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Research Article

**PERVASIVENESS OF ANEMIA IN CHILDREN IDENTIFIED  
WITH PNEUMONIA**<sup>1</sup>Dr. Shaff Fatima, <sup>2</sup>Dr. Maria Munir, <sup>3</sup>Dr. Haleema Afzal<sup>1</sup>Rashid Latif Medical College, Lahore., <sup>2</sup>Faisalabad medical university, Faisalabad., <sup>3</sup>Rashid Latif Medical College, Lahore.**Article Received:** October 2020**Accepted:** November 2020**Published:** December 2020**Abstract:**

**Introduction:** Anemia and pneumonia are common diseases that affect children. However, these two conditions can coexist. The aim of the study is to present the frequency of anemia among children who were diagnosed with pneumonia.

**Material and Methods:** This observational and cross-sectional descriptive study was conducted at the Department of Pediatrics, Services Hospital, Lahore for one-year duration from September 2019 to September 2020 on 80 children aged 6 months to 15 years was included. All involved patients were admitted to the pediatric ward due to pneumonia. Medical evaluation included anthropometric measurements and blood counts. Risk relationships were assessed using the odds ratio.

**Results:** Anemia was found in 21.25% of the whole group. Nevertheless, children under the age of three were more affected [18.75%]. Low mean blood cell volume and wide red blood cell distribution were more common than anemia itself; 38.75% and 28.75%, respectively. In addition, the incidence of anemia in children under 36 months of age was higher than in patients over 3 years of age, with a significant risk of anemia in the first group [OR 13.04; 95% CI 11.48-14.61;  $p < 0.05$ ] and low hematocrit [OR 14.64; 95% CI 12.53-16.75;  $p < 0.05$ ]. This was also observed in the case of low mean cell volume [OR 3.23; CI 95% 2.3-4.17;  $p < 0.05$ ], high width of red cell distribution [OR 2.77; CI 95% 1.76 -3.78;  $p < 0.05$ ] and mean blood hemoglobin [OR 8.48; 95% CI 7.14-9.82;  $p < 0.01$ ].

**Conclusions:** Anemia is a common disease in pediatric pneumonia, especially in the first three years of life. Therefore, anemia or nutritional deficiencies may be a risk factor for respiratory disease.

**Keywords:** anemia; Pediatrics; Pneumonia

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**INTRODUCTION:**

Anemia is one of the most common diseases, mainly affecting people in developing or low-income countries, with approximately 1.62 billion [25%] of the world's population affected. Moreover, anemia has become a significant public health problem that affects all age groups of the world's population, with the highest prevalence among children under five and pregnant women. Anemia is characterized by many different etiological factors. Some of these factors include insufficient intake of micronutrients [vitamin B12, folate and iron deficiencies], non-transferable disorders, infectious diseases [HIV / AIDS, tuberculosis, malaria, worm infections and general inflammation], socioeconomic factors and demographic conditions, genetic disorders and immunohematology. According to the World Health Organization [WHO], 50% of an estimated 293 million young children and 468 million non-pregnant women suffer from iron deficiency anemia; mainly due to insufficient iron intake. There are few studies in Pakistan that describe the prevalence of anemia in children; however, it varies between 12% and 45%. Like anemia, malnutrition also affects our pediatric population. According to UNICEF, chronic malnutrition affects 25.3% of children. In addition to this report, during the ninth epidemiological week of 2018 in Pakistan [February 25 to March 3], 477 cases of acute malnutrition were reported, of which 77.98% [372] cases corresponded to moderate acute malnutrition and 22.01% [105] cases correspond to severe acute malnutrition. Iron functions in the immune system are essential, including: maintaining phagocyte oxidase activity; increase in the expression of inducible nitric oxide synthase [iNOS]. Likewise, intracellular iron promotes the activation of nuclear factor kappa B [NF- $\kappa$ B] and toll-like receptor 4 [TLR4] 7 signaling. Therefore, there is an association between iron deficiency and a decreased immune response to infection. On the other hand, excess iron can be used by bacteria to improve their growth. This relationship between iron and the immune system may explain the increased risk of respiratory infections seen in children with iron deficiency anemia<sup>9</sup>. Pneumonia is a common disease in children; and with around 17% of the 6.3 million child deaths in 2010, it was the leading cause of child death this year. In addition, the overall prevalence of pneumonia in children under five from low- and middle-income countries has recently been estimated at 0.22 episodes per child-year, of which 11.5% met the criteria for severe disease. In Latin America and the Caribbean, community acquired pneumonia is the leading cause of childhood morbidity and mortality, with an estimated 327,000 cases and 12,000–28,000 deaths annually. This study aims to present the

prevalence of anemia and malnutrition among Pakistani children diagnosed with pneumonia and to compare whether anemia might have an impact on the length of hospital stay in children with pneumonia.

