Original Article
DOI: https://doi.org/10.70749/ijbr.v2i06.1933

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Risk Factors of Anemia in Children Age 6 Months to 5 Years Presenting to Qazi Hussain Ahmad Medical Complex

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ARTICLE INFO

Keywords: Anemia, Risk Factors, Children, Socioeconomic Status, Maternal Education, Breastfeeding, Morbidity, Qazi Hussain Ahmad Medical Complex.

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Declaration
Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 09-04-2025 Revised: 16-06-2025
Accepted: 17-06-2025 Published: 30-06-2025

ABSTRACT

Background: Anemia in children is a significant public health problem, particularly in developing countries, where it adversely affects physical, cognitive, and social development. This study aims to identify the key risk factors contributing to anemia in children aged 6 months to 5 years presenting to Qazi Hussain Ahmad Medical Complex, Nowshera. **Methods:** This cross-sectional study was conducted over six months, including 135 children with anemia. 'Participants were recruited using a non-probability consecutive sampling technique'. 'Data were collected through structured interviews with mothers, focusing on maternal, socioeconomic, and child-related factors'. Information on maternal age, education, inter-pregnancy intervals, breastfeeding practices, socioeconomic status, and recent child morbidity (e.g., diarrhea) was recorded. Data were analyzed using IBM SPSS version 23, with chi-square tests applied to evaluate the association between risk factors and anemia severity. A p-value ≤ 0.05 was considered statistically significant. **Results:** The most prevalent risk factors for anemia were poor socioeconomic status (59.3%), low maternal education (55.6%), and poor breastfeeding practices (44.4%). Other significant factors included short inter-pregnancy intervals (37.0%), younger maternal age (<24 years; 31.1%), and recent diarrhea episodes (22.2%). These factors were significantly associated with the severity of anemia, with p-values ≤ 0.05 for all associations. **Conclusion:** The economic status of the family, maternal factors, and the child's health all influence the occurrence of anemia in early childhood. Public health initiatives of the government, in combination with the educational campaigns directed towards mothers and better overall health facilities, can greatly mitigate the childhood anemia burden.

INTRODUCTION

Anemia refers to a pathological state marked by a decline in the concentration of hemoglobin, hematocrit, or a dip in the number of erythrocytes during a cellular evaluation when compared to standard physiological references for the individual's age, gender, and sociocultural environmental factors (1). WHO defines anemia in children under five years of age as having a hemoglobin level less than 11.0 g/dL. This condition continues to be one of the most prevalent forms of malnutrition in the world, especially in Africa, Asia, and Southeast Asia, regions where one in four children are impacted (2).

Anemia in young children is a multifaceted issue due to its 'profound implications on an individual's social, physical, and mental development, and can adversely impact these areas both in the short and long term' (3). It compromises immune function, hinders cognitive and motor development, and diminishes academic performance. In adulthood, this form of anemia may increase the risk of reduced productivity, adversely impacting national economic development. Therefore, addressing anemia in early childhood is important for individual and societal well-being and progression (4).

The foremost contributor to anemia in pediatric populations is iron deficiency, which constitutes close to fifty percent of the cases globally (5). These factors which contribute to iron deficiency are insufficient dietary intake, insufficient absorption, and increased nutritional demand during growth periods along with chronic blood loss and inappropriate early dietary introduction of complementary foods like cow's milk before six months of age. Other than iron deficiency, these are caused due to deficiency of folate, vitamin b12 and A, and certain infections like malaria and other chronic diseases. Other genetic factors also include some disorders like hemoglobinopathy, and some types of partial or complete blood cell destruction, and certain bone marrow conditions (6).

Multiple demographic and socioeconomic factors impact the prevalence of anemia. Evidence demonstrates that

children below the age of 24 months, children from poor families, and children facing nutritional deficits or food scarcity have a substantially increased risk (4). Moreover, educational neglect, low maternal health, and early introduction of complementary feeding practices are known to significantly contribute to anemia. To illustrate, Dutta and colleagues noted that among children younger than 24 months, there was a prevalence of anemia with 68.6% of cases being recent diarrheal episodes accounting for anemia.

The rationale was to understand the risk factors that contribute to anemia in children is essential for designing effective prevention and control strategies. By identifying the most prevalent risk factors in the local population, this study aims to provide insights that can guide public health initiatives, improve awareness, and promote better child health outcomes. The was to determine the frequency of risk factors for anemia in children aged 6 months to 5 years presenting at 'Qazi Hussain Ahmad Medical Complex, Nowshera'.

