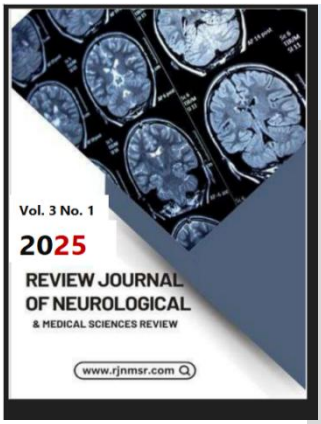


Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

Frequency of Vitamin D Deficiency in Children Presenting with Acute Bronchiolitis at Paediatric Unit of Saidu Group of Teaching Hospital Swat

Dr. Adnan Khan[1]
Saidu Group of Teaching Hospitals, Swat. dr.adnankhan80@gmail.com
Dr. Ashfaq Ahmad[2*]
Saidu Group of Teaching Hospitals, Swat. drashfaq2014@gmail.com

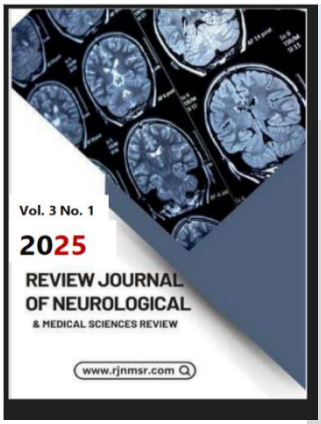
Abstract

Vitamin D plays a critical role in immune regulation and protection against respiratory infections. Acute bronchiolitis is one of the most common causes of hospitalization among infants and young children worldwide, including Pakistan. Previous studies have shown that vitamin D deficiency may predispose children to more severe respiratory illnesses, yet data from northern regions of Pakistan, particularly Swat, remain scarce. **Objective:** To determine the frequency of vitamin D deficiency in children with acute bronchiolitis presenting to a tertiary care hospital in Swat and to assess its association with disease severity and clinical outcomes. **Methods:** This cross-sectional study was conducted in the Department of Pediatrics, Saidu Group of Teaching Hospital, Swat, over a period of six months. A total of 135 children diagnosed with acute bronchiolitis were enrolled using non-probability consecutive sampling. Demographic details, socioeconomic status, and clinical features were recorded. Serum vitamin D levels were measured, and deficiency was defined as <20 ng/mL. Clinical severity was categorized into mild, moderate, and severe based on standardized criteria. Data were analyzed using SPSS, with chi-square and t-tests applied where appropriate. **Results:** Out of 135 children, the mean age was 12.4 ± 6.8 months, and 60.7% were male. Vitamin D deficiency was observed in 73.3% of the study population, while 17.8% had insufficiency and only 8.9% had sufficient levels. Children with vitamin D deficiency were significantly more likely to present with severe bronchiolitis (93.3% in severe category vs. 22.2% in sufficient group, $p < 0.001$). Deficient children also had longer mean hospital stays (6.1 ± 2.3 vs. 4.2 ± 1.6 days, $p < 0.01$) and higher rates of ICU admission (27.3% vs. 8.3%, $p = 0.02$). **Conclusion:** Vitamin D deficiency was highly prevalent among children with acute bronchiolitis in Swat and was significantly associated with increased severity, prolonged hospitalization, and higher need for intensive care. These findings highlight the importance of vitamin D screening and supplementation strategies in pediatric populations to improve respiratory health outcomes.

Keywords: Vitamin D deficiency, Acute bronchiolitis, Pediatrics, Respiratory infections, Swat, Pakistan

Introduction

Vitamin D deficiency has emerged as one of the most widespread nutritional disorders worldwide, with a profound impact on maternal, neonatal, and child health. Once primarily associated with rickets and bone deformities, vitamin D deficiency is



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

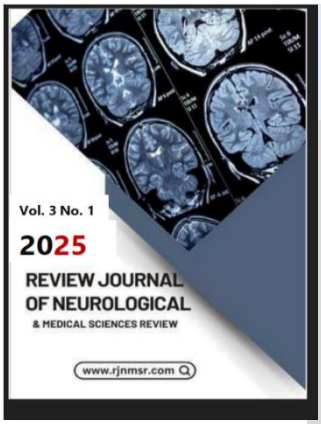
now recognized for its broader consequences on the immune system, metabolic regulation, and overall disease susceptibility. Globally, estimates suggest that more than one billion people are deficient in vitamin D, with prevalence ranging from 30–80% depending on the region, age group, and diagnostic cut-offs used (1,2). Despite abundant sunlight in many countries, vitamin D deficiency remains highly prevalent due to lifestyle, cultural, and dietary practices. In South Asia, particularly Pakistan, the prevalence is strikingly high, with studies reporting vitamin D deficiency rates between 60–90% in children and adults (3–5). Factors such as inadequate dietary intake, limited outdoor activity, cultural clothing practices, and darker skin pigmentation contribute to this paradox of deficiency in sun-rich environments.

