



Original Article

Epidemiological and Clinicopathological Profile of Anaemia Among Children visiting a Tertiary Care Centre

Dr Tanya Kaushik¹, Dr Manish Agrawal², Dr Neeraj Kabra³

¹Post-Graduate Resident, Department of Pediatrics, Muzaffarnagar Medical College and Hospital, Muzaffarnagar

²Professor & Head, Department of Pediatrics, Muzaffarnagar Medical College and Hospital, Muzaffarnagar

³Professor, Department of Pediatrics, Muzaffarnagar Medical College and Hospital, Muzaffarnagar



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Corresponding Author:

Dr Tanya Kaushik

Post-Graduate Resident, Department of Pediatrics, Muzaffarnagar Medical College and Hospital, Muzaffarnagar
Email-

tanyakaushik27.7.1998@gmail.com

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ABSTRACT

Background: Anaemia remains one of the most common nutritional and hematological disorders among children, particularly in developing countries. It adversely affects growth, cognitive development, immunity, and overall health. Understanding the epidemiological and clinicopathological characteristics of childhood anaemia is crucial for planning effective preventive and therapeutic strategies.

Objectives: To evaluate the epidemiological and clinicopathological profile of anaemia among children visiting a tertiary care hospital and to identify the common clinical presentations, severity patterns, and etiological factors associated with anaemia.

Materials and Methods: A hospital-based cross-sectional observational study was conducted in the Department of Paediatrics, Muzaffarnagar Medical College and Hospital, Uttar Pradesh, India, over a period of 18 months. A total of 200 children aged 1–18 years diagnosed with anaemia according to World Health Organization (WHO) criteria were enrolled. Detailed demographic information, clinical evaluation, complete blood count, peripheral smear examination, iron profile, vitamin B12 and folate estimation, and relevant investigations were performed. Data were analyzed using SPSS software and expressed as frequencies and percentages.

Results: Among the 200 children studied, the majority belonged to the 1–5 years age group (36.0%), followed by 6–10 years (29.0%). Males constituted 54.0% of participants, and 64.0% were from rural areas. Pallor was the most common presenting symptom (93.0%) and clinical sign (95.0%), followed by weakness/fatigue (64.0%), poor appetite (48.0%), and fever (36.0%). According to WHO criteria, moderate anaemia was the predominant severity category (49.0%), followed by mild (27.0%) and severe anaemia (24.0%). Iron deficiency anaemia was the most common etiological type, accounting for 56.0% of cases. Other causes included mixed anaemia (12.0%), anaemia of chronic disease (11.0%), megaloblastic anaemia (10.0%), thalassemia (6.0%), and hemolytic anaemia (5.0%).

Conclusion: Childhood anaemia remains a significant public health concern, primarily among younger children and those residing in rural areas. Iron deficiency anaemia continues to be the predominant etiological subtype. Early identification, nutritional interventions, routine screening, and appropriate etiological evaluation are essential to reduce the burden of childhood anaemia and its associated complications.

Keywords: Anaemia; Children; Iron Deficiency Anaemia; Epidemiology; Nutritional Deficiency.

INTRODUCTION

A decrease in circulating haemoglobin concentration, red blood cell mass, or haematocrit below age-specific reference levels is known as anaemia, and it impairs the blood's ability to transport oxygen. It continues to be one of the world's most significant public health issues, impacting around two billion people. Children represent one of the most vulnerable populations because of increased physiological demands associated with rapid growth and development.

According to estimates from the World Health Organization, 40% of children between the ages of 6 and 59 months worldwide suffer from anaemia, with low- and middle-income nations bearing the brunt of this burden.[1] The incidence of anaemia among preschoolers is above 65%, according to the most recent National Family Health Survey (NFHS-5) data, suggesting that India is a major contributor to this burden.

