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Study On Prevalence of Anaemia in Children in Tertiary Teaching Hospital of Coastal Karnataka

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Abstract

Background: Anaemia is a serious public health issue, and India falls into the severe group of anaemia in children based on the WHO's classification of nations by the level of anaemia. It is associated with various nutritional deficiencies and systemic illnesses.

Methods: A retrospective study was conducted on 100 paediatric patients aged 6 months to 14 years with haemoglobin levels less than 10.9g/dL. Laboratory investigations, including haemoglobin, red blood cell count, packed cell volume, red blood cell indices, and peripheral smear examination data were collected and analysed for different morphological patterns among different age groups.

Results: Among the 100 cases studied, 52% were males and 48% were females. The most affected age group was 6 months to 4 years of age, and the most common morphological pattern observed was microcytic hypochromic anaemia, followed by normocytic normochromic anaemia and macrocytic anaemia. Mild anaemia was the most frequently observed severity. Various systemic illnesses, including respiratory, gastrointestinal, and central nervous system disorders were associated with anaemia.

Conclusions: Microcytic hypochromic anaemia was the most prevalent morphological type among paediatric patients with slight male predominance. Early diagnosis through routine haematological evaluation can help identify underlying causes and improve the management of anaemia in children

Keywords: Anaemia, paediatric, microcytic hypochromic, children

Introduction

Anaemia is characterised by a lower-than-usual level of haemoglobin (Hb) in the body, which reduces the body's ability to carry oxygen. Based on the patient's age, gender, and health issues, the Hb level is used to diagnose anaemia.(1)

In general, the normal haemoglobin values in children range from 11.0 to 16.0 g/dL.(2) The child's haemoglobin level (in g/dL) and the severity of their anaemia are divided as mild (10-10.9 g/dL), moderate (7–9.9 g/dL), and severe (<7 g/dL).(3) The morphological categories of anaemia are Normocytic normochromic anaemia, Normocytic Hypochromic anaemia, Microcytic hypochromic anaemia , Macrocytic anaemia and Dimorphic anaemia.(4)

According to the World Health Organisation's (WHO) standards, anaemia is considered as a serious public health issue if its prevalence is 40% or higher.(5) Anaemia is a universal public health issue that has a significant impact on social and economic development as well as human health in both

developed and developing nations. Although it can occur at any stage of life, pregnant women and small children are more likely to experience it. A common nutritional issue that affects kids throughout their critical growth stage is anaemia.(6)

A child's growth, development, and survival are severely impacted by anaemia, and identifying the factors that contribute to anaemia in a community is essential to putting control measures in place. Establishing preventive programs, revising treatment protocols, monitoring, and caring for anaemic children, developing legislation, and raising public awareness of child anaemia will all be aided by the study's findings on the prevalence of anaemia and its contributing causes.(7) Therefore, this study aims to evaluate the frequency, morphological patterns, and severity of anaemia in paediatrics.

Materials And Methods:

Source of data, study setting

The study was conducted in a tertiary care teaching hospital. The paediatric patients aged between 6 months and 14 years with haemoglobin less than 10.9g/dL were selected (both IP and OP patients). The other parameters, including RBC count, PCV, Red Cell Indices, and peripheral smear findings, were retrieved from the laboratory information system.

Study Design

It is a Retrospective, Descriptive, cross-sectional hospital-based study.

Sample Size Calculation

Formula:

$$n = \frac{\left(Z^2_{1-\frac{\alpha}{2}} \times p(1-p)\right)}{d^2}$$

Where,

p =Expected proportion

d = Absolute precision

1-α/2 = Desired confidence level

Here,

Expected Proportion (From reference article) - 0.206

Precision / Margin of Error (%) - 8

Desired confidence level (1- alpha) % - 95

Z1-2 - 1.96

Minimum required sample size - 98

The final sample size was rounded up to the nearest 100, resulting in a total of 100 patients.(8)

Inclusion Criteria

Children aged between 6 months and 14 years with a haemoglobin level below 10.9 g/dL.

Exclusion Criteria

1. Infants less than 6 months of age.
2. Children above 14 years of age.

Methods

The present study is a descriptive cross-sectional study conducted in the Haematology section of the Central Laboratory of Father Muller Medical College. Ethical clearance was obtained from the Institutional Ethics Committee of Father Muller Charitable Institution.