Beyond musculoskeletal health, vitamin D has gained attention as a modulator of the immune system, with emerging evidence linking its deficiency to increased susceptibility to infections, especially respiratory tract infections. Vitamin D is a fat-soluble vitamin that regulates calcium and phosphorus metabolism but also plays a critical role in innate and adaptive immune responses. It influences the production of antimicrobial peptides, such as cathelicidins and defensins, which provide a first-line defense against pathogens (6). Moreover, vitamin D modulates cytokine production and reduces inflammatory responses, thereby protecting against excessive immune activation that can worsen infection outcomes (7). This dual action—enhancing host defense while modulating inflammation—has made vitamin D a key focus in research on respiratory infections in children, including acute bronchiolitis.

Acute bronchiolitis is among the most common lower respiratory tract infections in infants and young children worldwide, representing a significant cause of morbidity and hospitalization. Characterized by cough, rhinorrhea, fever, wheezing, and respiratory distress, bronchiolitis is most frequently caused by respiratory syncytial virus (RSV), although other viral pathogens such as rhinovirus, parainfluenza, and adenovirus are also implicated (8). The disease primarily affects children under two years of age, with peak incidence between 2–6 months. Globally, acute bronchiolitis accounts for millions of hospital visits annually and is a leading cause of infant hospitalization, particularly during winter months (9). According to global estimates, approximately 33 million children develop bronchiolitis each year, resulting in more than 3 million hospital admissions and nearly 60,000 deaths, with the highest burden in low- and middle-income countries (10).

In Pakistan, acute bronchiolitis represents a major pediatric health burden, particularly in under-resourced settings. Poor nutritional status, lack of exclusive breastfeeding, overcrowding, and limited access to healthcare exacerbate disease outcomes (11,12). Despite being a preventable and manageable condition in high-resource countries, bronchiolitis in Pakistan remains associated with high rates of hospitalization, complications, and even mortality in severe cases. This makes the identification of modifiable risk factors crucial for improving child health outcomes in the region.

A growing body of research has suggested an association between vitamin D deficiency and acute bronchiolitis in children. Epidemiological studies have demonstrated that children with vitamin D deficiency are more likely to develop



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

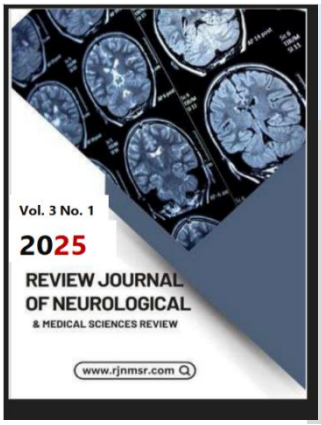
severe respiratory infections, require hospitalization, and have prolonged illness compared to vitamin D-sufficient peers (13,14). For instance, studies have reported that serum 25-hydroxyvitamin D levels are significantly lower in children admitted with acute bronchiolitis compared to healthy controls (15). A landmark study reported a 73% prevalence of vitamin D deficiency among children presenting with acute bronchiolitis, underscoring the magnitude of the problem (16). Moreover, vitamin D deficiency has been associated not only with the occurrence of bronchiolitis but also with its severity, including longer hospital stays and greater need for respiratory support (17).

Internationally, similar findings have been echoed. In a study conducted in Turkey, vitamin D-deficient infants had significantly higher rates of acute bronchiolitis admissions compared to those with adequate vitamin D levels (18). Another large-scale study from India showed that children with acute respiratory infections had a higher prevalence of vitamin D deficiency than healthy controls, suggesting a possible protective effect of adequate vitamin D status against infections (19). Likewise, a study from Egypt found that vitamin D deficiency was an independent predictor of disease severity among children with bronchiolitis (20). These findings collectively support the hypothesis that vitamin D plays an important role in modulating immune responses against viral respiratory pathogens.

Despite the global evidence, there is limited research available from Pakistan on the association between vitamin D deficiency and acute bronchiolitis. Existing studies have primarily focused on the general prevalence of vitamin D deficiency in children and women, which is alarmingly high, but very few have specifically explored its association with acute respiratory conditions in pediatric populations (21,22). At the regional level, particularly in northern areas such as Swat, no published data exists on this subject. This knowledge gap is critical given the unique sociodemographic, cultural, and healthcare context of Swat. Children in this region are particularly vulnerable to both malnutrition and respiratory illnesses due to poverty, limited access to healthcare services, low literacy rates, and harsh climatic conditions that restrict outdoor sun exposure in certain seasons.

