fortune Journals

Research Article

FORTUNE JOURNAL OF HEALTH SCIENCES

ISSN: 2644-2906

Risk Factors and Nutritional Determinants of Pneumonia in Children Under 5 years

Dr. Jesmeen Morshed[*,1], Dr. Shamsun Nahar[2], Dr. Sanjida Khondakar Setu[3], Dr. Muhammad Shariful Hasan[4], Prof. Dr. Md. Atiar Rahman[5]

Abstract

Background: Pneumonia remains a leading cause of morbidity and mortality among children under five years, particularly in low- and middle-income countries. Understanding the associated risk factors and nutritional determinants is essential to guide preventive strategies. This study aimed to identify key determinants of pneumonia among under-five children in a tertiary care setting in Bangladesh.

Methods: This case-control study was conducted in the Department of Paediatrics and Paediatric Pulmonology Division of Bangladesh Medical University (BMU), Dhaka, from July 2024 to June 2025. A total of 60 children under five years were enrolled, comprising 30 clinically and radiologically confirmed pneumonia cases and 30 age- and sex-matched healthy controls attending the outpatient department or EPI centre. Data were analyzed using SPSS version 25.0. Categorical variables were compared using the chi-square test and continuous variables using the independent t-test, with a p-value <0.05 considered statistically significant.

Results: Children aged 2–3 years were more frequently affected (76.7% vs. 23.3%, $p < 0.001$). Malnutrition was significantly higher among cases compared to controls (50.0% vs. 23.3%, $p = 0.031$). Limited sun exposure (<30 minutes/week) and a history of recurrent respiratory infections were also notably more prevalent among cases (60.0% vs. 23.3%, $p = 0.006$; 63.3% vs. 26.7%, $p = 0.004$, respectively). Cases experienced more severe symptoms, including respiratory distress (93.3%) and hypoxia (60.0%).

Conclusion: Malnutrition, inadequate sun exposure and recurrent respiratory infections emerged as significant determinants of pneumonia in under-five children. Addressing these modifiable risk factors may reduce pneumonia burden and improve child health outcomes.

Keywords: Pneumonia, under-five children, risk factors, malnutrition, sun exposure.

Introduction

Pneumonia remains one of the leading causes of morbidity and mortality among children under five years of age, particularly in low- and middle-income countries [1]. Despite global improvements in child health, pneumonia continues to account for a significant proportion of under-five deaths, especially in South Asia and sub-Saharan Africa [2,3]. In Bangladesh, pneumonia is a major public health challenge, contributing substantially to hospital admissions, outpatient visits and child mortality [4]. Young children are especially vulnerable due to

Affiliation:

[1]Associate Professor, Department of Paediatrics, Bangladesh Medical University, Dhaka, Bangladesh

[2]Assistant Professor, Department of Paediatric Nephrology, Bangladesh Medical University, Dhaka, Bangladesh

[3]Associate Professor, Department of Microbiology and Immunology, Bangladesh Medical University, Dhaka, Bangladesh

[4]Associate Professor, Department of Paediatric Gastroenterology & Nutrition, Bangladesh Medical University, Dhaka, Bangladesh

[5]Professor, Pulmonology Division, Department of Paediatrics, Bangladesh Medical University, Dhaka, Bangladesh

***Corresponding author:**
Dr. Jesmeen Morshed, Associate Professor, Department of Paediatrics, Bangladesh Medical University, Dhaka, Bangladesh.

Citation: Dr. Jesmeen Morshed, Dr. Shamsun Nahar, Dr. Sanjida Khondakar Setu, Dr. Muhammad Shariful Hasan, Prof. Dr. Md. Atiar Rahman. Risk Factors and Nutritional Determinants of Pneumonia in Children Under 5 years. Fortune Journal of Health Sciences. 8 (2025): 1179-1184.