The study includes both outpatient (OP) and inpatient (IP) paediatric patients aged above 6 months and below 14 years, with haemoglobin levels less than 10.9 g/dL.

The Ethylene Diamine Tetra Acetic (EDTA) blood sample was analysed for Haematological parameters like haemoglobin, red blood cell (RBC) count, packed cell volume (PCV) and red cell indices such as mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), and red cell distribution width (RDW) using the Sysmex XN1000 analyser. A Peripheral smear was prepared from the sample, stained with Leishman stain, and examined under high power and oil immersion for characteristics of red blood cells. These analytical data were collected from the hospital information system along with demographical details and diagnosis.

The paediatric patients included in the study were divided into three age categories to compare the frequency, morphological patterns and severity of anaemia.

Categories are as follows.

1. 6 months to 4 years
2. 5 years to 11 years
3. 12 years to 14 years

Volume 9, Issue 3; May-June 2026; Page No 305-312

The data are then analyzed and represented as frequency and percentage.

Statistical analysis- Statistical analysis of the data is performed using SPSS 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp). Demographic data and Descriptive statistics were expressed using frequency and percentage for categorical variables.

Results

A total of 100 paediatric patients aged 6 months to 14 years with haemoglobin levels less than 10.9g/dL were included in this study. There were 52 male and 48 female patients.

Anaemic children were categorised into three groups based on age, and most of the anaemic children fell in the age group of 6 months to 4 years, followed by 5-11 years and 12-14 years. (Table 1)

Three morphological patterns of anaemia were observed in this study: - Normocytic normochromic anaemia, Microcytic hypochromic anaemia and Macrocytic anaemia. Microcytic hypochromic anaemia was the most prevalent type, accounting for 59% of cases, followed by normocytic normochromic anaemia and macrocytic anaemia, which accounted for 39% and 2% cases, respectively.

The morphological patterns of anaemia were studied among three age categories. The distribution of anaemia patterns across different age groups showed that most cases were observed in the 6 months–4 years age group (n = 67). (Figure 1)

Severity of anaemia is classified as Mild, Moderate and Severe. Out of the total cases, 62 had mild anaemia, which was the predominant severity, followed by 33 cases with moderate anaemia and 5 cases with severe anaemia. The severity-wise distribution of anaemia showed that mild anaemia was the predominant form across all age groups. (Figure 2)

Distribution of RBC Count, PCV, Red Cell Indices, and RDW across different age groups in Microcytic Hypochromic Anaemia is presented in Table 2. RBC count and MCHC values were normal in most cases. PCV values were predominantly reduced among the study population. Most cases demonstrated low MCV and MCH values. RDW was predominantly elevated across all age groups, suggesting variation in red cell size among study subjects.

Distribution of RBC count, PCV, Red Cell Indices and RDW across different age groups in Normocytic Normochromic Anaemia is presented in Table 3. RBC count showed predominantly low values among the study population. PCV values were reduced in a greater number of cases across all age groups. Most cases demonstrated normal MCV, MCH, and MCHC values, consistent with normocytic normochromic morphology. Increased RDW values were observed in many study subjects.

Distribution of RBC count, PCV, Red Cell Indices and RDW across different age groups in Macrocytic anaemia is presented in Table 4. RBC count and PCV values were reduced in all cases. MCV values were increased in all study subjects, indicating macrocytosis.

Anaemia in the study population was associated with various underlying systemic diseases involving the central nervous, respiratory, gastrointestinal, genitourinary and other organ systems. (Table 5)

Discussion

The current study's gender distribution revealed 52% male, and 48% females are affected by anaemia with a slight male predominance. Similarly, male predominance was seen in the study done by Lahari N A et al where they observed 58% male and 42% females were anaemic(4). Also, the study carried out by Choudhary P et al exhibited male predominance with 71.7% of total anaemic cases.(1)

The age group of 6 months to 4 years old accounted for 67% of the anaemic children in the current study suggests that anaemia affects younger kids more frequently than it does in older kids. A similar observation was reported by Choudhary P et al., where the highest number of anaemic cases were observed in children between 1 and 5 years of age, indicating that early childhood is the most vulnerable period for the development of anaemia.(1)