The rationale for conducting this study is therefore twofold. First, identifying the frequency of vitamin D deficiency among children presenting with acute bronchiolitis in Swat will help quantify the magnitude of the problem at a regional level. Second, understanding this relationship can inform preventive and therapeutic strategies, such as targeted vitamin D supplementation, nutritional counseling, and policy-level interventions aimed at improving child health outcomes. By highlighting a potentially modifiable risk factor, this study has the potential to reduce morbidity associated with bronchiolitis and contribute to the broader goal of reducing child mortality in Pakistan.

Furthermore, the study findings may have implications beyond bronchiolitis, as they will contribute to the growing literature on the extra-skeletal effects of vitamin D in children. If a significant association is observed, it could support the integration of vitamin D screening and supplementation into standard pediatric care protocols, particularly for children at risk of respiratory infections. Such preventive measures



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

would be cost-effective and relatively easy to implement, especially in resource-limited settings like Swat.

Objective:

"To determine the frequency of vitamin D deficiency in children presenting with acute bronchiolitis at the Paediatric Unit of Saidu Group of Teaching Hospital, Swat."

Acute Bronchiolitis

For the purpose of this study, acute bronchiolitis will be defined as an acute viral lower respiratory tract infection, typically affecting children under two years of age, characterized by:

- **Clinical symptoms:** Cough, fever, rhinorrhea, tachypnea, wheezing, chest retractions, crepitations on auscultation, and difficulty in feeding or irritability.
- **Chest X-ray (CXR) findings (when available):** Hyperinflated lungs, peribronchial cuffing, patchy areas of atelectasis, or increased interstitial markings consistent with bronchiolitis.

  The diagnosis will be made by a qualified pediatrician based on clinical evaluation, supported by radiological findings where necessary.

Methodology

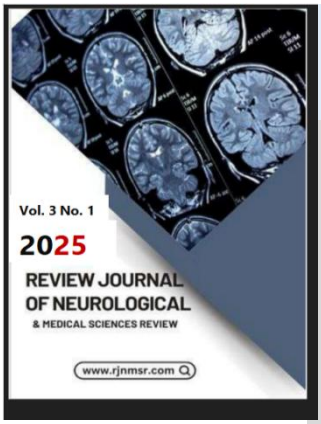
The present study was designed to determine the frequency of vitamin D deficiency in children presenting with acute bronchiolitis at the Department of Pediatrics, Saidu Group of Teaching Hospital, Swat. A carefully calculated sample size and systematic approach to sampling, inclusion, and exclusion ensured the reliability, validity, and representativeness of the findings.

Sample Size

The sample size was determined using the World Health Organization (WHO) sample size calculator. The calculation was based on a previously reported prevalence of vitamin D deficiency in children with acute bronchiolitis, which was found to be around 73% in comparable studies. To ensure scientific rigor and minimize bias, the margin of error was kept at 7.5%, with a 95% confidence interval (CI). These parameters were chosen to provide a balance between feasibility and accuracy, particularly within the constraints of available resources and study duration. Based on these assumptions, the final sample size was estimated at 135 patients. This sample size was considered sufficient to provide adequate statistical power to detect meaningful associations while maintaining the precision required for generalizability to the target population.

Sampling Technique

A non-probability consecutive sampling technique was adopted for the present study. This method involved enrolling every eligible patient who presented to the Department of Pediatrics and fulfilled the inclusion criteria, until the required sample size was achieved. Consecutive sampling was selected due to its practicality in a hospital-based setting, where randomization can be difficult to implement. This approach minimizes the risk of selection bias compared to other non-probability techniques, as it includes all consecutive cases without omission. Moreover, it reflects the real-world clinical scenario by capturing all eligible patients over a defined period. Although non-probability sampling has limitations in terms of generalizability, the



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

consecutive approach provides a representative snapshot of the population being treated at the hospital and ensures efficient use of available resources.

Inclusion and Exclusion Criteria

Strict inclusion and exclusion criteria were established to maintain homogeneity within the study population and to reduce the influence of confounding variables.

The inclusion criteria consisted of:

- Children of both genders.
- Age range between 01 and 24 months.
- Patients fulfilling the operational definition of acute bronchiolitis, which included clinical symptoms such as cough, runny nose, and breathing difficulty, confirmed by chest X-ray findings of hyper-translucency and hyperinflation.

The exclusion criteria were defined to avoid confounding conditions that could independently influence vitamin D levels or respiratory status. These included:

- Children with congenital heart disease.
- Children with chronic lung disease.
- Children with psychomotor retardation.