**MATERIAL AND METHODS:**

This observational and cross-sectional descriptive study was conducted at the Department of Pediatrics, Services Hospital, Lahore for one-year duration from September 2019 to September 2020. Each patient's clinical history data was extracted using the software from HE-1, which includes a detailed clinical evaluation and all follow-up tests. The analysis of the HE-1 database included a total of 80 children aged 6 months to 15 years. Of the potential group of 100 patients, 20 children were excluded. The exclusion criteria from this study were: age outside the range established for this study, no recorded anthropometric parameters, no complete blood count [CBC] on admission to the hospital, diagnosis of concomitant diseases that may affect anthropometric parameters or hemoglobin. or may predispose to pneumonia. The sample size was not determined as all children diagnosed with pneumonia were included. Since anthropometric measurements and determination of hematology parameters were viewed as part of the clinical evaluation of each patient, no experiments were performed during the clinical trial. In addition, all procedures were performed in accordance with national and international guidelines to obtain an accurate diagnosis. Therefore, there was no risk for the patients in this study. Diagnosis of Pneumonia: Physical findings such as fever, rapid breathing, difficulty breathing, rhonchi, crackling and wheezing were used to make the diagnosis of pneumonia. At that time, the assessment of hydration status, activity level and oxygen saturation were necessary to decide on hospitalization and treatment. According to the World Health Organization [WHO], the respiratory rate thresholds for the diagnosis of pneumonia are: in children from 2 to 12 months of age, 50 breaths per minute [BPM] [normal 25-40 BPM]; 40 breaths per minute per minute for children aged one to five years [normally 20-30 beats per minute]; and over 20 beats per minute in children over five years of age. The criteria for hospitalization were hypoxemia, defined as persistent peripheral blood saturation [SpO<sub>2</sub>] <90%, as well as criteria for respiratory failure, which include: tachypnoea, dyspnea, retractions [suprasternal, intercostal or subcostal], grunting, rhinitis, apnea and changes in mental state. In addition, CBC, acute phase reagents and chest radiography were performed. After achieving a BMI, all children were classified according to the nutrition guidelines for primary prevention and control of

overweight and obesity in children and adolescents established by the Ministry of Public Health which coincides with the WHO parameters. Body weight, height and BMI were assessed for all children included in this study by means of the Z-score and percentile classification. Determination of hematological parameters: The hematological parameters were determined with the Mindray BC-6800 auto-hematological analyzer, which uses 3D analysis, obtaining information from laser light scattering at two angles and fluorescence signals, as well as a colorimetric method of measuring hemoglobin. To diagnose anemia, we based our criteria on hemoglobin values suggested by WHO when levels were below normal for age. In this study, the exposure factor was anemia or early markers of iron deficiency, such as high RDW or low MCV. Therefore, two groups of patients were enrolled in the study, one anemic patient diagnosed with pneumonia and the other non-anemic patients diagnosed with pneumonia. There were variables beyond the control of this study, such as ethnic differences, iron intake, and state of poverty. There were no cases of cigarette smoking or pregnancy. Clinical data were analyzed using SPSS and Excel, both in their latest versions for Windows 18. The risk relationship between anemia and pneumonia was calculated from the odds ratio [OR]. We used the Mann-Whitney U test to compare the length of stay in the hospital among the various diseases studied. We also used convenient sampling.

