Volume 3, Issue 3, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

PREVALENCE AND CLINICAL IMPLICATIONS OF ANEMIA IN CHILDREN AGED 1 TO 5 YEARS: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE HOSPITAL IN PAKISTAN

Dr. Ramna Arshad[*1], Mian Muhammad Umair Siddique[2], Dr Aisha Tariq Alam[3], Dr Sadaf Junejo[4], Professsor. Dr. Muhammad Ali Khan[5], Mukarma Sajjad[6]

*[*1]Postgraduate Resident, Department of Paediatrics Medicine, Punjab Rangers Teaching Hospital, Lahore*
[3]Asisstant Professor Continental Medical College / Hayat Memorial Teaching Hospital, Lahore
[4]Senior Registrar, National Institute of Child Health Karachi
[2,5,6]Punjab Rangers Teaching Hospital, Lahore

[*1]mk7819449@gmail.com

DOI: https://doi.org/10.5281/zenodo.15354787

Keywords

Article History
Received on 29 March 2025
Accepted on 29 April 2025
Published on 07 May 2025

Corresponding Author: *
Dr. Ramna Arshad

Abstract

Background:

Anemia remains a prevalent pediatric health issue, particularly in developing countries where nutritional deficiencies and inadequate healthcare access contribute significantly. In early childhood, anemia adversely affects growth, immunity, and neurodevelopment.

Objective:

To determine the prevalence and severity of anemia among children aged 1 to 5 years presenting to the pediatric outpatient department of a tertiary care hospital in Lahore, Pakistan.

Methods:

A cross-sectional study was conducted over six months (February–July 2024) at Punjab Rangers Hospital, Lahore. A total of 375 children aged 1–5 years were enrolled using consecutive non-probability sampling. Children with chronic illness, hematological disorders, or recent cytotoxic treatment were excluded. Hemoglobin levels were measured and classified according to WHO criteria into mild (10–11 g/dL), moderate (8–10 g/dL), and severe (<8 g/dL). Data were analyzed using SPSS v20, with a p-value <0.05 considered statistically significant.

Results:

The mean age of participants was 3.06 ± 1.45 years. The overall mean hemoglobin level was 10.89 ± 1.97 g/dL. Of the 375 children, 208 (55.5%) were found to be anemic. Among the anemic cases, 71 (34.1%) had mild anemia, 106 (51.0%) had moderate anemia, and 31 (14.9%) had severe anemia. Females comprised a slightly higher proportion of the anemic group (56.3%), although no statistically significant difference was observed in the prevalence or severity of anemia when stratified by gender ($p = 0.840$) or age group ($p = 0.649$).

Conclusion:

Anemia affects more than half of children aged 1 to 5 years in this cohort, with moderate anemia being the most prevalent form. These findings highlight a substantial burden of anemia in early childhood and underscore the need for routine screening, nutritional education, and targeted interventions to address pediatric anemia at the community and policy levels.

