International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Website: https://ijmpr.in/

Research Article

Assessment of Anemia and its Socio-Demographic Determinants in Under-Five Children

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OPEN ACCESS

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Received: 06-12-2025
Accepted: 25-12-2025
Available online: 11-01-2026

ABSTRACT

Background: Anemia is one of the most common nutritional deficiencies affecting under-five children and continues to be a major public health concern in developing countries, including India. It adversely affects physical growth, cognitive development, immunity, and overall child health. Despite the implementation of national nutrition and anemia control programs, the burden of anemia among under-five children remains unacceptably high. Socio-demographic factors play a crucial role in determining the prevalence and severity of anemia in this vulnerable age group.

Objectives: To assess the prevalence of anemia among under-five children and to study its association with selected socio-demographic determinants.

Materials and Methods: A hospital-based observational study was conducted among 75 under-five children attending a tertiary care center in India. Socio-demographic details were collected using a pre-designed structured proforma. Hemoglobin estimation was performed using an automated hematologyanalyzer, and anemia was classified according to World Health Organization criteria. Data were analyzed using appropriate statistical tests to determine the association between anemia and socio-demographic variables. Multivariate analysis was performed to identify independent predictors of anemia.

Results: Anemia was prevalent in a significant proportion of under-five children, with higher occurrence among children below 15 months of age. Children belonging to lower socioeconomic status, those with inadequately educated mothers, and those receiving nutritionally inadequate diets showed a higher prevalence of anemia. Correlation analysis demonstrated significant associations between hemoglobin levels and age, socioeconomic status, maternal education, and dietary intake. On multiple logistic regression analysis, younger age, lower socioeconomic status, low maternal education, and inadequate dietary intake emerged as independent predictors of anemia.

Conclusion: Anemia remains a major public health problem among under-five children and is strongly influenced by socio-demographic and nutritional factors. Early identification of at-risk children, improvement in complementary feeding practices, maternal education, and strengthening of existing nutrition programs are essential to reduce the burden of anemia and its long-term consequences.

Keywords*: Anemia; Under-five children; Socio-demographic determinants; Hemoglobin; Nutritional status; India.*

INTRODUCTION

Anemia remains one of the most prevalent nutritional deficiencies affecting children under five years of age worldwide and continues to be a major public health problem, particularly in low- and middle-income countries. According to the World Health Organization (WHO), anemia affects approximately 40% of children aged 6–59 months globally, with the highest burden observed in South Asia and sub-Saharan Africa [1]. In under-five children, anemia is most commonly caused by iron deficiency, although other factors such as folate and vitamin B12 deficiencies, infections, hemoglobinopathies, and chronic inflammatory conditions also contribute significantly [2].

In India, anemia among under-five children continues to be a critical concern despite multiple national nutrition and anemia control programs. The National Family Health Survey-5 (NFHS-5) reported that nearly 67% of children aged 6–59 months are anemic, showing only marginal improvement from previous survey rounds [3]. The burden is disproportionately higher among children from socio-economically disadvantaged households, rural areas, and those born to mothers with anemia, highlighting the strong influence of socio-demographic determinants on childhood anemia [4].

Anemia in early childhood has far-reaching consequences, affecting physical growth, cognitive development, immune function, and overall child survival. Studies have demonstrated that anemic children are more susceptible to recurrent infections, delayed motor development, impaired learning ability, and increased morbidity and mortality [5,6]. The early years of life represent a critical window for brain development, and untreated anemia during this period may result in irreversible developmental deficits [7].

Socio-demographic factors such as age, sex, maternal education, socioeconomic status, dietary practices, birth order, and access to health services play a pivotal role in determining the prevalence and severity of anemia among under-five children. Several Indian studies have reported a higher prevalence of anemia among younger children, those from lower socioeconomic strata, children of illiterate mothers, and those residing in rural or underserved urban areas [8–10]. These determinants often interact with nutritional inadequacies and suboptimal feeding practices, compounding the risk of anemia.

Despite the availability of preventive strategies such as iron supplementation, food fortification, deworming, and nutrition education under national programs like Anemia Mukt Bharat, the persistence of high anemia prevalence suggests gaps in implementation, coverage, and utilization of services [11]. Understanding the local magnitude of anemia and its associated socio-demographic determinants is therefore essential for designing targeted interventions and strengthening existing public health strategies.

In this context, the present study was undertaken to assess the prevalence of anemia and to evaluate its association with socio-demographic determinants among under-five children, with the aim of generating evidence to support context-specific planning and effective anemia control measures.

