Original Research

ASSESSMENT OF ANEMIA AND ASSOCIATED RISK FACTORS IN UNDER-FIVE PEDIATRIC POPULATION

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ABSTRACT

Background: Anemia is one of the most common nutritional disorders in children under five years of age, particularly in developing countries. Iron deficiency remains the leading cause, contributing significantly to morbidity, impaired growth, and developmental delay.

Methodology: This hospital-based observational study was conducted in the Department of Paediatrics, Sree Mookambika Institute of Medical Sciences, Kulasekharam. Children aged 6–59 months were screened based on hemoglobin and serum ferritin levels. Detailed clinical history, physical examination, and laboratory investigations including complete blood count and iron profile were performed. Data were entered in Microsoft Excel and analyzed using SPSS version 23. Categorical variables were expressed in percentages and statistical significance was assessed using appropriate tests, with $p<0.05$ considered significant.

Results: A total of 200 children were studied. Moderate anemia was the most common (48%), followed by mild anemia, while severe anemia was observed in 9.5% of cases. Pallor was present in most moderate and severe cases but was absent in a proportion of mild cases, indicating limited sensitivity of clinical diagnosis alone. Anemia was most prevalent in the 6–24 months age group (93.2%). Laboratory findings showed reduced hemoglobin indices and iron deficiency pattern in most cases.

Conclusion: Anemia is highly prevalent among under-five children, predominantly due to iron deficiency. Early screening and combined clinical-laboratory diagnosis are essential for effective management and prevention.

Keywords: Anemia, Under-Five Children, Iron Deficiency, Prevalence, Pediatric Nutrition.

INTRODUCTION

Anemia remains one of the most widespread and under-recognized nutritional disorders affecting children under five years of age, particularly in low- and middle-income countries. It is characterized by a reduction in hemoglobin concentration, hematocrit, or red blood cell mass, resulting in decreased oxygen-carrying capacity of the blood. Among young children, anemia is most commonly due to iron deficiency, although deficiencies of other micronutrients, infections, genetic disorders, and chronic diseases also contribute significantly to its burden [1].

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Globally, anemia is a major public health problem. The World Health Organization (WHO) estimates that approximately 1.62 billion people are affected worldwide, with preschool children representing the most vulnerable group. The global prevalence of anemia in preschool-aged children is estimated at 47.4%, affecting around 293 million children, of whom a significant proportion reside in India [1]. This highlights the disproportionate burden borne by developing countries, where nutritional deficiencies and infectious diseases remain highly prevalent.

Iron deficiency anemia (IDA), the most common form of anemia, shows marked variation between industrialized and developing nations. In developed countries, its prevalence ranges from 10–20%, whereas in developing regions it can reach 50–60%, reflecting differences in dietary intake, socioeconomic conditions, and healthcare access [2]. Another large-scale analysis has reported that anemia affects approximately 43% of children globally, emphasizing its persistent contribution to childhood morbidity [3].

In India, anemia continues to be a significant public health challenge, affecting more than half of children under five years of age, along with other vulnerable groups such as pregnant women and

adolescents [4,5]. The high prevalence is attributed to multiple interrelated factors, including inadequate dietary iron intake, poor socioeconomic conditions, repeated infections, low birth weight, and suboptimal infant feeding practices. Additionally, parasitic infestations and poor sanitation further exacerbate iron loss and impair absorption, contributing to chronic anemia in this population.

Beyond its direct health consequences, anemia has profound long-term developmental and socioeconomic impacts. It is associated with impaired cognitive development, reduced physical growth, decreased immunity, and poor school performance. On a broader scale, anemia contributes significantly to disability-adjusted life years (DALYs) and economic productivity losses. In India alone, iron deficiency anemia in children aged 6–59 months has been estimated to account for millions of DALYs and substantial economic burden, with productivity losses reaching billions of dollars annually [5].

Given its high prevalence and wide-ranging consequences, early identification of risk factors and timely intervention are essential to reduce the burden of anemia in children under five years of age. Understanding the prevalence and associated determinants is crucial for designing effective public health strategies, improving nutritional programs, and implementing targeted preventive measures.

Therefore, the present study aims to assess the prevalence and risk factors of anemia among children under five years of age, with an emphasis on identifying modifiable determinants that can help reduce disease burden and improve child health outcomes.