### RESULTS:

Of the 80 patients, we found 47.50% of them were under the age of three. Despite the fact that we divided patients into two groups according to age [minors and over three years old], we observed that 29 were under 24 months, 19 were two to three years old, 18 were four to six years old, and the rest were between 7 and 15 years old. Besides, the mean age

was 3.98 years [SD 3.35; CI 3.25-4.72]. In the whole group of respondents, the percentage of female children was higher than that of men [51.25% vs 48.75%, respectively]. In addition, we observed that 31.25% of participants had a previous episode of pneumonia. Nutritional status: The most common nutritional problem observed in our study population was low weight [16.25%], more common in children under three years of age. However, we found the anthropometric parameters under Z-score -1 [weight Z score <-1.40%; Growth Z-score <-1.33.75%; BMI Z score <-1.30%]. Both very low body weight and very short stature were seen in 3.75% of the patients. There were no very emaciated children. Incidence of anemia: Anemia was found in 21.25% of the whole group. However, children under three years of age were more affected [18.75%]. Early markers of iron deficiency such as mean blood cell volume and red cell distribution width were more common than anemia itself; 38.75% and 28.75%, respectively. Risk of anemia in young children: Comparing the incidence of anemia between children under 36 months of age [toddlers] and patients over 3 years of age, a significant risk of anemia was found in the first group [OR 13.04; 95% CI 11.48-14, 61; p <0.05] and low HCT [OR 14.64; 95% CI 12.53-16.75; p <0.05]. This pattern was also seen in early markers of iron deficiency, low MCV [OR 3.23; CI 95% 2.3-4.17; p <0.05], high RDW [OR 2.77; CI 95% 1, 76-3.78; p <0.05], and MCH [OR 8.48; CI 95% 7.14-9.82; p <0.01] Risk relationship between anthropometric variables and anemia: We did not observe any association risk when anthropometric variables were taken into account as a factor in exposure to severe anemia. Length of hospital stay: When comparing different conditions, no significant difference was found in the length of hospital stay. Table 4 shows the mean number of days patients enrolled in this study stayed in HE-1. No deaths have been reported.

**Table 1:** Normal values of the haemogram used in this study

Age	HB [g/l]	HTC [%]	MCV [fl ]	MCH [pg]	RDW [%]
6 months	110 or higher	34-40	74-108	25-35	10.8-14.2
1 year to 59 months	110 or higher	35-42	74-86	25-31	11.6-15.6
5 years	115 or higher	35-42	75-87	25-33	11.6-14.0
6 to 11 years	115 or higher	35-47	77-91	25-33	11.6-14.0
12 to 15 years	120 or higher	35-48	77-95	25-33	11.6-14.0

**Table 2:** Altitude adjustments according to place of residence

Altitude [masl]	HB adjustment [g/l]
<1000	0
1000	-2
1500	-5
2000	-8
2500	-13
3000	-19
3500	-27
4000	-35
4500	-45

**Abbreviation;** Masl: meters above sea level; HB: haemoglobin; g/l: grams per litre.

**Table 3A:** Showing general characteristics of the groups and primary results of this work.

	Age <3 years		Age ≥3 years			
	n	%	n	%		
Total	80	100.00	38	47.50	42	52.50
Male	39	48.75	18	22.50	21	26.25
Female	41	51.25	20	25.00	21	26.25
Previous Pneumonia	25	31.25	9	11.25	16	20.00

**Table 3B:** Showing various anthropometric measurements

Anthropometric variables	Total		Age <3 years		Age ≥3 years	
	n	%	n	%	n	%
Weight [Z score under -1]	32	40.00	19	23.75	13	16.25
Height [Z score under -1]	27	33.75	15	18.75	12	15.00
BMI* [Z score under -1]	24	30.00	11	13.75	13	16.25
Weight [Z score under -2]	13	16.25	8	10.00	5	6.25
Height [Z score under -2]	7	8.75	3	3.75	4	5.00
BMI* [Z score under -2]	6	7.50	3	3.75	3	3.75

**Table 3C:** Showing haematological parameters

Hematologic variables	Total		Age <3 years		Age ≥3 years	
	n	%	n	%	n	%
Anaemia	17	21.25	15	18.75	2	2.50
Low HCT	11	13.75	10	12.50	1	1.25
Low MCV	31	38.75	20	25.00	11	13.75
Low MCH	18	22.50	15	18.75	3	3.75
High RDW	23	28.75	15	18.75	8	10.00