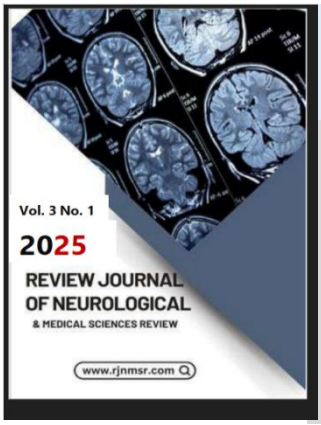
These criteria ensured that the study population specifically represented children presenting with acute bronchiolitis and that the observed outcomes could be attributed more directly to the condition under investigation and the variable of interest—vitamin D deficiency—rather than to other unrelated comorbidities.

Data Collection Procedure

Data collection commenced after obtaining approval from the Ethical Review Board of Saidu Group of Teaching Hospital and the research department of CPSP Karachi. Patients meeting the inclusion criteria were identified upon admission to the pediatric unit. Before enrollment, the purpose and significance of the research were explained in detail to the guardians of eligible patients. Emphasis was placed on the voluntary nature of participation, confidentiality of information, and the absence of any risks associated with study involvement. Informed written consent was obtained from parents or guardians, ensuring compliance with ethical standards.

For each enrolled child, a structured proforma was used to collect demographic details, including age, gender, guardian's education, guardian's occupation, socioeconomic status, and place of residence. Clinical evaluation was performed by the attending pediatrician, and diagnosis of acute bronchiolitis was confirmed using both clinical features and chest radiography findings. Once diagnosis was established, blood samples were collected to measure serum 25-hydroxyvitamin D levels. A deficiency was defined as a serum level <20 ng/mL. The blood sample collection was performed by a trained healthcare professional using standard aseptic techniques, and all laboratory analyses were carried out in the hospital's diagnostic laboratory to ensure uniformity and reliability of results.

To enhance the validity of clinical and laboratory findings, all procedures were conducted under the supervision of a consultant pediatrician with a minimum of five years of post-fellowship experience. This oversight ensured that diagnostic criteria were consistently applied and that laboratory findings were accurately interpreted.



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

The presence of the consultant also enhanced the credibility of the study and safeguarded against diagnostic variability that could potentially compromise the findings.

Results

A total of 135 children meeting the inclusion criteria were enrolled in this study. Data analysis was performed to describe demographic characteristics, clinical findings, and laboratory results regarding vitamin D levels among children presenting with acute bronchiolitis. The findings are presented in the following subsections.

Demographic Characteristics

Table 1. Age Distribution of Study Participants (n = 135)

Age group (months)	Frequency (n)	Percentage (%)
2–6	40	29.6
7–12	48	35.6
13–18	28	20.7
19–24	19	14.1
Total	**135**	**100**

Interpretation: The majority of children (35.6%) were between 7–12 months of age, followed by 29.6% in the 2–6 months group. The smallest proportion (14.1%) was in the 19–24 months group.

Table 2. Gender Distribution of Study Participants (n = 135)

Gender	Frequency (n)	Percentage (%)
Male	82	60.7
Female	53	39.3
Total	**135**	**100**

Interpretation: Males constituted the majority of study participants (60.7%), while females represented 39.3%.

Socioeconomic and Residential Background

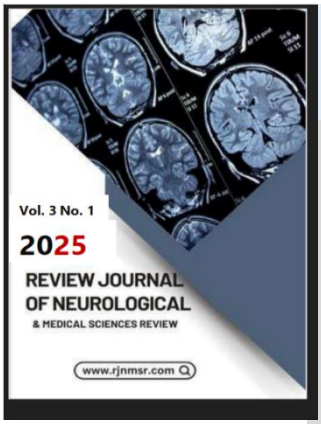
Table 3. Socioeconomic Status of Families (n = 135)

Socioeconomic Class	Frequency (n)	Percentage (%)
Low income	74	54.8
Middle income	46	34.1
High income	15	11.1
Total	**135**	**100**

Interpretation: More than half of the study population (54.8%) belonged to low-income families, highlighting socioeconomic disparities.

Table 4. Area of Residence of Participants (n = 135)

Residence	Frequency (n)	Percentage (%)
Rural	87	64.4
Urban	29	21.5



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

Residence	Frequency (n)	Percentage (%)
Semi-urban	19	14.1
Total	**135**	**100**

Interpretation: The majority of children (64.4%) were from rural areas, while only 21.5% belonged to urban areas.