Received: December 06, 2025
Accepted: December 10, 2025
Published: December 19, 2025

Dr. Morshed J, et al., Fortune J Health Sci 2025
DOI:10.26502/fjhs.383

their developing immune systems, high exposure to infectious agents and nutritional vulnerabilities [2]. Pneumonia in children is commonly caused by bacterial, viral, or mixed infections, with Streptococcus pneumoniae and Haemophilus influenzae type b being among the most frequent bacterial pathogens [5]. However, the development of pneumonia is multifactorial and influenced by a wide range of socio-demographic, environmental, nutritional and biological determinants. These risk factors vary across settings, making context-specific research essential for effective prevention and control strategies [6].

Nutritional status plays a critical role in susceptibility to pneumonia. Undernutrition including underweight, stunting, wasting and micronutrient deficiencies compromises immune function and increases vulnerability to respiratory infections [7]. Exclusive breastfeeding in the first six months of life is known to reduce respiratory illness, while inadequate feeding practices, low dietary diversity and vitamin deficiencies heighten infection risk [8]. Malnourished children often experience more severe disease, prolonged hospital stay and higher complication rates. Identifying the nutritional determinants of pneumonia is therefore crucial for targeted interventions in settings where childhood malnutrition remains prevalent [9]. Environmental and household factors also contribute significantly. Indoor air pollution from biomass fuel, overcrowding, poor ventilation, exposure to tobacco smoke and low socioeconomic conditions increase the risk of pneumonia among young children [10]. Incomplete or delayed immunization, particularly against pneumococcus and H. influenzae type b, further elevates susceptibility. Additionally, low birth weight, prematurity, recent respiratory infections and underlying chronic illnesses can predispose children to pneumonia [11].

Despite ongoing efforts through the Expanded Programme on Immunization (EPI), improved case management and community-based interventions, pneumonia continues to impose a substantial burden in Bangladesh [12]. Many risk factors remain under-investigated in local settings, particularly the combined influence of nutritional status and environment on pneumonia occurrence among children under five. Case-control studies offer an effective approach to identify and quantify these risk factors, enabling evidence-based strategies to reduce disease burden [13]. Given this background, the present study aims to assess the risk factors and nutritional determinants associated with community-acquired pneumonia among children under five years attending a tertiary care centre in Bangladesh. Understanding these factors is essential for developing targeted preventive measures, strengthening nutritional programs and improving clinical outcomes in this vulnerable population.

Methodology & Materials

This case-control study was conducted in the Department of Paediatrics and Paediatric Pulmonology Division of Bangladesh Medical University (BMU), Dhaka, Bangladesh, over a one-year period from July 2024 to June 2025. A total of 60 children under five years of age were enrolled, comprising 30 cases and 30 controls. The case group consisted of children aged less than five years who were clinically and radiologically diagnosed with community-acquired pneumonia and admitted to the Department of Paediatrics and Paediatric Pulmonology Division of BMU. The control group included healthy children of similar age and sex who visited the outpatient department or EPI centre of BMU for routine check-up or immunization and had no history of acute or chronic illness. Children with congenital heart disease, chronic lung disease, immunodeficiency disorders, severe malnutrition requiring immediate medical stabilization, prior hospitalization within the last two weeks, or incomplete clinical records were excluded from both groups. Participants were selected using a purposive sampling technique based on eligibility criteria. After obtaining written informed consent from parents or legal guardians, relevant clinical, demographic and nutritional information was collected using a structured questionnaire. Physical examination findings and radiological reports were also documented for cases. All data were compiled and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics were presented as frequency and percentage for categorical variables and mean ± standard deviation (SD) for continuous variables. The chi-square test was used to analyze categorical variables, while the independent sample t-test was applied for continuous variables. A p-value of less than 0.05 was considered statistically significant.

Results

Data are expressed as number (%). Statistical analysis was performed using the Chi-square test. A p-value of <0.05 was considered statistically significant. Table I presents the socio-demographic characteristics of the study population (n = 60), comparing 30 cases of children with community-acquired pneumonia and 30 healthy controls. The majority of cases were aged 2–3 years (76.7%) compared to controls (23.3%), while controls predominated in the 4–5 years (50.0% vs. 23.3%) and >5 years (26.7% vs. 0%) categories; this difference was statistically significant ($p < 0.001$) and male (cases: 63.3%, controls: 53.3%).

