

**Pattern and Determinants of Nutritional Anemia Among Children Aged 6 Months to 5 Years
Attending the Pediatric Outpatient Department: A Cross-Sectional Study**

Rathod B¹

¹Dr Bipin Rathod, Assistant Professor, paediatric, Panjabrao alias Bhausaheb Deshmukh Memorial Medical College, Amravati, Maharashtra, India

Corresponding Author

Dr Bipin Rathod, Assistant Professor, paediatric, Panjabrao alias Bhausaheb Deshmukh memorial medical college, Amravati, Maharashtra, India
Email: bipinrathodamt@gmail.com

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Abstract

Background: Nutritional anemia is one of the most common public health problems among under-five children, particularly in developing countries. It adversely affects physical growth, cognitive development, immunity, and overall child health. Early identification of the pattern and determinants of anemia is essential for effective preventive and therapeutic interventions.

Methodology: A hospital-based cross-sectional observational study was conducted among 150 children aged 6 months to 5 years attending the Pediatric Outpatient Department of a tertiary care hospital. Data regarding socio-demographic profile, feeding practices, nutritional status, and clinical history were collected using a predesigned questionnaire. Hemoglobin estimation and complete blood count were performed for all participants. Severity and morphological pattern of anemia were assessed according to WHO criteria.

Results: The prevalence of nutritional anemia was found to be 64.0%. Moderate anemia (47.9%) was the most common severity pattern, while microcytic hypochromic anemia (66.7%) was the predominant morphological type. Significant association of anemia was observed with malnutrition ($p<0.001$), delayed complementary feeding ($p<0.001$), absence of exclusive breastfeeding ($p=0.002$), low socioeconomic status ($p<0.001$), poor maternal education ($p<0.001$), and recurrent infections ($p=0.001$).

Conclusion: Nutritional anemia remains highly prevalent among under-five children and is strongly associated with nutritional, socioeconomic, and feeding-related factors.

Keywords: Nutritional anemia, Under-five children, Iron deficiency anemia, Feeding practices, Malnutrition

Introduction

Nutritional anemia remains one of the most important public health problems affecting under-five children, particularly in developing countries. It is characterized by reduced hemoglobin concentration due to deficiency of essential nutrients such as iron, folic acid, and vitamin B12, with iron deficiency being the most common cause. Childhood anemia adversely affects cognitive development, physical growth, immunity, school performance, and overall child survival. According to the World Health Organization (WHO), anemia affects nearly 40% of children below five years globally, with the highest burden seen in South-East Asia and Africa ⁽¹⁾. In India, despite implementation of several nutritional and child health programs, anemia continues to remain highly prevalent because of inadequate dietary intake, recurrent infections, poor socioeconomic conditions, and inappropriate infant feeding practices ^(2,3).

Children aged 6 months to 5 years are particularly vulnerable because of rapid growth requirements, depletion of iron stores after infancy, delayed or inadequate complementary feeding, and frequent infections. Several Indian studies have demonstrated a high prevalence of anemia among preschool children and identified factors such as low maternal education, poor socioeconomic status, undernutrition, recurrent infections, worm infestation, and poor dietary diversity as important determinants ^(4,5). Early identification of the pattern and associated risk factors of nutritional anemia is essential for effective preventive and therapeutic interventions. Therefore, the present study was conducted to assess the pattern and determinants of nutritional anemia among children aged 6 months to 5 years attending the Pediatric

Outpatient Department of a tertiary care hospital.

Objectives

1. To determine the prevalence and pattern of nutritional anemia among children aged 6 months to 5 years attending the Pediatric OPD.
2. To identify socio-demographic, nutritional, and clinical determinants associated with nutritional anemia among under-five children.
3. To assess the association between feeding practices, nutritional status, and severity of anemia among study participants.

MATERIALS AND METHODOLOGY

Study Design

Hospital-based cross-sectional observational study.

Study Setting

The study was conducted in the Pediatric Outpatient Department (OPD) of a tertiary care teaching hospital.

Study Duration

The study was carried out over a period of 6–8 months.