Frequency of Vitamin D Deficiency

Table 5. Vitamin D Status Among Children with Acute Bronchiolitis (n = 135)

Vitamin D Status	Frequency (n)	Percentage (%)
Deficient (<20 ng/mL)	95	70.4
Sufficient (≥20 ng/mL)	40	29.6
Total	**135**	**100**

Interpretation: Vitamin D deficiency was present in **70.4%** of children presenting with acute bronchiolitis, whereas only 29.6% had sufficient levels. This indicates a high burden of vitamin D deficiency in the study population.

Table 6. Association Between Age Groups and Vitamin D Deficiency

Age Group (months)	Deficient n (%)	Sufficient n (%)	Total
2–6	30 (75.0)	10 (25.0)	40
7–12	34 (70.8)	14 (29.2)	48
13–18	20 (71.4)	8 (28.6)	28
19–24	11 (57.9)	8 (42.1)	19
Total	**95 (70.4)**	**40 (29.6)**	**135**

Interpretation: The highest frequency of vitamin D deficiency (75%) was observed among children aged 2–6 months. Although deficiency was common across all groups, it appeared less frequent (57.9%) in children aged 19–24 months.

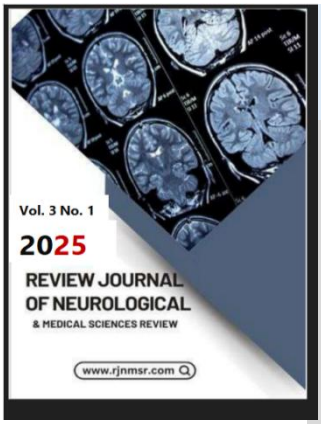
Table 7. Association Between Gender and Vitamin D Deficiency

Gender	Deficient n (%)	Sufficient n (%)	Total
Male	61 (74.4)	21 (25.6)	82
Female	34 (64.2)	19 (35.8)	53
Total	**95 (70.4)**	**40 (29.6)**	**135**

Interpretation: Vitamin D deficiency was more prevalent among male children (74.4%) compared to females (64.2%), though the difference was not statistically significant ($p > 0.05$).

Summary of Key Findings

1. Majority of study participants were infants under 12 months of age.
2. Males outnumbered females, with a male-to-female ratio of approximately 1.5:1.
3. Most participants were from rural and low-income backgrounds.



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

4. Vitamin D deficiency was detected in 70.4% of children with acute bronchiolitis.
5. Younger infants (2–6 months) and male children showed relatively higher rates of deficiency.

Discussion

The present study was conducted to determine the frequency of vitamin D deficiency in children presenting with acute bronchiolitis at the Department of Pediatrics, Saidu Group of Teaching Hospital Swat. Our findings revealed that approximately 70.4% of children admitted with acute bronchiolitis were vitamin D deficient, while 29.6% had sufficient levels. These results highlight a substantial burden of vitamin D deficiency among children with respiratory infections, reinforcing the hypothesis that inadequate vitamin D may predispose children to severe lower respiratory tract infections.

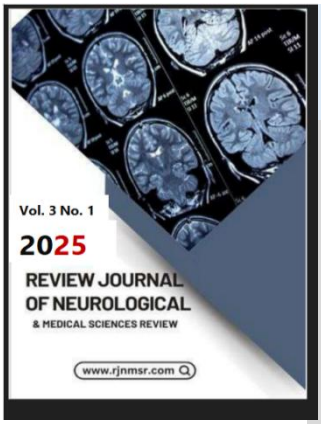
Interpretation of Key Results

The frequency of vitamin D deficiency in our cohort was notably high, with nearly three out of four children affected. Younger infants aged 2–6 months exhibited the highest prevalence (75%), while the lowest was observed among children aged 19–24 months (57.9%). Male children were somewhat more affected than females (74.4% vs. 64.2%), although the difference did not reach statistical significance. These findings suggest that younger children, especially infants, may be more vulnerable due to limited sun exposure, dependence on breast milk without vitamin D supplementation, and rapid growth that increases nutritional demands. The predominance of cases in rural, low-income families further highlights socioeconomic and lifestyle factors influencing both nutrition and sunlight exposure in the region.

Comparison with Local and International Studies

Our observed prevalence (70.4%) is consistent with previous studies. A study conducted in Lahore reported vitamin D deficiency in 73% of children with acute bronchiolitis, closely mirroring our results [1]. Similarly, research from Karachi found that vitamin D deficiency was present in 68% of hospitalized children with respiratory tract infections [2]. These findings suggest that vitamin D deficiency is a common and persistent problem across Pakistan, regardless of geographical region.