The most prevalent morphological pattern observed in our study was microcytic hypochromic anaemia, followed by normocytic normochromic anaemia and macrocytic anaemia. These results are similar to the study conducted by Lahari N A et al., and Dr. Gauravi Dhruva et al who found that the most prevalent morphological type in children was microcytic hypochromic anaemia, followed by normocytic normochromic anaemia. (4,9)

Volume 9, Issue 3; May-June 2026; Page No 305-312

In the present study, mild anaemia was the most common severity category; in contrast, the study conducted by Choudhary P et al reported a different distribution pattern. In their study, moderate anaemia was the most prevalent(1). The predominance of mild anaemia observed in the present study may reflect early diagnosis of anaemia among children, which could be due to the availability and accessibility of healthcare services in the study area. The age-wise distribution of severity in the present study demonstrated that mild anaemia was the predominant form in all age groups.

The majority of the microcytic hypochromic anaemia cases in the current investigation had low MCV and low MCH, associated with elevated RDW, which are suggestive of iron deficiency anaemia. Omer et al. found similar findings, stating that iron deficiency anaemia is frequently linked to microcytosis with hypochromia and high RDW, especially in the paediatric population.(10) This observation supports the usefulness of red cell indices and RDW as important screening parameters for identifying iron deficiency anaemia in children, especially in resource-limited settings where advanced investigations may not always be feasible.

Normocytic normochromic anaemia is characterized by red blood cells with relatively normal size and haemoglobin concentration, although haemoglobin levels and red cell mass are reduced.(11) In the present study, a considerable proportion of children showed reduced RBC count and PCV across all age groups, reflecting the anaemic state. MCHC values were predominantly within the normal range, supporting the normochromic nature of the anaemia. While several cases demonstrated normal MCV and MCH values, a number of children, particularly in the younger age groups, showed slightly reduced indices. In addition, RDW was elevated in a significant proportion of cases, indicating variation in red cell size.

Two cases of macrocytic anaemia were demonstrated with low RBC count and low PCV, indicating anaemia, while MCV was elevated in both cases, confirming macrocytosis.

Conclusion:

The findings of this study highlight that the microcytic hypochromic anaemia was the predominant morphological pattern among paediatric patients, particularly in children below 5 years of age. Early detection through routine haematological evaluation and timely management of nutritional deficiencies and underlying diseases are essential to reduce the burden of anaemia and its associated complications in children. Investigations such as iron profile, Vit B12/ folic acid assay, Hb electrophoresis and bone marrow examination can be used to diagnose and guide the treatment.

References

1. Choudhary P, Kumar S, Ambhore J. Clinical and hematological profile of anemia in children aged 6 months to 12 years at tertiary care hospital in central India. Int J Contemp Pediatrics. 2021 Sep;8:1704. doi:10.18203/2349-3291.ijcp20213734
2. Turner J, Parsi M, Badrireddy M. Anemia. In: StatPearls(Internet). wiley; 2023. p. 99–104. doi:10.1002/9781119636540.ch12 PubMed PMID: 29763170.
3. Onyeneho NG, Ozumba BC, Subramanian S V. Determinants of Childhood Anemia in India. Sci Rep. 2019 Dec;9. doi:10.1038/s41598-019-52793-3 PubMed PMID: 31719548.
4. M B, Lahari N A. Morphological pattern based analysis of anemia in paediatric age group. IP Journal of Diagnostic Pathology and Oncology. 2019 Dec;4:253–5. doi:10.18231/j.jdpo.2019.052
5. World Health Organization (2017). Nutritional anaemias: tools for effective prevention and control. World Health Organization. https://iris.who.int/handle/10665/259425. License: CC BY-NC-SA 3.0 IGO
6. Raja P, Rajaselvan R. Prevalence of anemia in school children in the age group of 8 to 14 years in Thiruvarur, Tamilnadu, India. Int J Contemp Pediatrics. 2019 Jun;6:1428. doi:10.18203/2349-3291.ijcp20192168
7. Dutta M, Bhise M, Prashad L, Chaurasia H, Debnath P. Prevalence and risk factors of anemia among children 6–59 months in India: A multilevel analysis. Clin Epidemiol Glob Health. 2020 Sep;8:868–78. doi:10.1016/j.cegh.2020.02.015
8. M. K. M, Khan SA, Saldanha P. Clinical study of anemia in rural school children of Mangalore, Karnataka, India. Int J Contemp Pediatrics. 2019 Feb;6:416. doi:10.18203/2349-3291.ijcp20190051

