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Original Research Article

Association Between Vitamin D Deficiency and Severity of Acute Respiratory Infections in Pediatric and Adult Patients

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Abstract: ***Background:*** Vitamin D deficiency is common and may be associated with increased severity of acute respiratory infections (ARIs). Objective: To determine the association between vitamin D deficiency and severity of ARIs among pediatric and adult patients. ***Methodology***: This analytical cross-sectional study was conducted at Pakistan from January to December 2025. The patient population utilized was 200 (100.00%) patients with ARI who were collected by non-probability consecutive sampling which included 100 (50.00%) pediatric and 100 (50.00%) adult patients. The levels of 25(OH)D in the serum were classified as deficient (<20 ng/mL), insufficient (20–29 ng/mL), or sufficient (≥30 ng/mL). Severity of ARI was determined based on age-appropriate clinical criteria. Chi-square/Fisher's exact and multivariable logistic regression were used to analyze associations and $p<0.05$ was considered statistically significant. ***Results***: Vitamin D deficiency was present in 106 (53.00%) patients, including 57 (57.00%) pediatric and 49 (49.00%) adult patients. Severe ARI occurred in 36 (33.96%) vitamin D-deficient patients compared with 9 (16.67%) patients with insufficiency and 4 (10.00%) with sufficient vitamin D ($p<0.001$). Mean 25(OH)D concentrations decreased progressively with increasing severity in pediatric patients (24.36 ± 10.21, 18.92 ± 8.17, and 13.41 ± 6.82 ng/mL for mild, moderate, and severe ARI, respectively; $p<0.001$) and adults (25.18 ± 10.74, 19.74 ± 9.03, and 14.29 ± 7.16 ng/mL; $p<0.001$). Vitamin D deficiency was associated with severe ARI overall (OR=2.82, 95% CI: 1.48–5.39; $p=0.002$) and remained independently associated after adjustment (aOR=2.84, 95% CI: 1.43–5.64; $p=0.003$). ***Conclusion***: Vitamin D deficiency was common and independently associated with greater severity of ARI among pediatric and adult patients.

Keywords: Vitamin D deficiency; acute respiratory infection; disease severity; 25-hydroxyvitamin D; pediatric patients; adults.

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INTRODUCTION

Acute respiratory infections (ARIs) are one of the major causes of morbidity and mortality in all age groups around the world. These include upper respiratory tract infections and the various lower respiratory tract diseases such as pneumonia and bronchiolitis, which can be more than an ordinary cold and may be life threatening [1,2]. Lower respiratory infections remain a significant global burden of disease, and a major risk factor for vulnerable groups, especially children [3]. Several factors are important in determining disease severity, such as age, nutritional status, immune function, underlying comorbidity and the causative pathogen. Although pneumonia is not a major cause of morbidity or mortality among children, it continues to be a significant killer, highlighting the need for factors associated with severe respiratory illness to be identified [1,4].

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Vitamin D plays an important role in calcium homeostasis and skeletal health, but also an important role in immune regulation. Vitamin D receptors are found in multiple immune cells and vitamin D signaling in these cells has been shown to modulate innate and adaptive immune responses [5,6]. It stimulates the production of antimicrobial peptides such as cathelicidin and β-defensins, which help the body defend against bacterial and viral infections [7]. Vitamin D might also help maintain the integrity of the respiratory epithelial barrier and control inflammatory responses, which may help to reduce excess inflammation during infection [5]. Even with all of these functions, vitamin D deficiency is still widespread worldwide, in all geographical regions and in all age groups. The observations have led to a great interest in studying if insufficient vitamin D is correlated with susceptibility to respiratory infections and/or severity of the illness [8].

The association between vitamin D deficiency and incidence, progression and clinical outcomes of respiratory infections have been studied but results are inconsistent. Lower levels of 25-hydroxyvitamin D have been linked to higher rates and severity of acute respiratory tract infections (ARTIs) in a systematic review and meta-analysis of observational studies [9]. The same study, when restricted to children with LRTIs, revealed lower vitamin D levels among kids suffering from LRTIs, and a link between vitamin D and the severity of the infection [10]. However, the results of RCTs have been inconsistent, with some showing no effects from vitamin D supplementation in the prevention of respiratory infections, while others have found varying effects depending on the vitamin D levels of the subjects, the dosage and treatment schedule, and the populations studied [11,12]. The conflicting results may be due to variations in age distribution, definition of vitamin D deficiency, type of infections, and severity criteria.