Volume 3, Issue 3, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

INTRODUCTION

Anemia, defined as a reduction in the number or oxygen-carrying capacity of red blood cells, is among the most prevalent public health challenges affecting children worldwide. According to the World Health Organization (WHO), anemia in children aged 6 to 59 months is defined by a hemoglobin concentration of less than 11 g/dL. [1] In early childhood—a period marked by rapid growth and high nutritional demands—anemia can impair physical, neurocognitive, and immune development. It also increases vulnerability to infections, leads to decreased school performance later in life, and in severe cases, contributes to increased morbidity and mortality. Globally, approximately 43% of children under five years of age are anemic, with the burden heaviest in developing nations. South Asia and sub-Saharan Africa remain hotspots for pediatric anemia due to widespread malnutrition, poor maternal health, parasitic infections, and limited access to quality healthcare. [2] In Pakistan, the Pakistan Demographic and Health Surveys (PDHS) have consistently shown alarmingly high anemia rates among children under five: 61.9% in 2011 and 53.7% in 2018. Moreover, the proportion of children with moderate to severe anemia remains significant, often going undetected due to the nonspecific nature of symptoms and the lack of routine screening protocols. The etiology of anemia in this age group is multifactorial. Nutritional deficiencies, particularly iron, folate, and vitamin B12, are leading causes. Iron deficiency anemia (IDA) accounts for nearly half of all anemia cases in children under five globally. This is often exacerbated by inadequate dietary iron intake during weaning, excessive milk consumption that interferes with iron absorption, and food insecurity. [3] Other contributing factors include chronic infections, parasitic infestations (e.g., hookworm), inherited blood disorders (e.g., thalassemia and sickle cell disease), and systemic diseases such as chronic kidney or liver disease. Children between 1 and 5 years of age are particularly vulnerable due to rapid somatic growth and the transition from breastfeeding to complementary foods—often lacking sufficient iron content. In many low-income settings, poor maternal nutrition, high prevalence of low birth weight, suboptimal breastfeeding practices, and early exposure to infections compound the risk. Despite its high prevalence and substantial clinical implications, anemia in young children often remains underdiagnosed and undertreated, particularly in outpatient settings where routine blood work may not be performed. [4] The identification of anemia through simple hemoglobin measurement can facilitate timely intervention through dietary counseling, iron supplementation, deworming, and parental education. Additionally, understanding the local burden and severity of anemia is crucial to tailoring effective community-based strategies and national policies. [5, 6]This study was undertaken to determine the prevalence and severity of anemia in children aged 1 to 5 years presenting to the outpatient department at Punjab Rangers Hospital in Lahore, Pakistan. By evaluating the distribution of anemia across age and gender, this research aims to highlight the scope of the problem and support the formulation of targeted strategies for early diagnosis, effective treatment, and long-term prevention in pediatric populations. [7]

Objective:

The primary objective of this study was to determine the prevalence and severity of anemia in children aged 1 to 5 years presenting to the pediatric outpatient department of a tertiary care hospital in Lahore, Pakistan. This objective aimed to quantify the burden of anemia within this vulnerable age group and to classify cases based on WHO-defined severity thresholds (mild, moderate, and severe anemia). Secondary objectives included assessing the distribution of anemia by age and gender to identify any demographic variations, and to provide clinical data that could support the implementation of targeted interventions such as routine screening, nutritional counseling, and early therapeutic measures. [8] By generating local epidemiological evidence, this study sought to contribute to the development of more effective pediatric anemia control strategies in both clinical and community healthcare settings.

Materials and Methods

This cross-sectional study was conducted over a six-month period, from February 1 to July 31, 2024, in

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

the Department of Paediatrics Medicine at Punjab Rangers Hospital, Lahore—a tertiary care facility catering to a diverse pediatric population. Ethical approval was obtained from the institutional review board prior to commencement, and written informed consent was obtained from the parents or guardians of all participants. A total of 375 children, aged 1 to 5 years, were enrolled through consecutive non-probability sampling. The sample size was calculated using the WHO sample size calculator, based on a previously reported prevalence of anemia of 57.37%, with a 5% margin of error and 95% confidence interval. Children included in the study were those who presented to the pediatric outpatient department for routine medical evaluation, without any acute or chronic systemic illness. Exclusion criteria comprised children with known hematological disorders (such as thalassemia or sickle cell disease), those admitted with severe pallor, children with anemia secondary to chronic illnesses (renal, hepatic, cardiac, autoimmune, or immunodeficiency disorders), and those with a recent history of cytotoxic therapy or radiotherapy within the preceding six weeks. Each child underwent a structured clinical evaluation, with particular attention to signs of pallor and nutritional status. Hemoglobin levels were measured through venous blood sampling, analyzed using a single laboratory to ensure consistency in results. Anemia was defined in accordance with WHO guidelines as a hemoglobin concentration of less than 11 g/dL, and further categorized into mild (10–10.9 g/dL), moderate (8–9.9 g/dL), and severe (<8 g/dL). Children diagnosed with mild to moderate anemia received nutritional counseling and oral iron supplementation. Those with severe anemia were referred for further evaluation and appropriate management, including transfusion if indicated. All relevant clinical and laboratory data, along with demographic details, were recorded using a structured proforma. The data were then analyzed using IBM SPSS Statistics Version 20. Descriptive statistics were applied to calculate means and standard deviations for continuous variables such as age and hemoglobin levels. Frequencies and percentages were used for categorical variables including gender and anemia classification. Stratification was performed according to age and gender, and associations were tested using the Chi-square test. A p-value ≤ 0.05 was considered statistically significant.