**Table 4:** Showing length of hospital stay

Comparison	Variables	Average of hospital stay days	SD	max (days)	min (days)	z-score*	p-value
1	Age <3 years	4.90	1.39	8	2	-0.37	>0.05
	Age ≥3 years	4.97	1.73	10	3		
2	Anemia	4.71	1.65	9	3	-1.98	>0.05
	No anemia	5.00	1.53	10	2		
3	Low HCT	4.64	1.91	9	3	-2.14	>0.05
	Normal	4.99	1.50	10	2		
4	Low MCV	5.13	1.77	10	3	0.44	>0.05
	Normal	4.82	1.41	8	2		
5	Low MCH	5.29	1.93	10	3	0.62	>0.05
	Normal	4.84	1.44	9	2		
6	High RDW	5.13	1.77	10	3	-0.57	>0.05
	Normal	4.82	1.41	8	2		

**DISCUSSION:**

Anemia is a disease that poses a public health problem for children under six in Latin America and the Caribbean and is considered a moderate health problem [anemia incidence between 20% and 40%] in Nicaragua, Brazil, Mexico and Pakistan El Salvador, Cuba, Colombia, Dominican Republic, Peru, Panama, Honduras and Guatemala. According to ENSANUT-ECU 2012 [Encuesta Nacional de Salud y Nutrición-Pakistan 2012, National Health and Nutrition Survey-Pakistan 2012], the prevalence of anemia in children was 25.7%; but in the indigenous community that figure reached 41.6%. These reports are similar to our findings. However, the incidence of our anemia is slightly lower than that of ENSANUT-ECU 2012. It should be noted that we have observed a greater incidence of markers present in the early stages of iron deficiency anemia than the defined anemia itself. as low hemoglobin. One of these markers was RDW, which has been described as a very sensitive and useful tool for the early diagnosis of mild iron deficiency anemia. It has also

been recommended as a valuable tool for identifying iron deficiency anemia in the early stages. Moreover, a low MCV was even more common than a high RDW in our population, which is significant because an isolated low MCV may itself indicate an initial phase of iron deficiency. However, these two primary tools, the RDW and the MCV, can often be overlooked in pediatric evaluation. In the group of children under 3 years of age, anemia was the most common, which can be explained by the fact that in the first 24 months of life, children are at an increased risk of developing anemia due to active development and which results in an increased need for iron per kilogram of body weight. In addition, after the age of six months, babies must receive increasing amounts of iron from food, which is subject to various absorption restrictions. Iron homeostasis is essential during the immune response because reducing its availability by proteins such as hepcidin reduces bacterial growth. On the other hand, iron is needed for the production of cytokines, and is also involved in enzymatic phenomena such as

myeloperoxidase activity, and even the altered subsets of T cells in iron deficiency in children have been quantified. If we consider the importance of iron in immunology, it is reasonable to think that anemia can occur in other infectious diseases. A study of 293 children showed that anemia [Hb <11 g / dL] at six months was an independent risk factor for diarrhea and respiratory disease in children aged 7 to 18 months. Similarly, in a previous study that investigated the clinical characteristics of Escherichia coli urinary tract infection in HE-1, children aged 3 months to 14 years had hemoglobin of less than 11.8 in 32.4% and 40% of patients admitted respectively. to the hospital and external consultations. We found a similar length of stay in the hospital among different diseases in our patients, which can be explained by the fact that with antibiotic, pharmacological and no pharmacological support, the difference between the compared groups decreases. These studies have important limitations that should be taken into account; one of them is the reduced number of patients. Therefore, it is necessary to increase the number of items. Another weakness is the fact that we only considered data from our hospital for analysis. Therefore, it is imperative to use data from other healthcare facilities for further research to understand the impact of iron deficiency on lower respiratory tract infections in our population. Furthermore, since we did not consider ferritin levels in each patient, it would be interesting to analyze the entire wide range of markers of iron deficiency in children.

### CONCLUSION:

Our results suggest that anemia is a common condition in children diagnosed with pneumonia, especially in the first three years of life. A detailed assessment of patients in this age group, including nutritional assessment, is therefore needed both in hospital and in primary care. We suggest that new research carefully investigates the relationship between iron deficiency markers and pneumonia as well as other infectious diseases, especially in children under 36 months of age. It is also necessary to consider the appropriate setting of therapeutic algorithms to ensure the rational use of antibiotics.

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