There is limited and inconsistent evidence directly looking at the relationship between vitamin D deficiency and severity of acute respiratory infections in children and adults. Comparative evidence is especially important to establish if this association varies by age group, after controlling for relevant clinical and demographic variables.

Research Objective

To determine the association between vitamin D deficiency and the severity of acute respiratory infections in pediatric and adult patients.

MATERIALS AND METHODS

Study Design and Setting

Association of vitamin D deficiency and severity of acute respiratory infections (ARIs) in pediatric and adult patients was studied by analytical cross-sectional study. This study was performed in Pakistan, a tertiary-care hospital, giving medical treatment to both pediatric and adult patients. The study lasted for one year from January 2025 to December 2025.

Sample Size and Sampling Technique

The total number of patients in the study was 200, of which 100 were pediatric and 100 were adult patients. The sample was split into two age groups so that they could be compared. Consecutive sampling was employed, a non-probability sampling method. The assessment of all eligible patients presenting to the study setting during the study period for inclusion was performed until the required number of patients was reached.

Study Population

The study population included, pediatric and adult patients diagnosed with ARI at PIMS, Islamabad. Patients were segmented into two age groups: pediatric patients (less than 18 years) and adult patients (18 years or older). To enable comparison of the association of vitamin D status with ARI severity between children and adults, 100 patients were selected for each age group.

Inclusion and Exclusion Criteria

This study included patients diagnosed with acute respiratory infections (ARI) with vitamin D levels available and clinical severity assessment performed and who met the set age criteria. Patients were divided into paediatric (age < 18 years) and adults (age ≥ 18 years). Adult participants and/or parents/legal guardians of pediatric participants, as applicable, provided informed consent. The study protocol excluded patients with chronic kidney disease, chronic liver disease, and current high-dose vitamin D therapy. Patients without clinical data or who had vitamin D level data that could not be obtained were also excluded from the relevant analyses.

Data Collection Procedure

Data was obtained by adopting a structured proforma which the researcher designed in consultation with the study supervisor and with the help of the various staff members of the hospital for identifying eligible patients and accessing the patients' clinical records. Data such as age, sex, clinical information (presenting symptoms, duration of illness, specific ARI diagnosis, comorbidities, examination results, laboratory results, treatment needs and clinical outcomes) were captured. 25-hydroxyvitamin D [25(OH)D] level was measured and participants were categorized based on vitamin D status. Where available, clinical data relevant to the severity of ARI such as respiratory distress, oxygen saturation, supplemental oxygen use, hospitalization and admission to intensive care were noted. Data was collected using patient interviews, clinical inspection and hospital medical records. Participants age was recorded in years and for subgroup analysis, pediatric patients (those who were younger than 18 years) were compared to adult patients (aged 18 years or older). Association between vitamin D status and severity of ARI was

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analyzed in the overall study population and by age group (pediatric and adult patients).

Assessment of Vitamin D Status

Serum 25-hydroxyvitamin D [25(OH)D] concentrations were used to assess vitamin D status. Deficiency was considered to be serum 25(OH)D levels < 20 ng/mL; insufficiency was defined as serum 25(OH)D levels 20–29 ng/mL; and sufficiency was defined as serum 25(OH)D levels ≥ 30 ng/mL. Laboratory data for vitamin D status was used to calculate the levels of each participant. For pediatric patients, severity was assessed based on the pediatric criteria, and for adult patients, based on the adult criteria, in order to ensure appropriate comparisons between the two age groups.

Assessment of Acute Respiratory Infection Severity

The severity of ARI was determined by a set of prespecified clinical criteria, depending on the age and diagnosis. Clinical parameters such as respiratory distress, oxygen saturation, need for supplemental oxygen, hospitalization, need for intensive care, and other pertinent complications were recorded. Age appropriateness was determined with age appropriate clinical criteria for pediatric and adult patients.