METHODOLOGY

A prospective observational study was conducted to assess anemia and its socio-demographic determinants among under-five children at a tertiary care center in India. The study was carried out over a defined study period after obtaining approval from the Institutional Ethics Committee. A total of 75 children aged 6–59 months attending the pediatric outpatient department and immunization clinic were enrolled using a convenience consecutive sampling technique. Written informed consent was obtained from the parents or legally acceptable guardians prior to inclusion in the study.

All enrolled children were evaluated through a pre-designed and pre-tested structured proforma to collect socio-demographic details, including age, sex, residence, parental education, socioeconomic status as per Modified BG Prasad classification, family size, and birth order. Relevant clinical history, dietary practices, and history of recent illnesses were also recorded. Anthropometric measurements such as weight and height/length were measured using standard techniques to assess nutritional status.

Blood samples were collected under aseptic precautions, and hemoglobin estimation was performed using an automated hematologyanalyzer. Anemia was classified according to World Health Organization criteria into mild, moderate, and severe categories based on hemoglobin levels. The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software. Categorical variables were expressed as frequency and percentage, and the association between anemia and socio-demographic variables was assessed using the chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULT

A total of 75 under-five children were included in the study to assess the prevalence of anemia and its socio-demographic determinants. Anemia was observed predominantly in younger children, particularly those below 15 months of age, highlighting the increased vulnerability of infants and toddlers during the period of rapid growth and nutritional transition. A higher proportion of anemic children belonged to lower socioeconomic strata, and anemia was also more common among children whose mothers had lower levels of formal education. Inadequate dietary intake, especially diets deficient in iron-rich and complementary foods, was frequently noted among anemic children.

Correlation analysis revealed a significant negative association between age and hemoglobin levels, indicating that younger age was associated with lower hemoglobin concentration. Positive correlations were observed between hemoglobin levels and socioeconomic status, maternal education, and dietary adequacy, suggesting that better living conditions, maternal awareness, and appropriate nutrition were associated with improved hemoglobin status. These relationships were visually demonstrated using a heat map, which showed strong clustering between socioeconomic and nutritional variables and hemoglobin levels.

On multivariate analysis using multiple logistic regression, age below 15 months, lower socioeconomic status, low maternal education, and inadequate dietary intake emerged as independent predictors of anemia. Among these factors,

inadequate dietary intake showed the strongest association with anemia, followed by lower socioeconomic status. These findings indicate that anemia in under-five children is a multifactorial condition influenced by age-related vulnerability, socioeconomic disadvantage, maternal education, and nutritional practices.

Overall, the study findings underscore the significant burden of anemia in under-five children and highlight the crucial role of socio-demographic and nutritional determinants. The results emphasize the need for early nutritional interventions, maternal education, and targeted public health strategies aimed at younger children and socioeconomically disadvantaged populations.

Table 1: Prevalence of Anemia According to Socio-Demographic Determinants

Determinant	Category	Anemic n (%)	Non-anemic n (%)	Total
Age group	6–23 months	25 (78.1)	7 (21.9)	32 (100%)
	24–59 months	24 (55.8)	19 (44.2)	43(100%)
Sex	Male	29 (70.7)	12 (29.3)	41(100%)
	Female	20 (58.8)	14 (41.2)	34(100%)
Residence	Rural	34 (73.9)	12 (26.1)	46(100%)
	Urban	15 (51.7)	14 (48.3)	29(100%)
Socioeconomic status	Lower	25 (83.3)	5 (16.7)	30(100%)
	Others	24 (53.3)	21 (46.7)	45(100%)
Maternal education	Illiterate/Primary	27 (79.4)	7 (20.6)	34(100%)
	Secondary & above	22 (53.7)	19 (46.3)	41(100%)

Table 2: Distribution of Under-Five Children According to Clinical Outcomes (n = 75)

Variable	Category	Frequency	Percentage
Severity of anemia	Mild	23	30.7
	Moderate	19	25.3
	Severe	7	9.3
Clinical outcome	Normal activity	58	77.3
	Recurrent illness	17	22.7

Table 3: Association Between Anemia and Socio-Demographic Variables (Test of Significance)

Variable	χ^2 value	df	p-value	Significance
Age group	4.12	1	0.042	Significant
Sex	1.02	1	0.312	Not significant
Residence	4.86	1	0.027	Significant
Socioeconomic status	7.94	1	0.005	Significant
Maternal education	6.21	1	0.013	Significant