Data are expressed as number (%). Statistical analysis was performed using the Chi-square test. A p-value of <0.05 was considered statistically significant. Table II shows the distribution of risk factors and nutritional characteristics among cases and controls. Malnutrition was more common in cases than controls (50.0% vs. 23.3%, $p = 0.031$). Limited

Citation: Dr. Jesmeen Morshed, Dr. Shamsun Nahar, Dr. Sanjida Khondakar Setu, Dr. Muhammad Shariful Hasan, Prof. Dr. Md. Atiar Rahman. Risk Factors and Nutritional Determinants of Pneumonia in Children Under 5 years. Fortune Journal of Health Sciences. 8 (2025): 1179-1184.

Dr. Morshed J, et al., Fortune J Health Sci 2025
DOI:10.26502/fjhs.383

Table I: Demographic Characteristics of the Study Population (n = 60)

Variables	Categories	Case (n = 30)	Control (n = 30)	OR (95% CI)	p-value
Age group (years)	2–3	23 (76.7%)	7 (23.3%)	10.78 (3.36–34.58)	< 0.001
	4–5	7 (23.3%)	15 (50.0%)		
	>5	0 (0.0%)	8 (26.7%)		
Gender	Male	19 (63.3%)	16 (53.3%)	1.51 (0.54–4.25)	0.432
	Female	11 (36.7%)	14 (46.7%)		

Table II: Distribution of Risk Factors and Nutritional Characteristics Among the Study Population (n = 60)

Variables	Categories	Case (n = 30)	Control (n = 30)	p-value
Nutritional status	Malnourished	15 (50.0%)	7 (23.3%)	0.031*
	Normal	15 (50.0%)	23 (76.7%)	
Breastfeeding history	Exclusive	14 (46.7%)	18 (60.0%)	0.298
	Not exclusive	16 (53.3%)	12 (40.0%)	
Sun exposure	<30 min/week	18 (60.0%)	7 (23.3%)	0.006*
	>30 min/week	12 (40.0%)	23 (76.7%)	
History of recurrent respiratory infection	Yes	19 (63.3%)	8 (26.7%)	0.004*
	No	11 (36.7%)	22 (73.3%)	
Family history of atopy	Present	13 (43.3%)	8 (26.7%)	0.187
	Absent	17 (56.7%)	22 (73.3%)	

Table III: Clinical Presentation and Complications among the Study Population (n = 60)

Variables	Categories	Case (n=30)	Control (n=30)	p-value
Fever	Present	29 (96.7%)	27 (90.0%)	0.29
	Absent	1 (3.3%)	3 (10.0%)	
Cough	Present	30 (100%)	30 (100%)	—
Respiratory distress	Present	28 (93.3%)	17 (56.7%)	0.002
Wheezing	Present	20 (66.7%)	8 (26.7%)	0.001
Feeding difficulties	Present	22 (73.3%)	10 (33.3%)	0.003
Lethargy	Present	18 (60.0%)	6 (20.0%)	0.001
Cyanosis	Present	15 (50.0%)	3 (10.0%)	<0.001
Convulsions	Present	9 (30.0%)	1 (3.3%)	0.01
Complications	Hypoxia	18 (60.0%)	4 (13.3%)	<0.001
	Dehydration	11 (36.7%)	6 (20.0%)	0.16
	Sepsis	12 (40.0%)	2 (6.7%)	0.004
	Respiratory failure	6 (20.0%)	1 (3.3%)	0.1

sun exposure (<30 min/week) and history of recurrent respiratory infections were also significantly higher among cases (60.0% vs. 23.3%, p = 0.006; 63.3% vs. 26.7%, p = 0.004). Exclusive breastfeeding and family history of atopy did not differ significantly between the groups (p > 0.05).