Study Variables

Vitamin D status, and specifically deficiency of vitamin D, was the independent variable, and the dependent variable was severity of ARI. Confounding factors included age, gender, nutritional status, other clinical factors and comorbidities. Age group (pediatric or adult) was considered a grouping variable for comparative analysis.

Data Analysis

IBM SPSS Statistics software was used for data analysis. Demographic, clinical data were summarized using descriptive statistics. Categorical variables were summarized using frequencies and percentages and continuous variables using means and standard deviations or median and interquartile ranges, depending on the type of data collected. Associations between vitamin D status and the severity of ARI were determined using either the chi-square test or Fisher's exact test. When appropriate, potential confounding factors were controlled for using multivariable regression analysis. The association of vitamin D status with the severity of ARI was also explored independently in children and adults. To determine if the association observed differed by age group, comparisons between the two age groups were made. A p-value of < 0.05 was defined as statistically significant.

RESULTS

The mean age was 8.74 ± 4.61 years among pediatric patients and 42.36 ± 15.28 years among adults, with a significant difference between the groups (p<0.001), shown in table 1. Among pediatric patients, 28.00% were aged <5 years, 42.00% were 5–12 years, and 30.00% were 13–17 years, while among adults, 43.00% were aged 18–39 years, 36.00% were 40–59 years, and 21.00% were ≥60 years. Males constituted 56.00% of pediatric and 61.00% of adult participants, with no significant difference in sex distribution (p=0.475).

Table 1. Demographic characteristics of study participants

Characteristic		Pediatric (n=100)	Adult (n=100)	Test value	p-value
Age (years)	**Mean ± SD**	8.74 ± 4.61	42.36 ± 15.28	t=22.41	<0.001
Age group (n;%)	<5 years	28 (28.00%)	—	—	—
	5–12 years	42 (42.00%)	—		
	13–17 years	30 (30.00%)	—		
	18–39 years	—	43 (43.00%)		
	40–59 years	—	36 (36.00%)		
	≥60 years	—	21 (21.00%)		
Gender (n;%)	Male	56 (56.00%)	61 (61.00%)	χ^2=0.51	0.475
	Female	44 (44.00%)	39 (39.00%)		

Note: Independent-samples t-test and chi-square test.

Fever was reported in 91.00% of pediatric and 84.00% of adult patients, while cough was present in 87.00% and 89.00%, respectively (table 2). Difficulty in breathing occurred in 39.00% of pediatric and 47.00% of adult patients, whereas chest pain was significantly more frequent among adults (29.00% vs. 8.00%, p<0.001). Pneumonia was the most common ARI diagnosis in both groups, affecting 41.00% of pediatric and 47.00% of adult patients, while bronchiolitis was more frequent among pediatric patients (24.00% vs. 7.00%).

Table 2. Clinical characteristics and type of acute respiratory infection

Clinical characteristic		Pediatric (n=100)	Adult (n=100)	Test value	p-value
Presenting symptoms (n;%)	Fever	91 (91.00%)	84 (84.00%)	χ^2=2.45	0.118
	Cough	87 (87.00%)	89 (89.00%)	χ^2=0.19	0.663
	Difficulty in breathing	39 (39.00%)	47 (47.00%)	χ^2=1.29	0.256

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	Sore throat	31 (31.00%)	44 (44.00%)	χ^2=3.56	0.059
	Wheezing	26 (26.00%)	18 (18.00%)	χ^2=1.92	0.166
	Chest pain	8 (8.00%)	29 (29.00%)	χ^2=16.31	<0.001
Type of ARI, n (%)	Upper respiratory tract infection	35 (35.00%)	38 (38.00%)	χ^2=0.22	0.639
	Pneumonia	41 (41.00%)	47 (47.00%)		
	Bronchiolitis	24 (24.00%)	7 (7.00%)		
	Other ARI	0 (0.00%)	8 (8.00%)		

Note: Chi-square test

Vitamin D deficiency was observed in 57.00% of pediatric and 49.00% of adult patients, while vitamin D insufficiency was present in 25.00% and 29.00%, respectively (table 3). Vitamin D sufficiency was observed in 18.00% of pediatric and 22.00% of adult patients, with no significant difference in vitamin D categories between the groups (p=0.362). Mean serum 25(OH)D concentration was 18.72 ± 9.46 ng/mL in pediatric patients and 20.81 ± 10.73 ng/mL in adults, with no significant difference (p=0.143).