Volume 9, Issue 3; May-June 2026; Page No 305-312

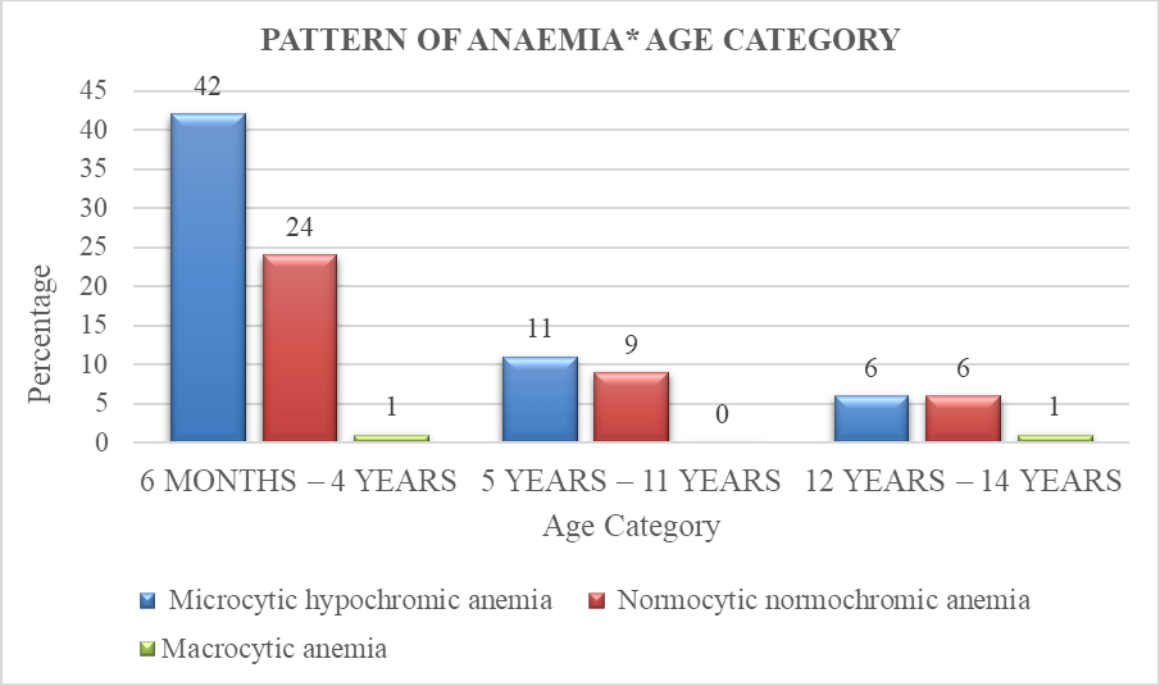
9. Dhruva G, Agravat A, Unadkat H. Study On Paediatric Anemia In Out Patient Department At A Tertiary Care Centre, Rajkot, Gujarat, India. Int J Med Pharm Res. 2025;6(5):391–6. doi:10.5281/zenodo.17355280
10. Omer A, Hailu D, Nigusse G, Mulugeta A. Magnitude and morphological types of anemia differ by age among under five children: A facility-based study. Heliyon. 2022 Sep;8. doi:10.1016/j.heliyon.2022.e10494
11. Saba F, Poornima S, Balaji PR, Varne SR, Jayashree K. Anemia among hospitalized children at a multispecialty hospital, Bangalore (Karnataka), India. J Family Med Prim Care. 2014;3(1):48. doi:10.4103/2249-4863.130275.

Tables And Figures:

Table 1: Age-Wise Distribution Of Anaemia.