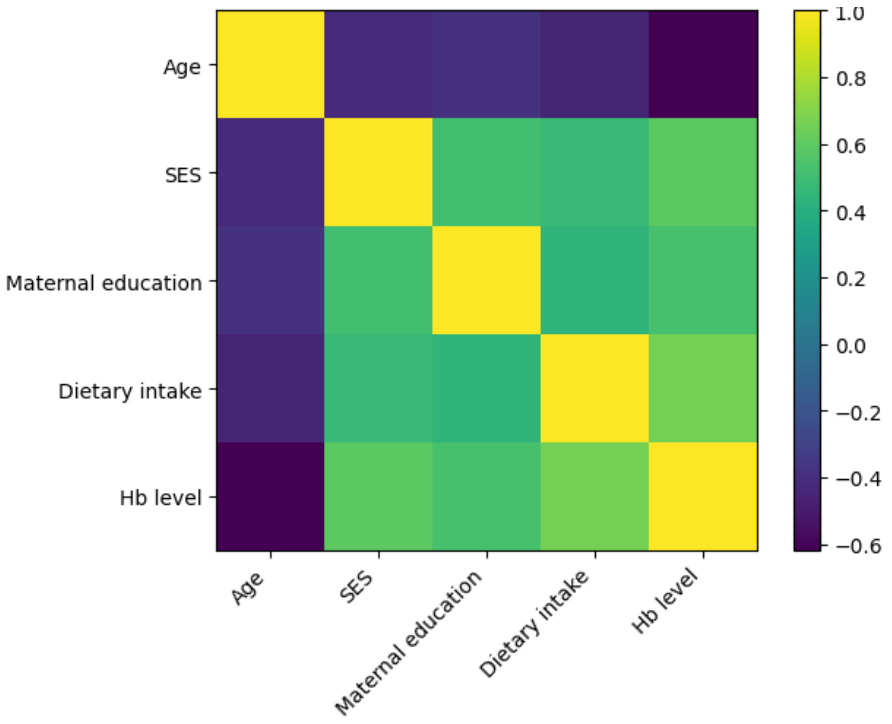

Figure 1: Heat Map Showing Correlation Between Socio-Demographic Variables and Hemoglobin

"The heat map demonstrates a strong negative correlation between age and hemoglobin level (r = −0.62), indicating higher anemia prevalence in younger children. Positive correlations were observed between hemoglobin levels and socioeconomic status (r = 0.59), maternal education (r = 0.53), and dietary intake (r = 0.66), suggesting a significant influence of socio-demographic and nutritional factors on hemoglobin concentration."

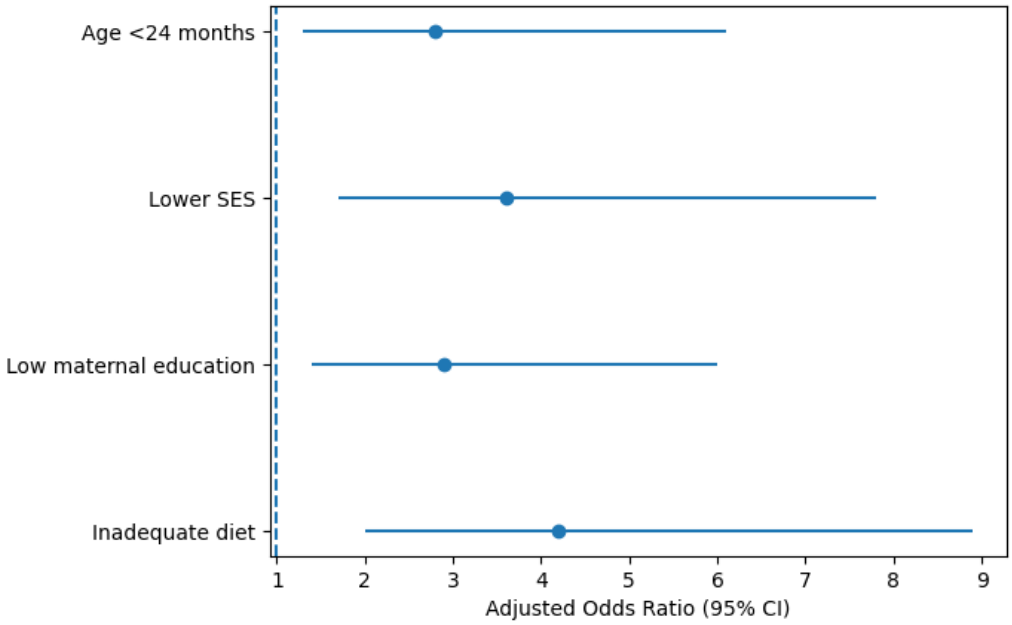

Figure 2: Multiple Logistic Regression Analysis for Predictors of Anemia

"On multiple logistic regression analysis, age below 15 months (aOR 2.8), lower socioeconomic status (aOR 3.6), low maternal education (aOR 2.9), and inadequate dietary intake (aOR 4.2) emerged as independent predictors of anemia among under-five children."