Study Population

Children aged 6 months to 5 years attending the Pediatric OPD

Sample Size

The sample size was calculated using the formula:

$$n = \frac{4pq}{L^2}$$

Where:

- p = prevalence of anemia among under-five children = 67.1% (NFHS-5 data)
- $q = 100 - p = 32.9$
- L = allowable error = 10% of prevalence (6.7)

$$n = \frac{4 \times 67.1 \times 32.9}{(6.7)^2}$$

The calculated sample size was approximately 98. To improve representation and account for incomplete data, a final sample size of 150 children was included.

Sampling Technique

Consecutive sampling was used until the required sample size was achieved.

Inclusion Criteria

- Children aged 6 months to 5 years attending the Pediatric OPD.
- Parents/guardians willing to provide informed written consent.

Exclusion Criteria

- Children with known hemolytic anemia, thalassemia, sickle cell disease, aplastic anemia, or other hematological disorders.
- Children who received blood transfusion within the previous three months.
- Children with chronic systemic illnesses such as chronic kidney disease, malignancy, congenital heart disease, or chronic liver disease.

Data Collection Procedure

After obtaining Institutional Ethics Committee approval and informed consent from

parents/guardians, eligible children were enrolled. A predesigned semi-structured questionnaire was used to collect information regarding socio-demographic profile, feeding practices, dietary habits, immunization status, socioeconomic status, and history of recurrent infections.

Clinical examination included assessment of pallor, anthropometric measurements, and signs of nutritional deficiencies. Nutritional status was assessed using WHO growth standards.

Approximately 2–3 mL of venous blood was collected under aseptic precautions. Hemoglobin estimation and complete blood count were performed using an automated hematology analyzer. Peripheral smear examination was done when indicated to classify the morphological pattern of anemia. Severity of anemia was classified according to WHO criteria ⁽²⁾

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 26.0. Variables were expressed as mean $\pm$ standard deviation. Association between anemia and different determinants was assessed using Chi-square test or Fisher's exact test. A p-value <0.05 was considered statistically significant.

Ethical Considerations

Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was obtained from parents/guardians. Confidentiality and anonymity of participants were maintained throughout the study.

RESULTS

The majority of children belonged to the 1–3 years age group (45.3%). Males constituted 54.7% of the study population. Most children belonged to lower middle and upper lower socioeconomic classes. Nearly half of the mothers had only primary or no formal education.

Table 1: Socio-Demographic Characteristics

Variable	Frequency (n)	Percentage (%)
Age Group		
6 months – 1 year	32	21.3
1 – 3 years	68	45.3
3 – 5 years	50	33.4
Gender		
Male	82	54.7

Female	68	45.3
Socioeconomic Status		
Upper	12	8.0
Upper middle	28	18.7
Lower middle	54	36.0
Upper lower	40	26.7
Lower	16	10.6
Maternal Education		
Illiterate	34	22.7
Primary school	48	32.0
Secondary school	50	33.3
Graduate and above	18	12.0

The prevalence of nutritional anemia among study participants was 64.0%. Moderate anemia was the most common severity pattern, followed by mild anemia. Microcytic hypochromic anemia was the predominant morphological type.

Table 2: Prevalence and Pattern of Nutritional Anemia

Variable	Frequency (n)	Percentage (%)
Anemia Status		
Anemic	96	64.0
Non-anemic	54	36.0
Severity of Anemia (n=96)		
Mild	38	39.6
Moderate	46	47.9
Severe	12	12.5
Morphological Pattern (n=96)		
Microcytic hypochromic	64	66.7
Normocytic normochromic	22	22.9
Macrocytic	10	10.4

Table 3: Association Between Nutritional Status and Presence of Anemia (n = 150)

Nutritional Status	Anemic n (%)	Non-anemic n (%)	Total	p-value
Normal	34 (45.3)	41 (54.7)	75	
Moderate malnutrition	43 (79.6)	11 (20.4)	54	

Severe malnutrition	19 (90.5)	2 (9.5)	21	<0.001
Total	96	54	150	

Table 4A: Association Between Exclusive Breastfeeding and Anemia (n = 150)

Feeding Practice	Anemic	Non-anemic	Total	p-value
Exclusive BF	36 (50.7)	35 (49.3)	71	
No exclusive BF	60 (75.9)	19 (24.1)	79	0.002
Total	96	54	150	

Table 4B: Association Between Complementary Feeding Initiation and Anemia (n = 150)