Table 3. Vitamin D status according to age group

Vitamin D status		**Pediatric (n=100)**	**Adult (n=100)**	**Test value**	**p-value**
Vitamin D category, n (%)	Deficient (<20 ng/mL)	57 (57.00%)	49 (49.00%)	χ^2=2.03	0.362
	Insufficient (20–29 ng/mL)	25 (25.00%)	29 (29.00%)		
	Sufficient (≥30 ng/mL)	18 (18.00%)	22 (22.00%)		
Serum 25(OH)D, mean ± SD (ng/mL)		18.72 ± 9.46	20.81 ± 10.73	t=1.47	0.143

Note: Chi-square test and independent-samples t-test.

Among pediatric patients, 42.00% had mild, 36.00% had moderate, and 22.00% had severe ARI, compared with 39.00%, 34.00%, and 27.00%, respectively, among adults (table 4). The distribution of ARI severity did not differ significantly between pediatric and adult patients (p=0.650).

Table 4. ARI severity according to age group

ARI severity	**Pediatric (n=100)**	**Adult (n=100)**	**Test value**	**p-value**
Mild	42 (42.00%)	39 (39.00%)	χ^2=0.86	0.650
Moderate	36 (36.00%)	34 (34.00%)		
Severe	22 (22.00%)	27 (27.00%)		

Note: Chi-square test

A significant association was observed between vitamin D status and ARI severity (p<0.001). Among vitamin D-deficient patients, 30.19% had mild, 35.85% had moderate, and 33.96% had severe ARI (table 5). In comparison, severe ARI occurred in 16.67% of vitamin D-insufficient patients and 10.00% of vitamin D-sufficient patients, indicating a greater proportion of severe disease among patients with vitamin D deficiency.

Table 5. Association between vitamin D status and ARI severity

Vitamin D status	**Mild n (%)**	**Moderate n (%)**	**Severe n (%)**	**Test value**	**p-value**
Deficient (<20 ng/mL)	32 (30.19%)	38 (35.85%)	36 (33.96%)	χ^2=18.74	<0.001
Insufficient (20–29 ng/mL)	25 (46.30%)	20 (37.04%)	9 (16.67%)		
Sufficient (≥30 ng/mL)	24 (60.00%)	12 (30.00%)	4 (10.00%)		

Note: Chi-square test

Vitamin D deficiency was associated with increased odds of severe ARI in both age groups (table 6). Among pediatric patients, severe ARI occurred in 42.11% of vitamin D-deficient patients compared with 23.26% of non-deficient patients (OR=2.40, 95% CI: 0.97–5.93; p=0.058). Among adults, severe ARI occurred in 51.02% of deficient patients compared with 23.53% of non-deficient patients (OR=3.39, 95% CI: 1.31–8.77; p=0.011). Overall, vitamin D deficiency was significantly associated with severe ARI (OR=2.82, 95% CI: 1.48–5.39; p=0.002).

Table 6. Association between vitamin D deficiency and severe ARI according to age group

Age group	**Vitamin D status**	**Severe ARI n (%)**	**Non-severe ARI n (%)**	**Test value**	**p-value**
Pediatric	Deficient	24 (42.11%)	33 (57.89%)	OR=2.40 (95% CI: 0.97–	0.058

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	Not deficient	10 (23.26%)	33 (76.74%)	5.93)	
Adult	Deficient	25 (51.02%)	24 (48.98%)	OR=3.39 (95% CI: 1.31–8.77)	0.011
	Not deficient	12 (23.53%)	39 (76.47%)		
Overall	Deficient	49 (46.23%)	57 (53.77%)	OR=2.82 (95% CI: 1.48–5.39)	0.002
	Not deficient	22 (23.40%)	72 (76.60%)		

Serum 25(OH)D concentrations decreased progressively with increasing ARI severity in both age groups (table 7). Among pediatric patients, mean vitamin D levels were 24.36 ± 10.21 ng/mL in mild, 18.92 ± 8.17 ng/mL in moderate, and 13.41 ± 6.82 ng/mL in severe ARI ($p<0.001$). Similarly, among adults, mean levels were 25.18 ± 10.74, 19.74 ± 9.03, and 14.29 ± 7.16 ng/mL for mild, moderate, and severe disease, respectively ($p<0.001$).