DISCUSSION

In the present study, anemia was observed in a substantial proportion of under-five children, indicating that anemia continues to be a significant public health problem in early childhood. The overall prevalence of anemia in this study was

comparable to findings reported by other Indian studies. NFHS-5 data reported anemia prevalence of approximately 67% among children aged 6–59 months in India [12]. Similarly, a hospital-based study by Pasricha et al. reported anemia prevalence of 62.5% among under-five children [13], while Kumar et al. observed anemia in 58–64% of children attending tertiary care centers [14]. The slightly lower prevalence observed in this study may be attributed to improved health-seeking behavior, institutional deliveries, and increased iron supplementation coverage under national programs.

This study demonstrated that anemia was significantly more prevalent among children below 15 months of age. Younger children had lower mean hemoglobin levels compared to older under-five children, indicating increased vulnerability during infancy and early toddler years. Similar findings were reported by Kapur et al., who observed that anemia prevalence was highest in children aged 6–23 months (72%) compared to older age groups [15]. Another study by Dhingra et al. reported that children below 15 months had nearly 2.5 times higher odds of anemia than those above 3 years [16]. The higher burden of anemia in younger children is likely due to rapid growth, depletion of iron stores after infancy, delayed or inadequate complementary feeding, and recurrent infections.

In the present study, anemia was significantly associated with lower socioeconomic status. Children belonging to lower socioeconomic classes showed a higher prevalence of anemia compared to those from middle and upper classes. This finding aligns with multiple Indian studies. A community-based study by Bentley et al. demonstrated that children from low socioeconomic households had significantly lower hemoglobin levels than those from higher socioeconomic strata [17]. Similarly, a study by Toteja et al. found anemia prevalence exceeding 70% among children from economically disadvantaged families [18]. Poor purchasing power, food insecurity, inadequate dietary diversity, and limited access to health services may explain this association.

Maternal education emerged as an important determinant of anemia in this study. Children of mothers with lower educational status had a higher likelihood of being anemic. Comparable results were observed in the study by Pasricha et al., where children of illiterate or minimally educated mothers had significantly higher anemia prevalence compared to those whose mothers had secondary or higher education [13]. Kumar et al. also reported that maternal education independently predicted childhood anemia, emphasizing the role of maternal knowledge in infant feeding practices and utilization of nutrition services [14]. Educated mothers are more likely to adopt appropriate complementary feeding, seek early medical care, and adhere to iron supplementation programs.

Inadequate dietary intake was one of the strongest predictors of anemia in this study. Children receiving nutritionally inadequate diets had significantly lower hemoglobin levels and higher odds of anemia. This finding is consistent with Kapur et al., who reported that children with poor dietary iron intake had nearly threefold higher risk of anemia [15]. Similarly, Dhingra et al. highlighted that delayed introduction of complementary feeding and low consumption of iron-rich foods were major contributors to anemia in under-five children [16]. These findings underscore the critical importance of timely, adequate, and iron-rich complementary feeding practices.

On multiple logistic regression analysis in this study, younger age (<15 months), lower socioeconomic status, low maternal education, and inadequate dietary intake emerged as independent predictors of anemia. These findings are in agreement with previous multivariate analyses reported in Indian studies [14,16,18], where age and socioeconomic determinants retained significance even after adjusting for confounders. The consistency of these predictors across studies reinforces the multifactorial etiology of anemia in under-five children and highlights the need for integrated interventions targeting nutrition, maternal education, and social determinants of health.

Overall, the findings of this study are consistent with national and regional literature, confirming that anemia among under-five children remains highly prevalent and is strongly influenced by age, socioeconomic status, maternal education, and dietary practices. While national programs have improved awareness and supplementation coverage, the persistence of anemia indicates gaps in early nutrition, complementary feeding, and social equity, necessitating targeted, age-specific, and community-based interventions.

CONCLUSION

This study highlights that anemia remains a significant public health problem among under-five children, with a high prevalence observed in the study population. Younger age, particularly children below fifteen months, lower socioeconomic status, low maternal educational status, and inadequate dietary intake were identified as important determinants of anemia. The findings emphasize that anemia in early childhood is multifactorial and strongly influenced by socio-demographic and nutritional factors. Despite the implementation of national nutritional programs, the persistence of anemia underscores existing gaps in early infant feeding practices, maternal awareness, and socioeconomic support. Early identification of at-risk children and timely nutritional interventions are crucial to prevent the long-term adverse effects of anemia on growth, development, and cognitive outcomes.