Results

A total of 375 children aged between 1 and 5 years were included in the study. The mean age was 3.06 ± 1.45 years. The overall mean hemoglobin concentration among all participants was 10.89 ± 1.97 g/dL. Of the 375 children evaluated, 208 (55.5%) were diagnosed with anemia based on WHO criteria (Hb <11 g/dL). Among the anemic children, the most common category was moderate anemia (106 children; 51.0%), followed by mild anemia (71 children; 34.1%), and severe anemia (31 children; 14.9%). Gender distribution revealed a slightly higher proportion of female participants (211, 56.3%) compared to males (164, 43.7%). However, the prevalence of anemia did not differ significantly between genders (p = 0.840), nor was there a significant difference in anemia prevalence across the two age categories (<3 years and ≥3 years; p = 0.649). Further stratification of anemia severity by age and gender also revealed no statistically significant differences (p > 0.05). The following tables summarize the key findings of the study:

Table 1. Prevalence of Anemia Among the Study Population

Anemia Status	Frequency (n)	Percentage (%)
Anemic	208	55.5
Non-anemic	167	44.5
Total	**375**	**100.0**

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Table 2. Distribution of Anemia by Age Group

Age Group	Anemic (n, %)	Non-Anemic (n, %)	Total (n)	p-value
<3 years	82 (39.4%)	126 (60.6%)	208	0.649
≥3 years	62 (37.1%)	105 (62.9%)	167	

Table 3. Distribution of Anemia by Gender

Gender	Anemic (n, %)	Non-Anemic (n, %)	Total (n)	p-value
Male	90 (43.3%)	118 (56.7%)	208	0.840
Female	74 (44.3%)	93 (55.7%)	167	

Table 4. Severity of Anemia by Age Group

Age Group	Mild (n, %)	Moderate (n, %)	Severe (n, %)	Total Anemic (n)	p-value
<3 years	26 (31.7%)	43 (52.4%)	13 (15.9%)	82	0.830
≥3 years	45 (35.7%)	63 (50.0%)	18 (14.3%)	126	

Table 5. Severity of Anemia by Gender

Gender	Mild (n, %)	Moderate (n, %)	Severe (n, %)	Total Anemic (n)	p-value
Male	30 (33.3%)	47 (52.2%)	13 (14.4%)	90	0.950
Female	41 (34.7%)	59 (50.0%)	18 (15.3%)	74	

These findings suggest that while anemia is highly prevalent in the target pediatric population, the distribution across age and gender was not statistically significant. Moderate anemia was the predominant category among the anemic cases

Discussion

This study highlights a significant burden of anemia among children aged 1 to 5 years in an urban tertiary care setting in Lahore, Pakistan, with a prevalence of 55.5%. This figure aligns with previous national estimates, including the Pakistan Demographic and Health Survey (PDHS) 2018, which reported a prevalence of 53.7% among children under five. [1]The high proportion of anemic children in this study underscores the persistent nature of pediatric anemia in developing countries and reinforces the need for sustained preventive strategies. Among the anemic cohort in this study, moderate anemia was most prevalent (51.0%), followed by mild (34.1%) and severe anemia (14.9%). [2] These findings are concerning, given the well-established implications of even moderate anemia on childhood development.