Aim and Objectives

Aim

To determine the prevalence and risk factors of anemia among children under five years of age.

Objectives

1. To estimate the prevalence of anemia in children under five years attending the study setting.
2. To assess the severity and distribution of anemia among the study population.
3. To identify socio-demographic and nutritional risk factors associated with anemia.

METHEDOLOGY

The present study was conducted in the Department of Paediatrics, Sree Mookambika Institute of Medical Sciences, Kulasekharam, during the study period from September 2025 to February 2026. Children aged between 6 months and 59 months were screened for inclusion based on predefined criteria, which included hemoglobin level less than 11 g/dL and serum ferritin level less than 12 µg/L. Children with a history of blood transfusion, hemolytic anemia or familial blood disorders, chronic systemic illnesses, and anemia secondary to hematological malignancies such as leukemia or aplastic anemia were excluded from the study.

After applying inclusion and exclusion criteria, eligible children were enrolled and detailed clinical history was obtained, followed by thorough physical examination. All findings, along with laboratory reports, were recorded in a predesigned pro forma. Hematological investigations included hemoglobin estimation, hematocrit, total red blood cell count, reticulocyte count, mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), red cell distribution width (RDW), total and differential white blood cell count, erythrocyte sedimentation rate (ESR), and peripheral blood smear examination. Iron profile investigations such as serum iron, serum ferritin, total iron-binding capacity (TIBC), and transferrin saturation were also performed to assess iron status comprehensively.

Anemia was defined and classified according to World Health Organization (WHO) criteria. Children with hemoglobin less than 11 g/dL were considered anemic. Severity was further categorized as mild anemia (10.0–10.9 g/dL), moderate anemia (7.0–9.9 g/dL), and severe anemia (<7 g/dL).All collected data were entered into Microsoft Excel and analyzed using SPSS version 23. Categorical variables were expressed as frequencies and percentages, while continuous variables were represented as mean ± standard deviation. Appropriate statistical tests such as Chi-square test and t-test were applied where necessary, and a p-value of less than 0.05 was considered statistically significant.

RESULT

Table 1: Association of Socio-Demographic Profile of Children with Anemia

Variable	Group	Number (%)
Gender	Male	100
	Female	100
Age (months)	6-24months	74(37%)
	25-48 months	68(34%)
	49-59 months	58(29%)
Anemia	No anemia	37 (18.5%)
	Mild Anemia	48 (24%)

	Moderate Anemia	96 (48%)
	Severe Anemia	19 (9.5%)
Socioeconomic Status	Lower	78 (39%)
	Upper lower	69 (34.5%)
	Lower middle	44 (22%)
	Middle	7 (3.5%)
	Upper middle	2 (1%)
Residence	Rural	114 (57%)

Table 1 – Socio-demographic profile: Among the 200 children studied (100 male, 100 female), anemia was found to be highly prevalent, affecting 81.5% of the sample, with only 18.5% having no anemia. Moderate anemia was the predominant severity (48%), nearly double the proportion of mild anemia (24%), while severe anemia was present in about 1 in 10 children (9.5%). This points to anemia being a significant nutritional health problem in this population rather than an occasional finding. The majority of children belonged to the lower and upper-lower socioeconomic strata (together 73.5%), and over half (57%) resided in rural areas — both factors commonly linked to limited dietary diversity and poorer access to iron-rich foods or healthcare, suggesting these groups may be at greater underlying risk for anemia.

Table 2: Prevalence of Anemia in Male & Female Children

Gender	**Anemia**		
	Mild	Moderate	Severe
	No. (%)	No. (%)	No. (%)
Male	30(62.5%)	43(44.8%)	7(36.9%)
Female	18(37.5%)	53(55.2%)	12(63.9%)
Total	48	96	19

Table 2 – Gender-wise prevalence: A clear pattern emerges when severity is examined by gender. Mild anemia was considerably more common in males (62.5%) than females (37.5%), but the trend reverses for higher severities: females accounted for a greater share of moderate anemia (55.2%) and a markedly greater share of severe anemia (around 63–64%) compared to males. This suggests that while anemia affects both sexes, when it occurs in female children it tends to be of greater severity, possibly reflecting gender-based disparities in nutritional intake, intra-household food allocation, or care-seeking behavior — an area worth targeting in nutrition programs.