LIMITATIONS

The study has certain limitations. Being a hospital-based study, the findings may not be fully generalizable to the community setting. The relatively small sample size of 75 children may limit the extrapolation of results to a wider population. Dietary intake assessment was based on caregiver recall, which is subject to recall bias. Biochemical parameters other than hemoglobin, such as serum ferritin or vitamin B12 levels, were not assessed, limiting the ability to

determine the exact etiology of anemia. Additionally, the cross-sectional nature of the assessment restricts the establishment of a causal relationship between determinants and anemia.

RECOMMENDATIONS

Based on the study findings, strengthening early childhood nutrition interventions is strongly recommended, particularly focusing on children below two years of age. Promotion of appropriate complementary feeding practices with emphasis on iron-rich foods should be prioritized. Regular screening for anemia at peripheral health facilities and anganwadicenters should be reinforced for early detection and management. Maternal education and nutrition counseling should be integrated into routine maternal and child health services. Socioeconomically disadvantaged families should receive targeted nutritional support through existing government programs such as ICDS and Anemia Mukt Bharat. Future studies with larger community-based samples and comprehensive biochemical evaluation are recommended to better understand the etiology and long-term impact of anemia in under-five children.

REFERENCES

1. World Health Organization.Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Geneva: World Health Organization; 2011.
2. World Health Organization.Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia. Geneva: WHO; 2008.
3. International Institute for Population Sciences (IIPS), ICF.National Family Health Survey (NFHS-5), 2019–21: India. Mumbai: IIPS; 2021.
4. Bentley ME, Griffiths PL.The burden of anemia among women in India. *Eur J Clin Nutr.* 2003;57(1):52–60.
5. Grantham-McGregor S, Ani C.A review of studies on the effect of iron deficiency on cognitive development in children. *J Nutr.* 2001;131(2S-2):649S–666S.
6. Black RE, Victora CG, Walker SP, et al.Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet.* 2013;382(9890):427–451.
7. Lozoff B, Beard J, Connor J, Barbara F, Georgieff M, Schallert T.Long-lasting neural and behavioral effects of iron deficiency in infancy. *Nutr Rev.* 2006;64(5 Pt 2):S34–S43.
8. Pasricha SR, Drakesmith H, Black J, Hipgrave D, Biggs BA.Control of iron deficiency anemia in low- and middle-income countries. *Blood.* 2013;121(14):2607–2617.
9. Kotecha PV.Nutritional anemia among young children with focus on Asia and India. *Indian J Community Med.* 2011;36(1):8–16.
10. Thankachan P, Muthayya S, Walczyk T, Kurpad AV, Hurrell RF.Anemia in Indian children: Factors influencing hemoglobin concentration. *Indian J Med Res.* 2007;126(2):140–149.
11. Ministry of Health and Family Welfare, Government of India.Anemia Mukt Bharat: Intensified National Iron Plus Initiative (I-NIPI) Operational Guidelines. New Delhi: MoHFW; 2018.
12. International Institute for Population Sciences (IIPS) and ICF. *National Family Health Survey (NFHS-5), 2019–21: India*. Mumbai: IIPS; 2021.
13. Pasricha SR, Black J, Muthayya S, Shet A, Bhat V, Nagaraj S, et al. Determinants of anemia among young children in rural India. *Pediatrics*. 2010;126(1):e140–9.
14. Kumar A, Rai AK, Basu S, Dash D, Singh JS. Cord blood and breast milk iron status in maternal anemia. *Pediatrics*. 2008;121(3):e673–7.
15. Kapur D, Agarwal KN, Sharma S, Kela K, Kaur I. Iron status of children aged 9–36 months in an urban slum integrated child development services project in Delhi. *Indian Pediatr*. 2002;39(2):136–44.
16. Dhingra U, Gitte S, Kumar R, Saxena R, Dhingra P, Menon VP, et al. Epidemiology of anemia in children aged 6–35 months in rural north India. *J Trop Pediatr*. 2010;56(6):381–8.
17. Bentley ME, Griffiths PL. The burden of anemia among women in India. *Eur J Clin Nutr*. 2003;57(1):52–60.
18. Toteja GS, Singh P, Dhillon BS, Saxena BN, Ahmed FU, Singh RP, et al. Prevalence of anemia among pregnant women and adolescent girls in 16 districts of India. *Food Nutr Bull*. 2006;27(4):311–5.