

Association of Nutritional Status with Severity of Pneumonia in Under-Five Children

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ABSTRACT

Introduction: Pneumonia remains a major cause of morbidity and mortality among children under five years of age, particularly in low- and middle-income countries. Malnutrition may increase vulnerability to severe respiratory infection by impairing immune function and reducing physiological reserves. This study was conducted to assess the association between nutritional status and the severity of pneumonia among under-five children. **Methods & Materials:** This cross-sectional observational study was conducted at Department of Paediatrics, South Apollo Medical College & Hospital, Barishal, Bangladesh from January 2025 to December 2025 among 100 children aged 2–59 months diagnosed with pneumonia. Eligible children were enrolled consecutively, with a total sample size of 100. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. **Result:** Among 100 under-five children with pneumonia, 61.0% had severe pneumonia. Nutritional deficits were common, with 30.0% underweight, 35.0% stunted, 25.0% wasted, and 45.0% having at least one nutritional deficit. Severe pneumonia occurred in 77.8% of nutritionally deficient children compared with 47.3% of those with normal nutritional status ($p=0.007$). Severe stunting showed the strongest individual association with severe pneumonia, occurring in 83.3% of severely stunted children compared with 56.1% of those without severe stunting ($p=0.032$). **Conclusion:** The study demonstrated a significant association between poor nutritional status and increased pneumonia severity among children under five years of age. Nearly half of the participants had some form of nutritional deficiency, with severe pneumonia occurring more commonly among nutritionally

compromised children than those with normal nutritional status. Among the individual nutritional indicators, severe stunting was most strongly associated with severe pneumonia.

Keywords: Pneumonia, Nutritional Status, Under-Five Children

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INTRODUCTION

Pneumonia remains one of the most important causes of illness and death among children younger than five years, particularly in low- and middle-income countries. In 2019, pneumonia caused an estimated 740,180 deaths among children under five, accounting for approximately 14% of all deaths in this age group worldwide. Despite the availability of effective antibiotics, vaccination, and supportive care, the burden remains substantial because severe disease is strongly influenced by delayed care, young age, comorbidities, and underlying nutritional vulnerability [1]. The World Health Organization (WHO) therefore emphasizes early recognition of severity, prompt treatment, and identification of children with factors that increase the risk of poor outcomes. WHO clinical classification particularly uses danger signs and respiratory manifestations to distinguish severe pneumonia requiring urgent facility-based management [2]. Childhood malnutrition is another major global public-health problem and is closely intertwined with infectious disease. According to the 2025 Joint Child Malnutrition Estimates, approximately 150.2 million children under five were stunted, and 42.8 million were

wasted globally in 2024, corresponding to prevalences of 23.2% and 6.6%, respectively [3]. Undernutrition can impair both innate and adaptive immune responses, compromise respiratory muscle function, and reduce physiological reserves needed to withstand acute infection. Conversely, acute respiratory infection may worsen nutritional status through anorexia, increased metabolic demand, and nutrient losses, creating a clinically important vicious cycle [4]. Evidence from hospital- and community-based studies supports this relationship. A systematic review by Dean and Florin identified several demographic, clinical, and host-related factors associated with increased pneumonia severity in children, highlighting the importance of recognizing vulnerable subgroups at presentation [5]. More specifically, evidence from Bangladesh has demonstrated a direct association between nutritional deficits and severe disease. In a multicentre study involving 3,639 Bangladeshi children with pneumonia, 61% had severe pneumonia, and low weight-for-age was independently associated with severe disease (adjusted odds ratio [aOR] 1.22, 95% CI 1.04–1.42); low weight-for-age was also associated with mortality [6]. Further Bangladeshi evidence has shown that severe malnutrition may