Childhood anaemia is multifactorial in origin. Nutritional deficiencies, particularly iron deficiency, remain the predominant cause. Other contributors include folate deficiency, vitamin B12 deficiency, chronic infections, inflammatory disorders, parasitic infestations, hemoglobinopathies, and hereditary red cell disorders. The clinical manifestations vary according to severity and underlying etiology and range from mild fatigue to growth retardation, developmental delay, recurrent infections, and cardiovascular complications. [7,8]

Understanding local epidemiological patterns and clinicopathological characteristics is essential for planning effective preventive and therapeutic interventions. Data from tertiary care centres are particularly valuable because they encompass a wide spectrum of disease severity and etiological diversity. In order to assess the epidemiological and clinicopathological features of anaemia in children attending a tertiary care teaching hospital in northern India, the current study was conducted.

OBJECTIVE

To evaluate the epidemiological and clinicopathological profile of anaemia among children attending a tertiary care hospital with respect to demographic characteristics, clinical presentation, severity, and etiological patterns.

MATERIALS AND METHODS

Study Design

cross-sectional observational study carried out in a medical facility. The STROBE standards for cross-sectional studies were followed in the reporting of this study.

Study Setting

Department of Paediatrics, Muzaffarnagar Medical College and Hospital, Muzaffarnagar, Uttar Pradesh, India.

Study Duration

Eighteen months (January 2024 to June 2025)

Study Population

Children aged 1–18 years diagnosed with anaemia according to WHO age-specific criteria.

Sample Size

The study included **200 children diagnosed with anaemia** who fulfilled the eligibility criteria and were enrolled consecutively during the study period.

Inclusion Criteria

- Children aged 1–18 years.
- Diagnosed with anaemia according to WHO criteria.
- Informed consent obtained from parent/guardian.

Exclusion Criteria

- Refusal to participate.
- Previously diagnosed hematological malignancy under treatment.
- Incomplete investigations.

Data Collection

All enrolled children underwent:

- Detailed clinical history
- Nutritional assessment
- Anthropometric measurements

- Complete blood count
- Peripheral blood smear examination
- Reticulocyte count
- Iron profile
- Serum ferritin estimation
- Serum vitamin B12 estimation
- Serum folate estimation
- Stool examination

Statistical Analysis

The data was analysed using SPSS software. Frequencies and percentages were used to represent categorical data, while mean $\pm$ standard deviation was used to express continuous variables.

RESULTS

According to Table 1, the research comprised 200 children who had been diagnosed with anaemia. The age group of 1–5 years had the majority percentage of participation (36.0%), followed by 6–10 years (29.0%), 11–14 years (20.0%), and 15–18 years (15.0%). Males made up 54.0% of the studied population, while females made up 46.0%, indicating a small male preponderance. Most children were from rural areas (64.0%), whereas 36.0% resided in urban settings.

Table 2 presented regarding clinical presentation, pallor was the commonly reported symptom, observed in 93.0% of children, followed by weakness or fatigue (64.0%), poor appetite (48.0%), fever (36.0%), pica (26.0%), and dyspnea (19.0%). On physical examination, pallor was the most common clinical sign, present in 95.0% of participants. Other notable findings included hepatomegaly (17.0%), splenomegaly (14.0%), edema (9.0%), and lymphadenopathy (6.0%).

According to World Health Organization (WHO) guidelines, moderate anaemia was the most common severity group, affecting 49.0% of children, as Table 3 illustrates. Mild anaemia was observed in 27.0% of participants, while severe anaemia was present in 24.0%.

Iron deficiency anaemia was the most common cause, accounting for 56.0% of cases, according to the etiological profile study shown in Table 4. Mixed anaemia was identified in 12.0% of children, followed by anaemia of chronic disease (11.0%), megaloblastic anaemia (10.0%), thalassemia (6.0%), and hemolytic anaemia (5.0%).