Age category	No.	%
6 months – 4 years	67	67.0
5 years – 11 years	20	20.0
12 years – 14 years	13	13.0
Total	100	100

Figure 1: Morphological Patterns Of Anaemia In Relation To Age-Wise Distribution



Volume 9, Issue 3; May-June 2026; Page No 305-312

Figure 2: Distribution of severity among age categories.

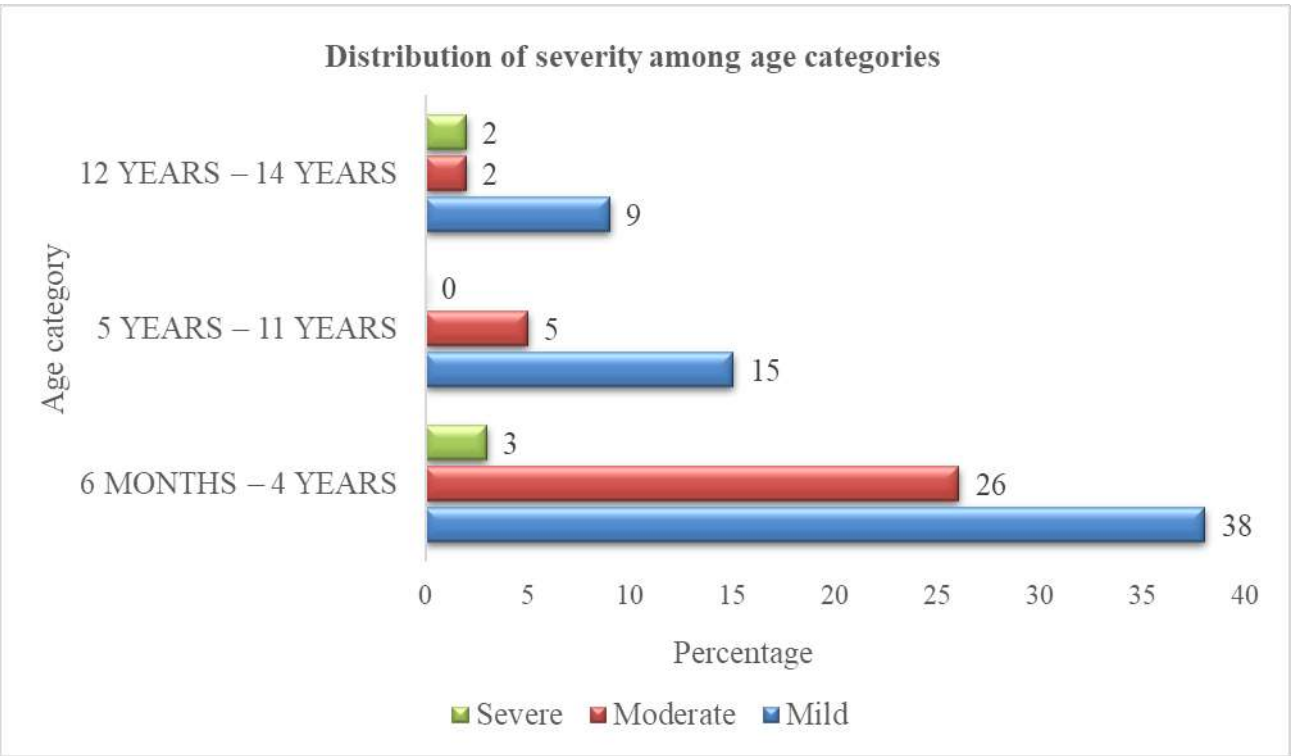


Table 2: Comparison of RBC Count, PCV, Red Cell Indices, and RDW across different age groups in Microcytic Hypochromic Anaemia.

Parameter	Status	6 MONTHS – 4 YEARS (n=42)		5 YEARS – 11 YEARS (n=11)		12 YEARS – 14 YEARS (n=6)		Total (n=59)	
		n	%	n	%	n	%	n	%
RBC	Normal	30	71.4%	7	63.6%	2	33.3%	39	66.1%
	High	7	16.7%	1	9.1%	3	50.0%	11	18.7%
	Low	5	11.9%	3	27.3%	1	16.7%	9	15.2%
PCV	Normal	10	23.8%	5	45.5%	4	66.7%	19	32.2%
	Low	32	76.2%	6	54.5%	2	33.3%	40	67.8%
MCV	High	0	0.0%	0	0.0%	1	16.7%	1	1.7%
	Normal	1	2.4%	0	0.0%	0	0.0%	1	1.7%
	Low	41	97.6%	11	100.0%	5	83.3%	57	96.6%
MCH	Normal	2	4.8%	1	9.1%	1	16.7%	4	6.8%