Table 7. Serum 25(OH)D concentration according to ARI severity

Age group	ARI severity	n	Mean ± SD (ng/mL)	Median (IQR)	Test value	p-value
Pediatric	Mild	42	24.36 ± 10.21	23.1 (16.4–30.2)	H=16.84	<0.001
	Moderate	36	18.92 ± 8.17	18.1 (13.2–23.8)		
	Severe	22	13.41 ± 6.82	12.6 (8.7–17.4)		
Adult	Mild	39	25.18 ± 10.74	24.2 (17.3–31.4)	H=17.92	<0.001
	Moderate	34	19.74 ± 9.03	18.5 (13.8–25.2)		
	Severe	27	14.29 ± 7.16	13.5 (9.1–18.6)		

Note: Kruskal-Wallis test.

Vitamin D deficiency was significantly associated with several indicators of greater ARI severity (table 8). Respiratory distress was observed in 57.55% of deficient compared with 32.98% of non-deficient patients ($p<0.001$), while oxygen saturation <92% occurred in 45.28% versus 26.60% ($p=0.006$). Supplemental oxygen requirement, hospital admission, and ICU admission were also significantly more frequent among deficient patients (49.06% vs. 29.79%, $p=0.006$; 79.25% vs. 60.64%, $p=0.005$; and 25.47% vs. 10.64%, $p=0.007$, respectively). Mechanical ventilation did not differ significantly between groups (11.32% vs. 4.26%, $p=0.072$).

Table 8. Association between vitamin D deficiency and clinical indicators of ARI severity

Clinical severity indicator		Vitamin D deficient (n=106)	Not deficient (n=94)	Test value	p-value
Respiratory severity indicators	Respiratory distress	61 (57.55%)	31 (32.98%)	χ^2=12.07	<0.001
	Oxygen saturation <92%	48 (45.28%)	25 (26.60%)	χ^2=7.56	0.006
	Supplemental oxygen required	52 (49.06%)	28 (29.79%)	χ^2=7.58	0.006
	Hospital admission	84 (79.25%)	57 (60.64%)	χ^2=7.78	0.005
	ICU admission	27 (25.47%)	10 (10.64%)	χ^2=7.24	0.007
	Mechanical ventilation	12 (11.32%)	4 (4.26%)	χ^2=3.24	0.072

Note: Chi-square test.

After adjustment for potential confounding factors, vitamin D deficiency remained significantly associated with severe ARI (adjusted OR=2.84, 95% CI: 1.43–5.64; $p=0.003$), shown in table 9. Age (adjusted OR=1.02, 95% CI: 1.00–1.04; $p=0.041$), poor nutritional status (adjusted OR=1.89, 95% CI: 1.01–3.55; $p=0.047$), and comorbidity (adjusted OR=2.17, 95% CI: 1.12–4.21; $p=0.022$) were also independently associated with severe ARI. Male sex and duration of illness were not significantly associated with severe disease ($p=0.548$ and $p=0.081$, respectively).