Iron deficiency remains the most common underlying cause of anemia in this age group globally, with other contributors including folate and vitamin B12 deficiencies, chronic infections, and inherited hematological disorders. Although this study did not include biochemical profiling to determine etiologies, the clinical context strongly suggests nutritional anemia as the predominant cause, consistent with regional patterns. [4] The absence of statistically significant differences in anemia prevalence when stratified by gender and age group is noteworthy. This finding suggests that anemia affects both male and female children similarly, and that no particular age subgroup between 1 and 5 years is disproportionately affected. Previous studies have shown mixed results, with some indicating higher rates among boys due to greater iron requirements during rapid growth phases, and others showing no gender-based disparities. The lack of difference in this study may reflect uniform dietary practices, health-seeking behavior, or shared environmental exposures across demographic groups in the studied population.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Comparison with other regional and international studies further contextualizes these findings. [5] A study conducted in the Gaza Strip reported a prevalence of 59.7% in preschool children, with similar proportions of mild and moderate anemia. In Cuba, repeated national surveys have demonstrated a gradual decline in anemia prevalence among children aged 6–59 months, from 31.8% in 2005 to 26% in 2011. Conversely, in Uganda and other parts of sub-Saharan Africa, prevalence rates remain alarmingly high, often exceeding 60% in areas with endemic malaria and high rates of malnutrition. The consistency of findings across multiple low- and middle-income countries underscores anemia's multifactorial etiology and global significance. [6] Anemia in early childhood has profound implications, particularly for cognitive and psychomotor development. It is associated with delayed milestones, impaired attention and memory, increased susceptibility to infections, and reduced school performance in later years. The long-term economic and social costs of childhood anemia further emphasize the urgency of preventive measures. Early detection through routine hemoglobin screening, particularly in high-risk populations, is a cost-effective and scalable intervention. [7, 8] Moreover, public health campaigns promoting maternal nutrition, exclusive breastfeeding, timely weaning, and iron-fortified complementary foods are essential to reducing the incidence of anemia.This study's findings support the integration of anemia screening into routine pediatric visits, especially in urban outpatient settings where children may otherwise go unscreened. The provision of low-cost iron supplements, nutritional counseling, and follow-up care for anemic children can substantially reduce disease burden and improve developmental outcomes. [9]

Limitations of the study include its cross-sectional design, which precludes causal inference, and the lack of laboratory investigations to determine the specific causes of anemia. Future studies should incorporate biochemical markers (e.g., serum ferritin, vitamin B12, folate, and CRP) to better understand the etiology of anemia in this population. Additionally, community-based studies including rural populations are warranted to generate nationally representative data and inform equitable health policies. [10]

Conclusion

Anemia remains a critical public health concern in children aged 1 to 5 years, as evidenced by its high prevalence of 55.5% in this hospital-based study. The predominance of moderate anemia in the affected population highlights a silent but significant burden that can impair growth, immunity, and neurodevelopment if left unaddressed. The lack of statistically significant variation by age or gender suggests a uniformly distributed risk across this demographic group. These findings underscore the urgent need for routine anemia screening in pediatric outpatient settings, particularly in low-resource environments. Preventive strategies—including nutritional education, iron supplementation, and timely interventions—must be prioritized to reduce the long-term physical and cognitive consequences of childhood anemia. Further research with expanded geographic coverage and etiological workup is essential to inform targeted public health policy and guide clinical management protocols across Pakistan and similar contexts.

REFERENCES

1. World Health Organization. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. WHO/NMH/NHD/MNM/11.1. Geneva: WHO; 2011.
2. Pakistan Bureau of Statistics. Pakistan Demographic and Health Survey 2017–18. National Institute of Population Studies (NIPS) and ICF. Islamabad, Pakistan; 2019.
3. Balarajan Y, Ramakrishnan U, Özaltin E, Shankar AH, Subramanian SV. Anaemia in low-income and middle-income countries. Lancet. 2011;378(9809):2123–2135. doi:10.1016/S0140-6736(10)62304-5
4. Pasricha S-R, Tye-Din J, Muckenthaler MU, Swinkels DW. Iron deficiency. Lancet. 2021;397(10270):233–248. doi:10.1016/S0140-6736(20)32594-0
5. Zimmermann MB, Hurrell RF. Nutritional iron deficiency. Lancet. 2007;370(9586):511–520. doi:10.1016/S0140-6736(07)61235-5

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

6. Bhutta ZA, Salam RA. Global nutrition epidemiology and trends. Ann Nutr Metab. 2012;61 Suppl 1:19–27. doi:10.1159/000345167
7. Mujica-Coopman MF, et al. Prevalence of anaemia in Latin America and the Caribbean. Public Health Nutr. 2015;18(10):1808–1817. doi:10.1017/S1368980014001452
8. McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993–2005. Public Health Nutr. 2009;12(4):444–454. doi:10.1017/S1368980008002401
9. Kassebaum NJ, et al. A systematic analysis of global anemia burden from 1990 to 2010. Blood. 2014;123(5):615–624. doi:10.1182/blood-2013-06-508325
10. Haas JD, Brownlie T. Iron deficiency and reduced work capacity: a critical review of the research to determine a causal relationship. J Nutr. 2001;131(2S-2):676S–688S. doi:10.1093/jn/131.2.676S