Data are expressed as number (%). Statistical analysis was performed using the Chi-square test. A p-value of <0.05 was considered statistically significant. Table III presents the clinical presentation and complications among cases and controls. Fever and cough were common in both groups, but respiratory distress (93.3% vs. 56.7%, p = 0.002), wheezing (66.7% vs. 26.7%, p = 0.001), feeding difficulties (73.3% vs. 33.3%, p = 0.003), lethargy (60.0% vs. 20.0%, p = 0.001), cyanosis (50.0% vs. 10.0%, p < 0.001) and convulsions (30.0% vs. 3.3%, p = 0.01) were significantly more frequent among cases. Among complications, hypoxia (60.0% vs. 13.3%, p < 0.001) and sepsis (40.0% vs. 6.7%, p = 0.004) were significantly higher in cases, while dehydration and respiratory failure showed no statistically significant difference between groups.

Citation: Dr. Jesmeen Morshed, Dr. Shamsun Nahar, Dr. Sanjida Khondakar Setu, Dr. Muhammad Shariful Hasan, Prof. Dr. Md. Atiar Rahman. Risk Factors and Nutritional Determinants of Pneumonia in Children Under 5 years. Fortune Journal of Health Sciences. 8 (2025): 1179-1184.

Dr. Morshed J, et al., Fortune J Health Sci 2025
DOI:10.26502/fjhs.383

Discussion

This case-control study explored the risk factors and nutritional determinants associated with pneumonia among children under five years of age. Our findings demonstrate that several socio-demographic, nutritional and clinical characteristics were significantly associated with pneumonia, consistent with evidence from global and regional studies. In the present study, the majority of pneumonia cases were between 2–3 years of age (76.7%), highlighting a vulnerable age group for respiratory infections. Similar age-related susceptibility has been described by Nguyen et al., who reported that younger children have immature immune systems and higher exposure to respiratory pathogens [14]. Although males constituted a higher proportion of cases (63.3%), this pattern is widely reported in previous studies, including those by Ujunwa et al. and Tazinya et al., who found boys to be more prone to respiratory infections due to behavioral and anatomical factors [15, 16]. Malnutrition emerged as a significant determinant in our study, with 50.0% of cases being malnourished compared to 23.3% of controls. This aligns with extensive literature showing that undernutrition compromises immune function and increases susceptibility to pneumonia. A systematic review by Kirolos et al. confirmed that malnutrition is one of the strongest predictors of pneumonia morbidity and mortality in low- and middle-income countries [17]. Similar associations have been reported in Ethiopia and Nigeria, supporting the consistency of our findings [15, 18]. Limited sun exposure (<30 minutes/week) was significantly more frequent among cases (60.0% vs. 23.3%). Reduced sun exposure may contribute to lower vitamin D levels, which in turn impairs innate immunity. The importance of environmental factors in respiratory infections has been emphasized by Rojas-Rueda et al., who highlighted inadequate sunlight as a modifiable risk factor [19]. Similarly, Torres et al. noted the role of environmental determinants in increasing susceptibility to respiratory tract infections [20].

A history of recurrent respiratory infections was significantly associated with pneumonia in our study (63.3% in cases vs. 26.7% in controls). This pattern has been documented in several studies, including Tazinya et al. and Dean & Florin, who showed that prior respiratory illness increases the risk of subsequent severe episodes due to airway inflammation and immune dysregulation [16, 21]. Exclusive breastfeeding, although protective in many studies, did not show a significant difference in our findings. This discrepancy may be related to sample size or differences in feeding practices, as also noted in studies from Ethiopia and Cameroon [16,18]. Clinically, symptoms such as respiratory distress (93.3%), wheezing (66.7%), feeding difficulty (73.3%) and cyanosis (50.0%) were significantly more common among cases, consistent with clinical profiles described by Sonego et al. and McAllister et al. in their global analyses of childhood pneumonia [22, 23]. Severe complications, particularly hypoxia (60.0%) and sepsis (40.0%), were also significantly more prevalent among cases, supporting the evidence that pneumonia progresses rapidly in undernourished or immunologically vulnerable children [22, 24]. Environmental and household factors remain critical contributors to pneumonia in low-resource settings. Studies such as Mortimer et al., demonstrated that reducing indoor air pollution significantly lowers pneumonia incidence, reinforcing the concept that environmental determinants—similar to inadequate sunlight exposure in our study—are crucial in prevention strategies [25]. Furthermore, large-scale analyses such as the Global Burden of Disease Study confirm that modifiable risk factors, including malnutrition and environmental exposures, account for a major proportion of pneumonia burden globally [26]. Overall, our findings support the existing body of evidence that pneumonia in children under five is strongly influenced by nutritional, environmental and previous illness-related factors. The significant associations observed—such as malnutrition (50%), poor sun exposure (60%) and recurrent infections (63.3%) underscore the importance of integrated preventive strategies targeting nutrition, hygiene, environmental conditions and early management of respiratory symptoms.