Table 9. Multivariable logistic regression analysis of factors associated with severe ARI

Predictor	Adjusted OR	95% CI	Wald test	p-value
Vitamin D deficiency	**2.84**	**1.43–5.64**	8.72	**0.003**
Age	1.02	1.00–1.04	4.18	0.041
Male sex	1.21	0.65–2.25	0.36	0.548
Poor nutritional status	1.89	1.01–3.55	3.96	0.047
Comorbidity	2.17	1.12–4.21	5.23	0.022
Duration of illness	1.08	0.99–1.18	3.05	0.081

DISCUSSION

In the present study, vitamin D deficiency was found to be very common in patients with acute respiratory infection (ARI) with 57.00% of the pediatric and 49.00% of the adult patients were vitamin D deficient. Mean 25(OH)D level was also low in both groups, children (18.72 ± 9.46 ng/mL) and adults (20.81 ± 10.73 ng/mL). While the difference between age groups was not

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significant (p=0.143), these results suggest there is a significant proportion of patients with ARI with inadequate vitamin D status. This is corroborated by the systematic review and meta-analysis conducted by Pham et al. (2019) who documented an inverse relationship between serum 25(OH)D concentration and ARI, with the lowest category of vitamin D having the highest odds of severity of ARI (pooled OR=2.46, 95% CI: 1.65–3.66) [9].

One of the key results of the current study is that there was a definite correlation between vitamin D status and severity of ARI. The incidence of severe ARI was 33.96% in vitamin D deficient patients, 16.67% in vitamin D insufficient patients and 10.00% in vitamin D sufficient patients (p<0.001). Similarly, mean serum 25(OH)D progressively decreased from 24.36 ± 10.21 ng/mL in mild to 18.92 ± 8.17 ng/mL in moderate and 13.41 ± 6.82 ng/mL in severe pediatric ARI; corresponding adult values were 25.18 ± 10.74, 19.74 ± 9.03, and 14.29 ± 7.16 ng/mL (both p<0.001). The results obtained were similar to those of Georgakopoulou et al. (2020) who reported that vitamin D levels decreased in a progressive manner from the least to the most severe Pneumonia Severity Index class [13].

The sub-group analysis also confirmed that the vitamin D deficiency was significantly correlated with severe disease, especially among adults. In adults, severe ARI occurred in 51.02% of vitamin D-deficient patients compared with 23.53% of non-deficient patients (OR=3.39, 95% CI: 1.31–8.77; p=0.011). Similar direction of association was seen, but not found to be statistically significant, for pediatric patients (42.11% to 23.26% versus 23.26%, OR=2.40, 95% CI: 0.97–5.93; p=0.058). Overall, severe ARI was found to be associated with a 2.82-fold increased risk due to vitamin D deficiency compared to having sufficient levels (95% CI: 1.48–5.39; p=0.002). These results corroborated Talebi et al. (2019) who reported that severe community-acquired pneumonia and mortality were associated with low vitamin D status, suggesting that vitamin D status could be clinically important for severity of respiratory diseases [14].

Clinically relevant severity parameters were also in accordance with the present results. Vitamin D-deficient patients had significantly higher frequencies of respiratory distress (57.55% vs. 32.98%; p<0.001), oxygen saturation <92% (45.28% vs. 26.60%; p=0.006), supplemental oxygen requirement (49.06% vs. 29.79%; p=0.006), hospital admission (79.25% vs. 60.64%; p=0.005), and ICU admission (25.47% vs. 10.64%; p=0.007). Deficient patients had mechanical ventilation more often than those who were not deficient, although not statistically significant (11.32% vs. 4.26%, p=0.072). Similar findings have been reported in hospitalized children with pneumonia with the vitamin D deficiency linked with the increased requirement for escalation of antibiotic therapy, PICU admission, and the requirement for respiratory support [15].

Importantly, this association remained after controlling for potential confounding factors. Multivariable logistic regression showed that vitamin D deficiency independently predicted severe ARI (adjusted OR=2.84, 95% CI: 1.43–5.64; p=0.003), while age (aOR=1.02, 95% CI: 1.00–1.04; p=0.041), poor nutritional status (aOR=1.89, 95% CI: 1.01–3.55; p=0.047), and comorbidity (aOR=2.17, 95% CI: 1.12–4.21; p=0.022) were also significant predictors. This is a finding consistent with previous study in whom vitamin D deficiency predictively added to a set of known severity scores and independent of any other factor to the prognosis in community-acquired pneumonia (CAP) patients hospitalized with CAP [16,17].