Table 3: Prevalence of Anemia in Children in Different Groups

Age	**Anemia**		
	Mild	Moderate	Severe
6-24 months	12(25%)	50 (52.08%)	7 (36.84%)
25- 48 months	14 (29.2%)	28 (29.16%)	11 (57.89%)
49-59 months	22 (45.8%)	18 (18.75%)	2 (10.52%)
Total	48	96	19

Table 3 – Age-wise prevalence: The youngest age group (6–24 months) showed both the highest overall anemia burden (about 93% of children in this group had some degree of anemia) and the highest share of moderate anemia (52.08%), consistent with the known vulnerability of this age band due to depletion of birth iron stores, rapid growth demands, and the transition to often iron-poor complementary feeding. Severe anemia peaked in the 25–48 month group (57.89%), possibly reflecting cumulative nutritional deficits carried forward from infancy. By the 49–59 month group, overall anemia prevalence had declined (~72%) and the picture shifted toward predominantly mild anemia (45.8%), suggesting some recovery as dietary diversity improves with age, though residual deficiency persists.

DISCUSSION

The present study highlights the high burden of anemia among children aged 6–59 months, with a substantial proportion showing moderate anemia (48%) followed by mild anemia, while 9.5% were found to have severe anemia. These findings are consistent with previous reports indicating that anemia remains a major public health problem in under-five children, particularly in developing countries where nutritional deficiencies and infections are highly prevalent [6].

In the present study, pallor was identified as the most common clinical sign among anemic children; however, its diagnostic utility was limited. Although all children with severe anemia had pallor, only 97% of those with moderate anemia and 50% of those with mild anemia showed clinical pallor. Importantly, 16% of anemic children would have been missed if pallor alone was used as a screening tool. This observation emphasizes that clinical signs alone are insufficient for accurate diagnosis of anemia, and laboratory confirmation remains essential. Similar findings have been reported in pediatric screening studies where reliance on pallor underestimated anemia prevalence, particularly in mild cases [7].

Age-wise distribution showed that anemia was most prevalent in the 6–24 months age group (93.2%), followed by 25–48 months (77.9%) and 49–59 months (72.4%). The higher prevalence in younger children may be attributed to rapid growth, increased iron requirements, inadequate complementary feeding practices, and depletion of iron stores after six months of age. These findings are in agreement with WHO reports that identify infants and toddlers as the most vulnerable group for iron deficiency anemia due to increased physiological demand and poor dietary iron intake [8].

Gender distribution revealed a slightly higher prevalence of anemia among females compared to males in moderate and severe categories, although overall differences were not statistically large. This may be related to nutritional disparities and cultural feeding practices in certain populations.

Laboratory evaluation in the present study showed decreased mean packed cell volume (21.92%) and reduced mean corpuscular volume (63.95 fL), indicating predominantly microcytic anemia. Serum iron levels were low (50.16 µg/dL) with elevated total iron-binding capacity (384.92 µg/dL), suggesting iron deficiency as the major etiology. Peripheral smear findings further supported this, with hypochromic anemia observed in 78% of cases and dimorphic anemia in 22%. These findings are consistent with iron deficiency anemia being the most common type of anemia in this age group [9].

Socioeconomic analysis revealed that a majority of children belonged to lower and lower-middle socioeconomic groups, and more than half were from rural areas. Poor socioeconomic status is strongly associated with inadequate dietary intake, poor maternal education, and limited access to healthcare services, all of which contribute to the high burden of anemia [10].

Overall, the present study demonstrates that anemia is highly prevalent among under-five children, with iron deficiency being the predominant cause. Early screening using both clinical and laboratory methods is essential for timely diagnosis and management. Public health strategies focusing on nutritional supplementation, dietary diversification, and early childhood interventions are necessary to reduce the burden of anemia.

CONCLUSION

The present study concludes that anemia is highly prevalent among children aged 6–59 months, with moderate anemia being the most common form followed by mild and severe anemia. Iron deficiency was identified as the predominant cause based on hematological and iron profile findings.

Strengthening public health strategies such as iron supplementation programs, dietary education, and routine anemia screening in early childhood can significantly reduce the burden of anemia and improve overall child health outcomes.

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