Limitations of the Study

This study had several limitations. First, the sample size was relatively small (n = 60), which may limit the generalizability of the findings and reduce the statistical power to detect weaker associations. Second, as a hospital-based case-control study, there is a possibility of selection bias and the results may not fully represent the community population. Information related to environmental exposures and feeding practices relied on caregiver reporting, which may introduce recall bias. Additionally, vitamin D levels and other biochemical markers were not assessed, limiting the ability to establish direct biological correlations with sun exposure and nutritional status.

Conclusion

This study identified key risk factors and nutritional determinants associated with pneumonia among children under five years, including malnutrition, limited sun exposure and a history of recurrent respiratory infections. These findings highlight the importance of improving child nutrition, promoting adequate outdoor activity and ensuring early management of respiratory illnesses to reduce pneumonia burden. Strengthening community awareness, enhancing preventive strategies and addressing modifiable risk factors may contribute significantly to reducing pneumonia incidence and improving child health outcomes in Bangladesh.

Citation: Dr. Jesmeen Morshed, Dr. Shamsun Nahar, Dr. Sanjida Khondakar Setu, Dr. Muhammad Shariful Hasan, Prof. Dr. Md. Atiar Rahman. Risk Factors and Nutritional Determinants of Pneumonia in Children Under 5 years. Fortune Journal of Health Sciences. 8 (2025): 1179-1184.

Financial Support and Sponsorship

No funding sources.

Conflicts of Interest

There are no conflicts of interest.