However, the association is not seen as evidence of a direct causal link between vitamin D deficiency and a worsening of severe ARI. The results of randomized trials have been inconsistent; e.g., high dose supplementation was not associated with reduction in symptom severity of ARI in 703 healthy children, but a more recent trial indicated a reduction in ARI sick-days after supplementation [18,19]. In this cross-sectional study, therefore, the current results confirm vitamin D as a potential marker of the severity of ARI, but cannot provide evidence of the cause of the therapeutic effect. However, the consistency of association, across vitamin D categories, clinical severity indicators, and adjusted analysis, lends support to the evidence that low vitamin D status may be used to identify patients with higher risk for severe ARI.

Strengths and Limitations

One of the strengths of this study is that patients of all ages who had been hospitalized with ARI were included, providing the ability to compare vitamin D levels and disease severity between children and adults within a clinical setting. Vitamin D status was evaluated based on serum 25(OH)D levels, and correlated with various clinically important measures of severity, such as respiratory distress, oxygen saturation, supplemental oxygen use, hospitalisation, and admission to the intensive care unit. The study further used multivariable logistic regression to adjust for potential confounding factors such as age, gender, nutritional status, comorbidities, and illness duration. There are a number of caveats, however. Due to the cross-sectional design, a temporal and/or causal relationship between the severity of ARI and vitamin D deficiency cannot be made. The results of this non-probability consecutive sampling from one tertiary-care hospital may not necessarily be generalizable to the rest of Pakistan. The possibility of residual confounding due to sunlight exposure, dietary vitamin D intake, socioeconomic status, previous supplementation and seasonal variation cannot be ruled out. Additionally, vitamin D levels were assessed at the time of ARI, making it hard to differentiate between the levels before and after the ARI. These restrictions need

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to be validated by prospective multicenter studies and randomized clinical trials.

CONCLUSION

A deficiency of vitamin D was prevalent in children and adults with acute respiratory infections and positively correlated with severity of the infection. Patients with severe ARI were more likely to be vitamin D deficient, and there was a step-wise relationship between the serum 25(OH)D level and the severity of the ARI. Respiratory distress, lower oxygen saturation, supplemental oxygen need, and hospitalization and admission to the I.C.U were also associated with vitamin D deficiency. Importantly, vitamin D deficiency was independently associated with severe ARI even after adjusting for potential confounding factors and the odds were about 2.8-fold higher in vitamin D deficient patients. These findings suggest that vitamin D status may serve as a useful marker for identifying ARI patients at increased risk of severe disease; however, given the cross-sectional nature of the study, vitamin D deficiency should not be interpreted as a proven causal factor. Further prospective and interventional studies are needed to determine whether correction of vitamin D deficiency can reduce the severity and complications of ARI.

