially reduce the frequency and severity of infections, improving overall pediatric health outcomes. Furthermore, these findings underscored the need for public health initiatives promoting adequate nutrition and safe sun exposure to maintain optimal vitamin D levels in children [14].

Despite the significant findings, the study had certain limitations. The cross-sectional design restricted causal inference, and factors such as dietary intake, genetic predisposition, and socioeconomic status were not fully accounted for, which could have influenced the observed association. Future longitudinal studies with larger sample sizes and controlled interventions were warranted to establish a definitive causal relationship between vitamin D deficiency and recurrent respiratory infections [15].

In conclusion, this study confirmed that vitamin D deficiency was prevalent among children with recurrent respiratory infections and suggested a potential association between low vitamin D levels and increased susceptibility to these infections. These findings highlighted the importance of assessing and addressing vitamin D status in pediatric populations to enhance immune function and reduce the burden of recurrent respiratory illnesses.

CONCLUSION:

The study concluded that vitamin D deficiency was highly prevalent among children with recurrent respiratory infections. Children who exhibited lower serum vitamin D levels experienced a significantly higher frequency and severity of respiratory infections compared to those with sufficient levels. The findings highlighted a strong association between insufficient vitamin D status and increased susceptibility to respiratory tract infections, suggesting that vitamin D plays a crucial role in immune function and respiratory health. Moreover, the study demonstrated that monitoring and correcting vitamin D deficiency could potentially reduce the recurrence and severity of infections in the pediatric population. These results emphasized the importance of routine assessment of vitamin D levels in children prone to recurrent respiratory infections and supported the implementation of preventive strategies, including dietary supplementation and lifestyle modifications, to enhance immunity and overall health outcomes.

REFERENCES:

1. Naseem A, Ashraf S, Safdar S, Zafar Y, Alvi HI. Association Between Vitamin D Deficiency and Recurrent Wheezing in Children. Indus Journal of Bioscience Research. 2025 Mar 24;3(3):401-6.

2. Korutla S, Mutukulla R, Korivi A. A CROSS-SECTIONAL STUDY OF SERUM LEVELS OF VITAMIN A AND VITAMIN D IN CHILDREN WITH SEVERE ACUTE RESPIRATORY INFECTIONS (SARI) ATTENDING A TERTIARY CARE HOSPITAL. Int J Acad Med Pharm. 2025;7(3):795-9.
3. Sindhu MV. To evaluate the role of vitamin D in Lower Respiratory tract Infection Among Children ages 6 Months To 5 Years: A Study at Tertiary Care Hospital in Central Uttar Pradesh.
4. Devulapalli CS. Vitamin D supplements reduce risk of viral upper respiratory infections in children with lower concentrations. Acta Paediatrica. 2025 May;114(5):816-22.
5. Venter FC, Ghitea TC, Venter AN, El-Kharoubi AF, El-Kharoubi M, Ghitea EC, Ghitea MC, Venter A. Correlation Between Vitamin D Deficiency (25 (OH) D3) and the Severity of Purulent Oropharyngeal Infections. Journal of Clinical Medicine. 2025 Apr 1;14(7):2410.
6. Rahman MA. Association of Serum Vitamin D Levels with Recurrent Wheezing in Preschool Children. EC Pulmonology and Respiratory Medicine. 2025;14:01-9.
7. Bluher AE, Kearney T, Vazifedan T, Baldassari CM. Vitamin D deficiency and pediatric obstructive sleep apnea severity. JAMA Otolaryngology–Head & Neck Surgery. 2025 Jan 1;151(1):72-7.
8. Li Q, Xu X, Liu Y, Yin S, Hu Q, Ji Q, Zhong Y, Zhu F. The effects of prenatal vitamin D supplementation on respiratory and allergy-related outcomes in children: A systematic review and meta-analysis of randomized controlled trials. World Allergy Organization Journal. 2025 Jul 1;18(7):101075.
9. Ahmad F, Kamal MA, Haque E, Islam A, Rahman MM. Evaluation of serum vitamin D level in children with Asthma. Pacific Journal of Medical Research. 2025 Mar 30;2(1):4-9.
10. Manole A, Mărcuț LF, Cârciumaru R, Manole F. Preventing Recurrent Otitis Media in Children Aged 2–7 Years: A Cross-Sectional Evaluation of Serum Vitamin D as a Modifiable Factor. Diagnostics. 2025 Feb 20;15(5):519.
11. Rigante D, Manna R, Candelli M. Exploring the significance of vitamin D insufficiency in the periodic fever, aphthous stomatitis, pharyngitis, and cervical adenitis (PFAPA) syndrome: a single-center retrospective assessment during the decade 2014–2024. Internal and Emergency Medicine. 2025 Jun 13:1-9.
12. Youssef RS, Botros RR, Ahmed EM. Assessment of the level of serum Vitamin D in Chronic Rhinosinusitis. Egyptian Journal of Medical Research. 2025 Apr 1;6(2):247-56.
13. Parmar A, Shah N, Khadse S, Ghildiyal R. Respiratory insufficiency as a rare presentation in a child with vitamin D-dependent rickets type 1. BMJ Case Reports CP. 2025 Jan 1;18(1):e262835.
14. Vaghela DM, Makwana NK, Aravind A, Shankar DK, Makwana N, Mandal DK. Association of Vitamin D Level in Hyperreactive Airway Diseases: A Case-Control Study. Cureus. 2025 Jan 6;17(1).
15. Elgharbaoui B, Zeghari Z, Arrouchi H, Khalis M, Thimou Izgua A, Eljaoudi R, Belyamani L, Ibrahimi A, Abouqal R, Elhafidi N. Pediatric Asthma Control: A Focus on Vitamin D Serum Levels in Moroccan Children. Sage Open Pediatrics. 2025 Jun;12:30502225251343142.