adversely affect the clinical course of pneumonia. Huq et al. reported that malnourished children with severe pneumonia had significantly higher odds of persistent rapid breathing, chest-wall indrawing, and fever compared with well-nourished children, with adjusted odds ratios of 1.64, 1.70, and 1.70, respectively [7]. Among severely malnourished Bangladeshi children, pneumonia has also been associated with important respiratory viral pathogens, including respiratory syncytial virus and influenza, demonstrating the substantial infectious burden faced by this nutritionally vulnerable population [8]. In Dhaka, severe stunting was independently associated with the development of WHO-defined severe pneumonia, further strengthening the evidence that chronic nutritional impairment may contribute to disease severity [9]. The relationship is also clinically important beyond the acute admission. Recent evidence from India found that malnutrition was a significant concern among children hospitalized with severe pneumonia and emphasized the need for nutritional assessment when evaluating children at risk of persistent disease [10]. Given the coexistence of pneumonia and childhood undernutrition in Bangladesh,

determining whether wasting, stunting, underweight, or overall nutritional status is associated with greater pneumonia severity could help clinicians identify high-risk children earlier and prioritize nutritional assessment alongside respiratory evaluation. Therefore, this study will aim to assess the association between nutritional status and severity of pneumonia among under-five children.

METHODS & MATERIALS

This cross-sectional observational study was conducted from January 2025 to December 2025 among 100 children aged 2–59 months diagnosed with pneumonia and admitted to Department of Paediatrics, South Apollo Medical College & Hospital, Barishal, Bangladesh. Consecutive sampling was used to enroll eligible children. The sample size was 100. Children aged 2–59 months presenting with cough and/or difficulty in breathing and fulfilling the WHO clinical criteria for pneumonia were included, while children with chronic respiratory diseases, congenital heart disease, severe neurological disorders, known immunodeficiency, malignancy, tuberculosis, or other major chronic

illnesses likely to influence nutritional status or pneumonia severity, as well as those whose parents or guardians declined participation, were excluded. Pneumonia was defined according to WHO criteria as cough and/or difficult breathing with fast breathing and/or lower chest-wall indrawing in a child aged 2–59 months. Severe pneumonia was defined by the presence of pneumonia with at least one general danger sign, including inability to drink or breastfeed, persistent vomiting, convulsions, lethargy or unconsciousness, or stridor in a calm child; hypoxaemia (SpO₂ <90%) or severe respiratory distress was also considered an indicator of severe disease. Nutritional status was assessed by measuring weight, length/height and, where appropriate, mid-upper-arm circumference, and classified according to WHO Child Growth Standards using weight-for-age, height-for-age and weight-for-height/length Z-scores to identify underweight, stunting and wasting. Relevant sociodemographic characteristics, presenting symptoms, and clinical findings were recorded using a structured questionnaire. Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0.

Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation. The association between nutritional status and pneumonia severity was assessed using the Chi-square test, and a p-value of <0.05 was considered statistically significant. Ethical approval was obtained from the concerned institutional authority, and written informed consent was obtained from the parents or legal guardians of all participating children.

RESULTS

Among the 100 children, 32 (32.0%) were aged 2–11 months and 29 (29.0%) were aged 12–23 months, indicating that 61.0% were younger than two years. Males predominated, accounting for 60 (60.0%) children, while 40 (40.0%) were female. Fifty-seven (57.0%) children were from urban areas and 43 (43.0%) from rural areas. Most children were of first or second birth order (62.0%), and 68.0% had been exclusively breastfed during the first six months (*Table I*).

Table I
Sociodemographic and baseline characteristics of the study children (n=100).

Characteristics	Frequency (n)	Percentage (%)
Age group		
2–11 months	32	32.0
12–23 months	29	29.0
24–35 months	21	21.0
36–59 months	18	18.0
Sex		
Male	60	60.0
Female	40	40.0
Residence		
Urban	57	57.0
Rural	43	43.0
Birth order		
First/second	62	62.0
Third or above	38	38.0
Exclusive breastfeeding for first 6 months		
Yes	68	68.0
No	32	32.0

Nutritional abnormalities were frequent in the study population. Thirty children (30.0%) were underweight, 35 (35.0%) were stunted, and 25 (25.0%) were wasted.

Overall, 45 (45.0%) children had at least one form of nutritional deficit, while 55 (55.0%) had no identified nutritional deficit.

Severe stunting was present in 18 (18.0%) children (*Table II*).

Table IINutritional status of the study children according to anthropometric assessment ($n=100$).