Table 1. Demographic Characteristics of Children with Anaemia (n = 200)

Characteristic	Category	n (%)
Age Group (years)	1–5	72 (36.0)
	6–10	58 (29.0)
	11–14	40 (20.0)
	15–18	30 (15.0)
Gender	Male	108 (54.0)
	Female	92 (46.0)
Place of Residence	Rural	128 (64.0)
	Urban	72 (36.0)

Table 2. Presenting Symptoms and Clinical Signs among Children with Anaemia (n = 200)

Variable	n (%)
Presenting Symptoms	
Pallor	186 (93.0)
Weakness/Fatigue	128 (64.0)
Poor Appetite	96 (48.0)
Fever	72 (36.0)
Pica	52 (26.0)
Dyspnea	38 (19.0)
Clinical Signs	
Pallor	190 (95.0)
Hepatomegaly	34 (17.0)
Splenomegaly	28 (14.0)
Edema	18 (9.0)
Lymphadenopathy	12 (6.0)

Table 3. Severity Classification of Anaemia According to WHO Criteria (n = 200)

Severity of Anaemia	n (%)
Mild	54 (27.0)
Moderate	98 (49.0)
Severe	48 (24.0)
Total	200 (100.0)

Table 4. Etiological Classification of Anaemia among Study Participants (n = 200)

Etiology	n (%)
Iron Deficiency Anaemia	112 (56.0)
Mixed Anaemia	24 (12.0)
Anaemia of Chronic Disease	22 (11.0)
Megaloblastic Anaemia	20 (10.0)
Thalassemia	12 (6.0)
Hemolytic Anaemia	10 (5.0)
Total	200 (100.0)

DISCUSSION

The present study assessed the clinicopathological and epidemiological characteristics of anaemia in 200 children receiving treatment at a tertiary care facility. The results show that anaemia is still a serious health issue in the paediatric population, especially in younger kids, people living in rural areas, and people with dietary inadequacies. These findings align with earlier national and international research that emphasised the significant prevalence of childhood anaemia in underdeveloped nations. Children's growth, immunity, cognitive development, and general quality of life are all still negatively impacted by anaemia. [1-3]

The age group of 1–5 years old had the largest percentage of anaemic children in the current research (36%), followed by children aged 6–10 years old (29%). Similar it has been reported by Bansal et al. [4] and Lokeshwar et al. [5] who found a greater prevalence of anaemia among preschool children owing to rapid growth, increased iron requirements, inadequate complementary feeding practices, and recurrent infections. Young children are particularly vulnerable because iron stores acquired during infancy become depleted during periods of rapid growth. The predominance of anaemia in early childhood observed in our study supports the need for intensified nutritional interventions in this age group.

A modest male preponderance was noticed, with men accounting for 54% of cases against 46% for females. Similar gender distributions have been reported by Jain et al. [6] and Reddy AB et al. [7] Although the biological susceptibility to anaemia may not differ significantly between sexes during early childhood, healthcare-seeking behavior and sociocultural factors may influence hospital attendance patterns. The difference observed in the present study was modest and may not reflect a true gender predisposition.

Most participants were from rural areas (64%), highlighting the higher burden of anaemia among rural populations. Similar findings have been reported in NFHS-5 data and studies by Kajale NA et al. [8] Rural children are often exposed to poor sanitation, inadequate nutrition, parasitic infestations, limited healthcare access, and lower socioeconomic conditions, all of which contribute to the development of anaemia. The current study's high percentage of rural patients emphasises how crucial it is to improve basic healthcare and nutrition initiatives in rural areas.

Regarding clinical presentation, pallor was the most common symptom (93%) and clinical sign (95%). Weakness or fatigue was present in 64% of children, while poor appetite (48%), fever (36%), and pica (26%) were also frequently reported. Similar observations were documented by Oski et al. [9] and Gomber et al. [10] who identified pallor as the most sensitive clinical indicator of childhood anaemia. Pica, observed in one-fourth of the children, is particularly associated with iron deficiency and serves as an important clinical clue in resource-limited settings.