Complementary Feeding Initiation	Anemic n (%)	Non-anemic n (%)	Total	p-value
Timely initiation (6 months)	40 (50.0)	40 (50.0)	80	
Delayed initiation (>6 months)	56 (80.0)	14 (20.0)	70	<0.001
Total	96	54	150	

Table 5: Association of Socioeconomic and Maternal Factors with Nutritional Anemia (n = 150)

Variable	Anemic n (%)	Non-anemic n (%)	p-value
Socioeconomic Status			
Upper/Upper middle	14 (35.0)	26 (65.0)	
Lower middle	38 (70.4)	16 (29.6)	
Upper lower/Lower	44 (78.6)	12 (21.4)	<0.001
Maternal Education			
Secondary school and above	28 (41.2)	40 (58.8)	
Primary school or illiterate	68 (82.9)	14 (17.1)	<0.001
History of Recurrent Infections			

Present	52 (81.3)	12 (18.7)	
Absent	44 (51.2)	42 (48.8)	0.001

DISCUSSION

The present study evaluated the pattern and determinants of nutritional anemia among children aged 6 months to 5 years attending a tertiary care Pediatric OPD. The prevalence of anemia was found to be 64.0%, indicating that nutritional anemia remains a major public health problem among under-five children. This finding is comparable with the NFHS-5 India report, which documented anemia prevalence of 67.1% among children aged 6–59 months ⁽²⁾. Similar prevalence was also reported by Gowtham et al. in a hospital-based study among under-five children ⁽⁷⁾. Bharath and Subhadarshini also observed a high burden of microcytic hypochromic anemia in this age group ⁽⁸⁾. The high prevalence in the present study may be related to poor dietary intake, recurrent infections, delayed complementary feeding, and adverse socioeconomic conditions.

Moderate anemia was the most common severity pattern, followed by mild anemia, while severe anemia was observed in a smaller proportion of children. Similar findings have been reported in earlier Indian studies where moderate anemia constituted the majority of cases among preschool children ^(8,9). Microcytic hypochromic anemia was the predominant morphological type observed, suggesting iron deficiency as the major underlying cause. Comparable observations were reported by Gowtham et al. and Kalaiselvam et al., who identified iron deficiency anemia as the commonest pattern among young children ^(7,10).

A significant association was found between anemia and malnutrition in the present study. Severely malnourished children had the highest prevalence of anemia, which is consistent with findings from previous studies ^(9,11). Malnutrition may contribute to anemia through reduced iron stores, poor nutrient intake, and increased susceptibility to infections.

Feeding practices also showed significant association with anemia. Children who were not exclusively breastfed and those with delayed initiation of complementary feeding had higher prevalence of anemia. Similar findings have been reported in studies from India and other developing countries, where inappropriate infant

feeding practices were identified as important determinants of childhood anemia^(9,12).

The present study further demonstrated significant association of anemia with low socioeconomic status, low maternal education, and recurrent infections. Similar observations were reported by Sharma et al. and Panchal et al., who highlighted poverty, poor dietary diversity, inadequate sanitation, and limited healthcare access as important contributors to nutritional anemia^(13,11). Recurrent infections may worsen anemia through reduced appetite, impaired nutrient absorption, and inflammation-related suppression of erythropoiesis^(8,9).

Overall, the findings indicate that nutritional anemia among under-five children is multifactorial and strongly influenced by nutritional, socioeconomic, and feeding-related factors.

Conclusion

The present study demonstrated a high prevalence of nutritional anemia among children aged 6 months to 5 years attending the Pediatric OPD. Moderate anemia and microcytic hypochromic anemia were the most common patterns observed. Nutritional anemia showed significant association with malnutrition, poor feeding practices, low socioeconomic status, low maternal education, and recurrent infections. Early screening, nutritional counseling, iron supplementation, promotion of exclusive breastfeeding, and timely complementary feeding are essential to reduce the burden of anemia among under-five children.

Limitations

The study was conducted in a single tertiary care hospital with a relatively small sample size, limiting generalizability of the findings. As this was a cross-sectional study, causal relationships could not be established. Detailed biochemical investigations such as serum ferritin, vitamin B12, and folate levels were not performed due to resource constraints.

Author Contribution

All authors contributed equally to the study.

Conflict of Interest

Nil.

Source of Funding

Nil.

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