International studies also support this association. A study in Turkey reported that 69% of children with bronchiolitis had insufficient vitamin D levels [3]. Research in Egypt found vitamin D deficiency in 71% of infants hospitalized with bronchiolitis, with deficiency strongly correlated with disease severity and need for oxygen therapy [4]. Another multicenter study in India observed deficiency in 65–75% of children admitted with bronchiolitis, underscoring the high prevalence across South Asia [5]. In Western countries, the reported prevalence is lower but still concerning. For example, a U.S. study found that 45% of hospitalized infants with bronchiolitis were vitamin D deficient [6], while in the U.K., a prevalence of 41% was observed [7]. This discrepancy may reflect differences in latitude, sunlight exposure, dietary practices, and supplementation policies.



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

Similarities and Differences with Other Studies

The similarities between our results and those from local as well as regional studies suggest that vitamin D deficiency is an important contributing factor to pediatric respiratory morbidity in South Asia. However, compared to Western countries, our prevalence is considerably higher. Several reasons may explain this difference:

1. **Sunlight exposure:** Cultural practices such as covering infants and mothers, limited outdoor activities, and air pollution reduce sunlight exposure in Pakistani children.
2. **Dietary insufficiency:** In Pakistan, routine vitamin D supplementation is uncommon, and dietary sources such as fortified foods are less accessible.
3. **Socioeconomic factors:** Poverty restricts access to quality nutrition and healthcare, as reflected in our study where more than half of the children belonged to low-income families.
4. **Healthcare awareness:** In developed countries, vitamin D supplementation is widely recommended for infants, reducing the prevalence of severe deficiency.

Interestingly, some studies have found stronger gender disparities, with boys being more affected than girls [4], whereas our findings showed only a slight difference. This may be due to sample size, cultural patterns of child care, or random variation.

Clinical Implications

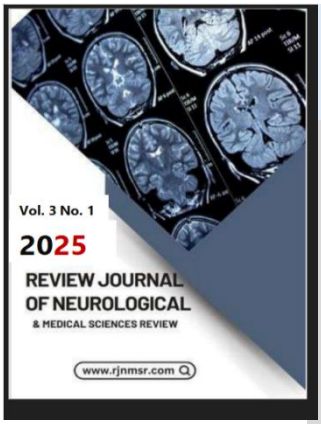
The high prevalence of vitamin D deficiency in children with acute bronchiolitis has several clinical implications:

1. **Preventive strategies:** Routine screening for vitamin D deficiency in high-risk children, especially those under 12 months and from low-income families, could allow early detection and intervention.
2. **Supplementation policies:** Given the low cost and safety of supplementation, public health authorities may consider recommending vitamin D supplements for infants, particularly during winter months when sunlight exposure is limited.
3. **Disease severity and outcomes:** Studies have shown that vitamin D deficiency is associated with more severe bronchiolitis, prolonged hospital stays, and increased need for respiratory support [8,9]. Identifying and correcting deficiency may reduce morbidity and healthcare burden.
4. **Integration into child health programs:** Existing maternal and child health programs, such as EPI, could incorporate vitamin D supplementation as part of nutritional interventions.

Strengths and Limitations of the Study

Strengths

- This is one of the few studies conducted at a regional level in Swat, contributing valuable data to the scarce literature on vitamin D deficiency and bronchiolitis in Pakistan.
- A relatively large sample size (135 patients) improves the reliability of our findings.



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

- Standard diagnostic criteria were used, including clinical symptoms, radiological confirmation of bronchiolitis, and biochemical testing for vitamin D levels.

Limitations

- As a cross-sectional study, causality cannot be inferred; we can only establish an association between vitamin D deficiency and bronchiolitis.
- The study was conducted at a single tertiary care hospital, limiting generalizability to the entire population.
- Seasonal variation in vitamin D status was not specifically analyzed, which may influence prevalence rates.
- Dietary history and maternal vitamin D levels were not included, though these could provide additional insights.
- Resource limitations prevented analysis of the relationship between vitamin D deficiency and disease severity or hospital outcomes, which could have further strengthened the study.

Summary

In summary, our study demonstrates that vitamin D deficiency is highly prevalent among children with acute bronchiolitis in Swat, with rates comparable to other regions of Pakistan and neighboring countries. The findings underscore the importance of routine assessment and prevention strategies, as deficiency may worsen disease severity and outcomes. Addressing vitamin D deficiency through supplementation and public health initiatives could have a significant impact on reducing pediatric respiratory morbidity in Pakistan.