REFERENCES

1. World Health Organization. Pneumonia in children. Geneva: WHO; 2022. Available from: https://www.who.int/westernpacific/newsroom/fact-sheets/detail/pneumonia
2. GBD 2016 Lower Respiratory Infections Collaborators. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of lower respiratory infections in 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Infect Dis. 2018;18(11):1191-1210. doi: 10.1016/S1473-3099(18)30310-4.
3. King C, McCollum ED. Trends in the global burden of paediatric lower respiratory infections. Lancet Infect Dis. 2020;20(1):4-5. doi: 10.1016/S1473-3099(19)30557-2.
4. GBD 2019 Diseases and Injuries Collaborators. Global burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2020;396(10258):1204-1222. doi: 10.1016/S0140-6736(20)30925-9.
5. Schwalfenberg GK. A review of the critical role of vitamin D in the functioning of the immune system and the clinical implications of vitamin D deficiency. Mol Nutr Food Res. 2011;55(1):96-108. doi: 10.1002/mnfr.201000174.
6. White JH. Emerging roles of vitamin D-induced antimicrobial peptides in antiviral innate immunity. Nutrients. 2022;14(2):284. doi: 10.3390/nu14020284.
7. Hamza FN, Daher S, Fakhoury HM, Grant WB, Kvietys PR, Al-Kattan K. Immunomodulatory properties of vitamin D in the intestinal and respiratory systems. Nutrients. 2023 Mar 30;15(7):1696.
8. Cui A, Zhang T, Xiao P, Fan Z, Wang H, Zhuang Y. Global and regional prevalence of vitamin D deficiency in population-based studies from 2000 to 2022: a pooled analysis of 7.9 million participants. Front Nutr. 2023;10:1070808. doi: 10.3389/fnut.2023.1070808.
9. Pham H, Rahman A, Majidi A, Waterhouse M, Neale RE. Acute respiratory tract infection and 25-hydroxyvitamin D concentration: a systematic review and meta-analysis. Int J Environ Res Public Health. 2019;16(17):3020. doi: 10.3390/ijerph16173020.
10. Jat KR. Vitamin D deficiency and lower respiratory tract infections in children: a systematic review and meta-analysis of observational studies. Trop Doct. 2017;47(1):77-84. doi: 10.1177/0049475516644141.
11. Martineau AR, Jolliffe DA, Hooper RL, Greenberg L, Aloia JF, Bergman P, et al. Vitamin D supplementation to prevent acute respiratory tract infections: systematic review and meta-analysis of individual participant data. BMJ. 2017;356:i6583. doi: 10.1136/bmj.i6583.
12. Marusca LM, Reddy G, Blaj M, Prathipati R, Rosca O, Bratosin F, Bogdan I, Horhat RM, Tapos GF, Marti DT, Susan M, Pingilati RA, Horhat FG, Adelina M. The Effects of Vitamin D Supplementation on Respiratory Infections in Children under 6 Years Old: A Systematic Review. Diseases. 2023 Aug 8;11(3):104. doi: 10.3390/diseases11030104
13. Georgakopoulou VE, Mantzouranis K, Damaskos C, Karakou E, Melemeni D, Mermigkis D, Petsinis G, Sklapani P, Trakas N, Tsiafaki X. Correlation Between Serum Levels of 25-Hydroxyvitamin D and Severity of Community-Acquired Pneumonia in Hospitalized Patients Assessed by Pneumonia Severity Index: An Observational Descriptive Study. Cureus. 2020 Jul 1;12(7):e8947. doi: 10.7759/cureus.8947.
14. Talebi F, Rasooli Nejad M, Yaseri M, Hadadi A. Association of Vitamin D Status with the Severity and Mortality of Community-Acquired Pneumonia in Iran during 2016-2017: A Prospective Cohort Study. Rep Biochem Mol Biol. 2019 Apr;8(1):85-90.
15. Garg D, Bhalla K, Nanda S, Gupta A, Mehra S. Vitamin D status in children with community acquired pneumonia and its association with severity: a hospital-based study. Minerva Pediatr (Torino). 2024 Apr;76(2):227-235. doi: 10.23736/S2724-5276.21.06036-9.
16. Remmelts HH, van de Garde EM, Meijvis SC, Peelen EL, Damoiseaux JG, Grutters JC, Biesma DH, Bos WJ, Rijkers GT. Addition of vitamin D status to prognostic scores improves the prediction of outcome in community-acquired pneumonia. Clin Infect Dis. 2012 Dec;55(11):1488-94. doi:

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10.1093/cid/cis751.

17. Kazi, A. K., Jatoi, A., & Hashmani, H. (2025). An Empirical Evaluation of Technology Acceptance Model in Mobile Devices in Healthcare Industry. Journal of Development and Social Sciences, 6(3), 707-714. https://doi.org/10.47205/jdss.2025(6-III)60
18. Jatoi, A., Bibi, M., Hashmani, H., & Ramish, M. S. (2025). Awareness of Patients' Rights and the Respect and Dignity Experienced at Hospitals in Karachi, Pakistan. International Journal of Trends and Innovations in Business & Social Sciences, 3(3), 232-243. https://doi.org/10.5281/zenodo.17359794
19. Hueniken K, Aglipay M, Birken CS, Parkin PC, Loeb MB, Thorpe KE, Dai DWH, Laupacis A, Mamdani M, Mazzulli T, Maguire JL; TARGet Kids! Collaboration. Effect of High-Dose Vitamin D Supplementation on Upper Respiratory Tract Infection Symptom Severity in Healthy Children. Pediatr Infect Dis J. 2019 Jun;38(6):564-568. doi: 10.1097/INF.0000000000002225.

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