Among physical findings, hepatomegaly (17%) and splenomegaly (14%) were notable. These findings may indicate underlying hemolytic disorders, chronic infections, nutritional deficiencies, or hematological diseases. Comparable results have been reported by Balgir et al. [11] and Mohanty D et al. [12] among children with chronic anaemia and hemoglobinopathies. The relatively low frequency of edema (9%) and lymphadenopathy (6%) suggests that severe systemic illnesses were less common in the study population.

Assessment of anaemia severity according to WHO criteria revealed that moderate anaemia was the most common category (49%), followed by mild anaemia (27%) and severe anaemia (24%). Similar distributions have been reported by WHO estimates and studies conducted by Choudhary P et al. [13] and Kotecha et al. [14] where moderate anaemia

represented the predominant form. The high percentage of moderate and severe anaemia found in this study suggests that afflicted children received insufficient nutritional supplements and a delayed diagnosis.

Iron deficiency anaemia (IDA) was the primary cause, accounting for 56% of all cases, according to the etiological study. This result is in line with research from around the world and India that shows iron deficiency is the commonest cause of anaemia in children. [15–17] Inadequate food intake, low dietary iron bioavailability, increasing physiological needs during development, repeated illnesses, and intestinal parasite infestations all contribute to iron insufficiency. Pasricha et al. [16] and Stoltzfus et al. [17] have reported comparable IDA proportions.

Mixed nutritional anaemia constituted 12% of cases, while anaemia of chronic disease (11%) and megaloblastic anaemia (10%) were also important contributors. These findings indicate that childhood anaemia is often multifactorial and not solely attributable to iron deficiency. Allen et al. [18], who highlighted the cohabitation of iron, folate, and vitamin B12 deficits in impoverished nations, observed similar findings. The presence of megaloblastic anaemia in one-tenth of children highlights the need for comprehensive nutritional assessment rather than empirical iron therapy alone.

Inherited and hemolytic causes constituted a smaller but clinically important proportion of cases, with thalassemia accounting for 6% and hemolytic anaemia for 5%. Comparable frequencies have been reported in tertiary care studies from North India where hemoglobinopathies contribute significantly to severe and recurrent anaemia. Genetic counselling, illness monitoring, and long-term management all depend on early detection of these diseases.

CONCLUSION

The current study comes to the conclusion that childhood anaemia is still a serious public health issue, especially for younger children and those who live in rural regions. The greatest afflicted group was children between the ages of one and five, with a slight male preponderance.

Pallor was the most frequent presenting symptom and clinical sign, followed by weakness, poor appetite, and fever. According to WHO classification, moderate anaemia was the most common severity category, although a substantial proportion of children also had severe anaemia.

Iron deficiency anaemia emerged as the predominant etiological type, accounting for more than half of all cases. However, mixed nutritional anaemia, anaemia of chronic disease, megaloblastic anaemia, thalassemia, and hemolytic anaemia also contributed significantly to the overall burden, indicating that childhood anaemia is a heterogeneous disorder with multiple underlying causes.

These results emphasise the necessity of early screening, thorough nutritional evaluation, prompt diagnosis, and suitable etiological assessment of children with anaemia. Strengthening nutritional supplementation programs, improving dietary practices, controlling infections and parasitic infestations, and enhancing healthcare access in rural communities are essential strategies to reduce the burden of childhood anaemia and its long-term consequences.

STRENGTHS

- Comprehensive clinicopathological evaluation.
- Inclusion of hematological and biochemical parameters.
- Assessment of nutritional and socioeconomic determinants.
- Adequate sample size (n=200).

LIMITATIONS

- Single-centre study.
- Hospital-based population may not represent community prevalence.
- Cross-sectional design limits causal inference.

ETHICS STATEMENT

The Institutional Ethics Committee of Muzaffarnagar Medical College and Hospital authorised the study prior to data collection. Parents or legal guardians provided written informed permission.

CONFLICT OF INTEREST

None declared.

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