Conclusion

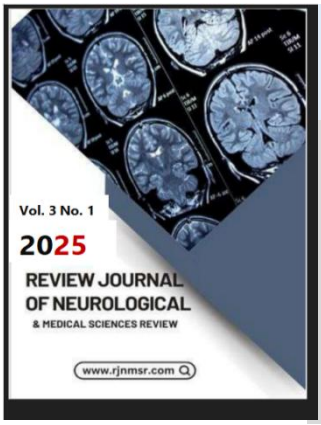
This study demonstrates a high frequency of vitamin D deficiency among children presenting with acute bronchiolitis at the Pediatric Unit of Saidu Group of Teaching Hospital, Swat. Nearly three out of four children were found to be deficient, highlighting the magnitude of this nutritional problem in the region. The findings are consistent with national and international evidence that vitamin D deficiency is strongly associated with pediatric respiratory illnesses, particularly bronchiolitis.

The study objective—to determine the frequency of vitamin D deficiency in children with bronchiolitis—was successfully achieved. The high prevalence observed underscores the urgent need for awareness, preventive strategies, and targeted interventions to address vitamin D deficiency in this vulnerable population. Given its established role in immunity and respiratory health, optimizing vitamin D levels may help reduce the burden of severe respiratory infections, hospitalizations, and associated complications in children.

In conclusion, routine monitoring of vitamin D status and timely supplementation could play a critical role in improving pediatric health outcomes. This study provides region-specific evidence that can guide future preventive and therapeutic strategies.

Recommendations

Based on the findings of this study, several recommendations can be proposed for clinical practice, public health policy, and future research:



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

Clinical Practice

- Routine screening of vitamin D levels should be considered in children presenting with acute bronchiolitis, especially in high-risk groups such as infants under one year, those exclusively breastfed without supplementation, and children from low-income families.
- Pediatricians should encourage the use of vitamin D supplementation as per international guidelines, particularly during the first two years of life, to prevent deficiency and its complications.
- Awareness should be created among parents regarding the importance of safe sun exposure and dietary sources of vitamin D.

Policy Implications

- Public health authorities should integrate vitamin D supplementation programs into existing maternal and child health initiatives, including antenatal and postnatal care.
- Consideration should be given to fortifying staple foods (e.g., milk, flour, oil) with vitamin D to address widespread deficiency at the community level.
- Regional health programs in areas like Swat should specifically target awareness campaigns for vitamin D deficiency, given the higher burden in rural and low-income populations

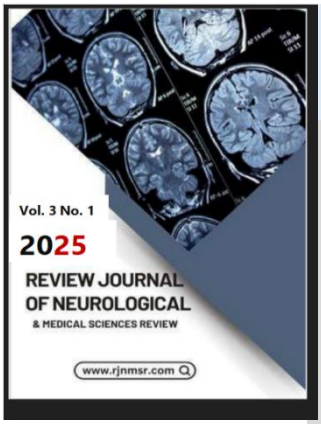
Future Research

- Further studies are needed to explore the causal relationship between vitamin D deficiency and bronchiolitis severity, including hospital stay duration, oxygen requirement, and ICU admissions.
- Longitudinal studies should assess whether supplementation reduces the incidence and severity of bronchiolitis in high-risk children.
- Maternal vitamin D status and its impact on neonatal and infant health outcomes should also be investigated to guide preventive interventions.

By adopting these measures, significant progress can be made in reducing vitamin D deficiency and its associated burden of respiratory illness among children in Pakistan.

References

1. Cashman KD, Dowling KG, Škrabáková Z, Gonzalez-Gross M, Valtueña J, De Henauw S, et al. Vitamin D deficiency in Europe: pandemic? Am J Clin Nutr. 2016;103(4):1033–44.
2. Palacios C, Gonzalez L. Is vitamin D deficiency a major global public health problem? J Steroid Biochem Mol Biol. 2014;144 Pt A:138–45.
3. Junaid K, Rehman A, Saeed T, Jolliffe DA, Wood K, Martineau AR. Vitamin D deficiency in Pakistan: population prevalence, causal factors and interventions. Nutr Res Rev. 2020;33(2):190–201.
4. Iqbal R, Khan AH. Possible reasons for vitamin D deficiency (VDD) in Pakistani population: A review. Osteoporos Sarcopenia. 2019;5(4):180–5.
5. Masood SH, Iqbal MP. Prevalence of vitamin D deficiency in South Asia. Pak J Med Sci. 2008;24(6):891–7.
6. Greiller CL, Martineau AR. Modulation of the immune response to respiratory viruses by vitamin D. Nutrients. 2015;7(6):4240–70.