Nutritional indicator	Frequency (n)	Percentage (%)
Weight-for-age		
Normal	70	70.0
Underweight	30	30.0
Height-for-age		
Normal	65	65.0
Stunted	35	35.0
Weight-for-height		
Normal	75	75.0
Wasted	25	25.0
Overall nutritional status		
Normal nutritional status	55	55.0
Any nutritional deficit	45	45.0
Severe stunting	18	18.0

Severe pneumonia was diagnosed in 61 (61.0%) children. Cough was the most frequent presenting symptom, occurring in 96 (96.0%) children, followed by fever in 74 (74.0%) and difficulty in breathing in 48

(48.0%). Fast breathing was documented in 69 (69.0%), while chest indrawing was present in 42 (42.0%). Hypoxemia was identified in 10 (10.0%) children. Feeding difficulty occurred in 14 (14.0%), lethargy

or altered consciousness in 8 (8.0%), and convulsions in 3 (3.0%) (*Table III*).

Table IIIClinical characteristics and severity of pneumonia among the study children ($n=100$).

Clinical characteristics	Frequency (n)	Percentage (%)
Pneumonia severity		
Pneumonia without severe features	39	39.0
Severe pneumonia	61	61.0
Major presenting symptoms/signs		
Cough	96	96.0
Fever	74	74.0
Difficulty in breathing	48	48.0
Chest indrawing	42	42.0
Fast breathing	69	69.0
Hypoxemia ($SpO_2 < 90\%$)	10	10.0
Inability to feed/drink	14	14.0
Lethargy/altered consciousness	8	8.0
Convulsion	3	3.0

A significant association was observed between overall nutritional status and pneumonia severity. Among children with nutritional deficits, 35 of 45 (77.8%)

developed severe pneumonia compared with 26 of 55 (47.3%) children with normal nutritional status ($p=0.007$). Thus, children with nutritional impairment showed a

substantially greater proportion of severe disease (*Table IV*).

Table IVAssociation between overall nutritional status and severity of pneumonia ($n=100$).

Nutritional status	Pneumonia, n (%)	Severe pneumonia, n (%)	Total	p-value*
Normal nutritional status	29 (52.7)	26 (47.3)	55	0.007
Any nutritional deficit	10 (22.2)	35 (77.8)	45	
Total	39 (39.0)	61 (61.0)	100	

*Chi-square test.

Severe stunting showed the strongest individual association with pneumonia severity. Among 18 children with severe stunting, 15 (83.3%) had severe pneumonia compared with 46 (56.1%) of 82 children without severe stunting ($p=0.032$). Stunting

overall was also more common among children with severe pneumonia (71.4%) than among those with non-severe pneumonia (28.6%), although the difference did not reach statistical significance. Wasting was present in 18 (72.0%) of 25

affected children with severe pneumonia, while underweight was present in 19 (63.3%) affected children; neither reached statistical significance individually (*Table V*).

Table V
Association of individual nutritional indicators with severity of pneumonia (n=100).

Nutritional indicator	Pneumonia n (%)	Severe pneumonia n (%)	Total	p-value*
Underweight				
Present	11 (36.7)	19 (63.3)	30	0.680
Absent	28 (40.0)	42 (60.0)	70	
Stunting				
Present	10 (28.6)	25 (71.4)	35	0.170
Absent	29 (44.6)	36 (55.4)	65	
Severe stunting				
Present	3 (16.7)	15 (83.3)	18	0.032
Absent	36 (43.9)	46 (56.1)	82	
Wasting				
Present	7 (28.0)	18 (72.0)	25	0.193
Absent	32 (42.7)	43 (57.3)	75	

*Chi-square test.