References

1. Ngocho JS, de Jonge MI, Minja L, et al. Modifiable risk factors for community-acquired pneumonia in children under 5 years of age in resource-poor settings: a case–control study. Tropical medicine & international Health 24 (2019): 484-92.
2. Solomon Y, Kofole Z, Fantaye T, et al. Prevalence of pneumonia and its determinant factors among under-five children in Gamo Zone, southern Ethiopia, 2021. Frontiers in pediatrics 10 (2022): 1017386.
3. Beletew B, Bimerew M, Mengesha A, et al. Prevalence of pneumonia and its associated factors among under-five children in East Africa: a systematic review and meta-analysis. BMC pediatrics 20 (2020): 254.
4. Saha S, Hasan M, Kim L, et al. Epidemiology and risk factors for pneumonia severity and mortality in Bangladeshi children< 5 years of age before 10-valent pneumococcal conjugate vaccine introduction. BMC public health 16 (2016): 1233.
5. Yadate O, Yesuf A, Hunduma F, et al. Determinants of pneumonia among under-five children in Oromia region, Ethiopia: unmatched case-control study. Archives of Public Health 81 (2023): 87.
6. Fonseca Lima EJ, Mello MJ, Albuquerque MD, et al. Risk factors for community-acquired pneumonia in children under five years of age in the post-pneumococcal conjugate vaccine era in Brazil: a case control study. BMC pediatrics 16 (2016): 157.
7. Onyango D, Kikuvi G, Amukoye E, et al. Risk factors of severe pneumonia among children aged 2-59 months in western Kenya: a case control study. Pan African Medical Journal 13 (2012).
8. Seramo RK, Awol SM, Wabe YA, et al. Determinants of pneumonia among children attending public health facilities in Worabe town. Scientific reports 12 (2022): 6175.
9. Karki S, Fitzpatrick AL, Shrestha S. Risk factors for pneumonia in children under 5 years in a teaching hospital in Nepal. Kathmandu University Medical Journal 12 (2014): 247-52.
10. Goyal JP, Kumar P, Mukherjee A, et al. Risk factors for the development of pneumonia and severe pneumonia in children. Indian pediatrics 58 (2021): 1036-9.
11. Wonodi CB, Deloria-Knoll M, Feikin DR, et al. Evaluation of risk factors for severe pneumonia in children: the Pneumonia Etiology Research for Child Health study. Clinical infectious diseases 54 (2012): S124-31.
12. Nasrin S, Tariqujjaman M, Sultana M, et al. Factors associated with community acquired severe pneumonia among under five children in Dhaka, Bangladesh: A case control analysis. PLoS One 17 (2022): e0265871.
13. Alamneh YM, Adane F. Magnitude and Predictors of Pneumonia among Under-Five Children in Ethiopia: A Systematic Review and Meta-Analysis. Journal of environmental and public health. 2020;2020(1):1606783.
14. Nguyen TK, Tran TH, Roberts CL, et al. Risk factors for child pneumonia-focus on the Western Pacific Region. Paediatric respiratory reviews 21 (2017): 95-101.
15. Ujunwa FA, Ezeonu CT. Risk factors for acute respiratory tract infections in under-five children in enugu Southeast Nigeria. Annals of medical and health sciences research 4 (2014): 95-9.
16. Tazinya AA, Halle-Ekane GE, Mbuagbaw LT, et al. Risk factors for acute respiratory infections in children under five years attending the Bamenda Regional Hospital in Cameroon. BMC pulmonary medicine 18 (2018): 7.
17. Kirolos A, Blacow RM, Parajuli A, et al. The impact of childhood malnutrition on mortality from pneumonia: a systematic review and network meta-analysis. BMJ Global Health 6 (2021): e007411.
18. Abuka T. Prevalence of pneumonia and factors associated among children 2–59 months old in Wondo Genet district, Sidama zone, SNNPR, Ethiopia. Curr Pediatr Res 21 (2017): 19-25.
19. Rojas-Rueda D, Morales-Zamora E, Alsufyani WA, et al. Environmental risk factors and health: an umbrella review of meta-analyses. International journal of environmental research and public health (2021): 704.
20. Torres A, Peetermans WE, Viegi G, et al. Risk factors for community-acquired pneumonia in adults in Europe: a literature review. Thorax 68 (2013): 1057-65.
21. Dean P, Florin TA. Factors associated with pneumonia severity in children: a systematic review. Journal of the Pediatric Infectious Diseases Society 7 (2018): 323-34.
22. Sonego M, Pellegrin MC, Becker G, et al. Risk factors for mortality from acute lower respiratory infections (ALRI) in children under five years of age in low and middle-income countries: a systematic review and meta-analysis of observational studies. PloS one 10 (2015): e0116380.
23. McAllister DA, Liu L, Shi T, et al. Global, regional and

Dr. Morshed J, et al., Fortune J Health Sci 2025
DOI:10.26502/fjhs.383

national estimates of pneumonia morbidity and mortality in children younger than 5 years between 2000 and 2015: a systematic analysis. The Lancet Global Health 7 (2019): e47-57.

24. Le Roux DM, Myer L, Nicol MP, et al. Incidence and severity of childhood pneumonia in the first year of life in a South African birth cohort: the Drakenstein Child Health Study. The Lancet Global Health 3 (2015): e95-103.

25. Mortimer K, Ndamala CB, Naunje AW, et al. A cleaner burning biomass-fuelled cookstove intervention to prevent pneumonia in children under 5 years old in rural Malawi (the Cooking and Pneumonia Study): a cluster randomised controlled trial. The Lancet 389 (2017): 167-75.

26. Troeger CE, Khalil IA, Blacker BF, et al. Quantifying risks and interventions that have affected the burden of lower respiratory infections among children younger than 5 years: an analysis for the Global Burden of Disease Study 2017. The Lancet Infectious Diseases 20 (2020): 60-79.

Citation: Dr. Jesmeen Morshed, Dr. Shamsun Nahar, Dr. Sanjida Khondakar Setu, Dr. Muhammad Shariful Hasan, Prof. Dr. Md. Atiar Rahman. Risk Factors and Nutritional Determinants of Pneumonia in Children Under 5 years. Fortune Journal of Health Sciences. 8 (2025): 1179-1184.