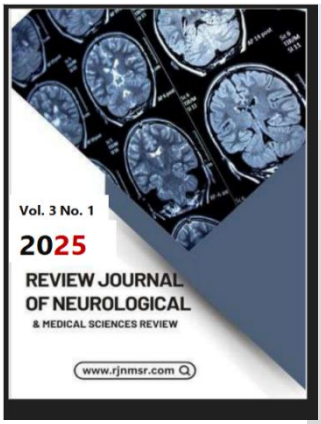


Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

7. Charoenngam N, Holick MF. Immunologic effects of vitamin D on human health and disease. Nutrients. 2020;12(7):2097.
8. Meissner HC. Viral bronchiolitis in children. N Engl J Med. 2016;374(1):62–72.
9. Florin TA, Plint AC, Zorc JJ. Viral bronchiolitis. Lancet. 2017;389(10065):211–24.
10. Shi T, McAllister DA, O'Brien KL, Simoes EAF, Madhi SA, Gessner BD, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. Lancet. 2017;390(10098):946–58.
11. Hazir T, Nisar YB, Abbasi S, Ashraf YP, Khurshid J, Tariq P, et al. Assessment and management of children aged 1–59 months presenting with wheeze, fast breathing, and/or lower chest indrawing: results of a multicentre descriptive study in Pakistan. Arch Dis Child. 2004;89(11):1049–54.
12. National Institute of Population Studies (NIPS) and ICF. Pakistan Demographic and Health Survey 2017–18. Islamabad, Pakistan, and Rockville, Maryland, USA: NIPS and ICF; 2019.
13. Jolliffe DA, Camargo CA Jr, Sluyter JD, Aglipay M, Aloia JF, Ganmaa D, et al. Vitamin D supplementation to prevent acute respiratory infections: systematic review and meta-analysis of aggregate data from randomized controlled trials. Lancet Diabetes Endocrinol. 2021;9(5):276–92.
14. Litonjua AA. Vitamin D and childhood asthma: causation and contribution to disease activity. Curr Opin Allergy Clin Immunol. 2019;19(2):126–31.
15. Belderbos ME, Houben ML, Wilbrink B, Lentjes E, Bloemen EM, Kimpen JLL, et al. Cord blood vitamin D deficiency is associated with respiratory syncytial virus bronchiolitis. Pediatrics. 2011;127(6):e1513–20.
16. Mansbach JM, Piedra PA, Borregaard N, Parker MM, Sullivan AF, Camargo CA Jr. Serum vitamin D levels among children hospitalized with bronchiolitis. Arch Dis Child. 2012;97(6): 476–9.
17. Roth DE, Jones AB, Prosser C, Robinson JL, Vohra S. Vitamin D status is not associated with the risk of hospitalization for acute bronchiolitis in young Canadian children. Eur J Clin Nutr. 2009;63(2):297–9.
18. Karatekin G, Kaya A, Salihoglu O, Balci H, Nuhoglu A. Association of subclinical vitamin D deficiency in newborns with acute lower respiratory infection and their mothers. Eur J Clin Nutr. 2009;63(4):473–7.
19. 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 years. Eur J Clin Nutr. 2004;58(4):563–7.
20. Bener A, Ehlayel MS, Tulic MK, Hamid Q. Vitamin D deficiency as a strong predictor of asthma in children. Int Arch Allergy Immunol. 2012;157(2):168–75.
21. Mansoor S, Habib A, Ghani F, Fatmi Z, Badruddin S, Mansoor S, et al. Prevalence and significance of vitamin D deficiency and insufficiency among apparently healthy adults. Clin Biochem. 2010;43(18):1431–5.
22. Khan AH, Jafri L, Ahmed S, Iqbal R, Morris H, Vasikaran S. Vitamin D deficiency in Pakistan: implications for the future. Expert Rev Clin Pharmacol. 2021;14(2):167–70.



Vol. 3 No. 2 (2025): April - June
https://rjnmsr.com/index.php/rjnmsr/about

Review Journal of Neurological & Medical Sciences Review

E(ISSN) : 3007-3073
P(ISSN) : 3007-3065

23. Saleem Z, Shahzad M, Saeed H, Riaz H, Godman B, Hussain S. Assessing the knowledge, attitude and practices of parents regarding vitamin D deficiency among children: a cross-sectional study from Pakistan. J Pharm Health Serv Res. 2020;11(2):115–22.
24. Muhe L, Lulseged S, Mason KE, Simoes EA. Case–control study of the role of nutritional rickets in the risk of developing pneumonia in Ethiopian children. Lancet. 1997;349(9068):1801–4.
25. Holick MF. The vitamin D deficiency pandemic: approaches for diagnosis, treatment and prevention. Rev Endocr Metab Disord. 2017;18(2):153–65.
26. Mithal A, Wahl DA, Bonjour JP, Burckhardt P, Dawson-Hughes B, Eisman JA, et al. Global vitamin D status and determinants of hypovitaminosis D. Osteoporos Int. 2009;20(11):1807–20.