DISCUSSION

In this study, 61.0% of the children were younger than two years, while 60.0% were male. Saha et al., in a large Bangladeshi cohort of 3,639 children with pneumonia, reported that 64.5% were male and 59.6% were aged 2–11 months; they also found that children aged 2–5 months and 6–11 months had significantly higher odds of severe pneumonia, with adjusted odds ratios of 1.60 and 1.31, respectively [6]. Similarly, Nasrin et al. reported a median age of 9.2 months and 60.0% male children in their Dhaka study of 2,597 children [9]. Thus, the younger age predominance and male majority in the present cohort followed the demographic pattern reported in comparable Bangladeshi populations. This study demonstrated considerable nutritional impairment: 30.0% were underweight, 35.0% stunted, 25.0% wasted, and 45.0% had at least one nutritional deficit. Chowdhury et al., using nationally representative Bangladeshi data, reported stunting in 31%, underweight in 22%, and wasting in 8% of under-five children [11]. The present study therefore showed somewhat higher prevalences, particularly for wasting (25.0% vs. 8.0%), which may be explained by the selection of children already suffering from pneumonia. More recent evidence has also demonstrated a strong nutritional burden among hospitalized children: Yadav et al., in a 2024 Nepalese hospital-based study of 170 children with pneumonia, found that 69 (40.6%) were undernourished [12]. This was close to the 45.0% prevalence of any nutritional deficit found in the present study. The clinical profile showed severe pneumonia in 61.0%, with cough in 96.0%, fever in 74.0%, fast breathing in 69.0%, difficulty in breathing in 48.0%, and chest indrawing in 42.0%. Saha et al. also found severe pneumonia in 61% of their 3,639 Bangladeshi children [6]. Huq et al., studying 1,693 Bangladeshi children with severe pneumonia, reported rapid breathing and chest-wall indrawing as important manifestations and found that these features persisted more frequently among malnourished children; malnutrition was

associated with rapid breathing (aOR 1.636), chest-wall indrawing (aOR 1.698) and fever (aOR 1.700) [7]. Therefore, the high frequency of respiratory signs in the present study occurred in a clinical context already associated with nutritional vulnerability. Another finding was the significant association between nutritional status and pneumonia severity. Severe pneumonia occurred in 77.8% of children with nutritional deficits compared with 47.3% among normally nourished children (p=0.007), corresponding to approximately 3.2-fold higher odds of severe disease. A particularly relevant recent study was conducted by Rizione et al., who evaluated 122 children aged 2–59 months in Indonesia in 2022–2024. They reported good nutritional status in 63.1% of children and demonstrated a highly significant association between nutritional status and pneumonia severity (p<0.001; PR 4.3023, 95% CI 3.449–20.338) [13]. The direction and strength of this association closely support the present finding. In Nepal, Yadav et al. likewise found that undernutrition was significantly associated with severe pneumonia, with an unadjusted OR of 8.2 (95% CI 3.9–17.5; p<0.001) [12]. The somewhat lower effect estimate in the present study may reflect its smaller sample and different nutritional classification. The study further showed that severe stunting had the clearest individual relationship with disease severity. Severe pneumonia affected 83.3% of severely stunted children compared with 56.1% of those without severe stunting (p=0.032). Nasrin et al. found severe stunting to be independently associated with WHO-defined severe pneumonia in Dhaka, with an adjusted association of approximately 1.44 (95% CI 1.09–1.91; p=0.009) [9]. Saha et al. also reported that low weight-for-age was independently associated with severe pneumonia (aOR 1.22, 95% CI 1.04–1.42) [6]. Although underweight and wasting in the present study were more frequent among severe cases, neither reached statistical significance, suggesting that chronic linear growth failure, particularly severe stunting, may have a stronger relationship with

pneumonia severity than individual measures of acute nutritional deficit. This interpretation is further supported by recent evidence from Nepal and Indonesia demonstrating that overall undernutrition is associated with substantially greater pneumonia severity [12,13].

LIMITATIONS

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The study found that nutritional impairment was significantly associated with greater pneumonia severity among under-five children. Nearly half of the children had at least one nutritional deficit, and severe pneumonia occurred more frequently among nutritionally deficient children than those with normal nutritional status. Severe stunting showed the strongest individual association with severe pneumonia.

RECOMMENDATION

Routine assessment of nutritional status should be incorporated into the clinical evaluation of under-five children with pneumonia, particularly screening for stunting and other nutritional deficits. Children with nutritional impairment should receive timely nutritional support along with appropriate pneumonia management, and further prospective studies with larger samples should be conducted to clarify the relationship between specific nutritional indicators and pneumonia severity.

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CONFLICT OF INTEREST

None declared

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