Volume 9, Issue 3; May-June 2026; Page No 305-312

	Low	40	95.2%	10	90.9%	5	83.3%	55	93.2%
MCHC	Normal	24	57.1%	9	81.8%	4	66.7%	37	62.8%
	Low	18	42.9%	2	18.2%	2	33.3%	22	37.2%
RDW	Normal	2	4.8%	1	9.1%	0	0.0%	3	5.0%
	High	40	95.2%	10	90.9%	6	100.0%	56	95.0%

Table 3: Comparison of RBC Count, PCV, Red Cell Indices, and RDW across different age groups in Normocytic Normochromic Anaemia.

Parameter	**Status**	**6 MONTHS – 4 YEARS (n=24)**		**5 YEARS – 11 YEARS (n=9)**		**12 YEARS – 14 YEARS (n=6)**		**Total (n=39)**	
		n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
RBC	Normal	14	58.3%	4	44.4%	0	0.0%	18	46.1%
	High	0	0.0%	0	0.0%	1	16.7%	1	2.6%
	Low	10	41.7%	5	55.6%	5	83.3%	20	51.3%
PCV	Normal	7	29.2%	5	55.6%	2	33.3%	14	35.9%
	Low	17	70.8%	4	44.4%	4	66.7%	25	64.1%
MCV	Normal	9	37.5%	4	44.4%	5	83.3%	18	46.1%
	Low	15	62.5%	5	55.6%	1	16.7%	21	53.9%
MCH	Normal	12	50.0%	6	66.7%	4	66.7%	22	56.4%
	High	1	4.2%	0	0.0%	0	0.0%	1	2.6%
	Low	11	45.8%	3	33.3%	2	33.3%	16	41.0%
MCHC	Normal	24	100.0%	8	88.9%	5	83.3%	37	94.9%
	Low	0	0.0%	1	11.1%	1	16.7%	2	5.1%
RDW	High	14	58.3%	5	55.6%	5	83.3%	24	61.6%
	Normal	10	41.7%	4	44.4%	1	16.7%	15	38.4%

Table 4: Comparison of RBC Count, PCV, Red Cell Indices, and RDW across different age groups in Macrocytic Anaemia.

Parameter	**Status**	**6 MONTHS – 4 YEARS (n=1)**		**12 YEARS – 14 YEARS (n=1)**		**Total (n=2)**	
		n	**%**	**n**	**%**	**n**	**%**

Volume 9, Issue 3; May-June 2026; Page No 305-312

RBC	Low	1	100.0%	1	100.0%	2	100.0%
PCV	Low	1	100.0%	1	100.0%	2	100.0%
MCV	High	1	100.0%	1	100.0%	2	100.0%
MCH	High	1	100.0%	0	0.0%	1	50.0%
	Normal	0	0.0%	1	100.0%	1	50.0%
MCHC	Normal	1	100.0%	0	0.0%	1	50.0%
	Low	0	0.0%	1	100.0%	1	50.0%
RDW	Normal	0	0.0%	1	100.0%	1	50.0%
	High	1	100.0%	0	0.0%	1	50.0%

Table 5: Distribution of associated systemic disorders involving different organ systems.

SYSTEM	n	%
Central nervous system	28	28.0%
Respiratory system	25	25.0%
Gastrointestinal system	16	16.0%
Genitourinary system	12	12.0%
Haematological disorder	10	10.0%
Viral fever	8	8.0%
Mucocutaneous diseases	4	4.0%
Autoimmune diseases	3	3.0%
Skeletal system	3	3.0%
Endocrine system	3	3.0%
Auditory system	2	2.0%
Lymphatic system	2	2.0%
Renal system	2	2.0%
Ocular system	1	1.0%
Cardiac system	1	1.0%
Muscular system	1	1.0%

Volume 9, Issue 3; May-June 2026; Page No 305-312