METHODOLOGY

This study was a 'cross-sectional analysis conducted at the Department of Pediatrics, Qazi Hussain Ahmad Medical Complex, Nowshera', from October 2023 to March 2024. The study was carried out over six months. The study was approved by the College of Physicians and Surgeons, Pakistan (CPSP) under RTMC Registration Number: PED-2021-305-6338 and the Research Review Board of Qazi Hussain Ahmad Medical Complex under the same registration number. Written informed consent was obtained from all guardians, and strict confidentiality and anonymity were maintained. The study adhered to the principles of the Declaration of Helsinki**.**

The sample size was calculated using the WHO sample size formula with an expected frequency of diarrhea as a morbidity factor (22.0%), a 7% margin of error, and a 95% confidence level. The final sample size was 135 children**.**

Participants were selected using a non-probability consecutive sampling method, ensuring all eligible children presenting during the study period were included.

Inclusion Criteria

- Children aged 6 months to 60 months.
- Both male and female participants.
- Children diagnosed with anemia as defined by the operational criteria.

Exclusion Criteria

- History of blood transfusion within the last four months.
- Known cases of blood dyscrasias.
- Recent use of iron supplements (within the last three months).
- Children separated from their mothers.
- Children with congenital disorders such as Down syndrome.

After approval from the Research Review Board of the hospital, children meeting the inclusion criteria were recruited from the outpatient department of pediatrics. Written informed consent was obtained from the parents or guardians. Baseline information, including the child's age (in months), gender, height, and weight, was recorded. Mothers were interviewed in simple, clear language to collect data on maternal age, educational status, inter-pregnancy intervals, breastfeeding duration, and household socioeconomic status. A structured questionnaire was used to document risk factors, including younger maternal age (<24 years), low maternal education (<matric), short inter-pregnancy intervals (<2 years), poor breastfeeding practices (<6 months exclusive), poor socioeconomic status (monthly income <Rs. 30,000), and recent morbidity (e.g., diarrhea in the last 30 days). All data were recorded by the principal investigator on a specially designed proforma.

Data were 'analyzed using IBM SPSS version 23'. 'Mean and standard deviations were calculated for numerical variables such as age, height, weight, and hemoglobin levels'. 'Frequencies and percentages were computed for categorical variables like gender and the presence of risk factors'.

Stratification was performed to control potential effect modifiers such as age, gender, and BMI. Post-stratification, chi-square tests were applied to evaluate the associations between risk factors and anemia severity. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

The study included 135 children aged 6 months to 5 years. The average age of the participants was approximately 25 months, with toddlers (13–36 months) constituting the largest age group (48.1%), followed by infants (22.2%) and preschoolers (29.6%). A slight male predominance was observed, with 55.6% being boys. The mean hemoglobin level was 8.9 ± 1.2 g/dL, indicating that most children had moderate anemia based on WHO definitions. The average height and weight of the children were 84.3 cm and 11.5 kg, respectively, which are consistent with mild growth deficits often associated with anemia.

Table 1

Baseline Characteristics of the Study Population

Variable	Classification	Frequency (n)	Percentage (%)
Age (months)	6–12 months (Infants)	30	22.2%
	13–36 months (Toddlers)	65	48.1%
	37–60 months (Preschoolers)	40	29.6%
Gender	Male	75	55.6%
	Female	60	44.4%
Height (cm)	-	84.3 ± 11.2	-
Weight (kg)	-	11.5 ± 2.7	-
Hemoglobin Level (g/dL)	Mild Anemia (10–11 g/dL)	60	44.4%
	Moderate Anemia (7–9.9 g/dL)	65	48.1%
	Severe Anemia (<7 g/dL)	10	7.4%

The data revealed that poor socioeconomic status was the most frequent risk factor, affecting 59.3% of the children, followed by low maternal education (55.6%). Poor breastfeeding practices (less than six months exclusive breastfeeding) were also common, observed in 44.4% of cases. Low inter-pregnancy intervals (less than two years) were reported in 37% of cases, while younger maternal age (<24 years) accounted for 31.1%. Interestingly, recent diarrhea episodes were recorded in 22.2% of children, further highlighting the interplay between infectious morbidity and anemia. These findings emphasize that

'maternal and socioeconomic factors play a critical role in childhood anemia in this population'.

Table 2

Frequency of Risk Factors for Anemia

Risk Factor	Classification	Frequency (n)	Percentage (%)
Maternal Age	Younger Maternal Age (<24 years)	42	31.1%
	Maternal Age ≥24 years	93	68.9%
Maternal Education	Illiterate (No Formal Education)	30	22.2%
	Primary Level (Grade 1–5)	25	18.5%
	Middle Level (Grade 6–8)	20	14.8%
	Matriculation (Grade 9–10)	35	25.9%
	Higher Education (Above Matric)	25	18.5%
Inter-Pregnancy Interval	Very Short (<12 months)	20	14.8%
	Short (12–24 months)	30	22.2%
	Optimal (25–36 months)	50	37.0%
	Long (>36 months)	35	25.9%
Duration of Breastfeeding	Poor Breastfeeding (<6 months)	60	44.4%
	Adequate Breastfeeding (≥6 months)	75	55.6%
Socioeconomic Status	Low Income (<Rs. 15,000/month)	40	29.6%
	Lower-Middle Income (Rs. 15,000–30,000)	40	29.6%
	Middle Income (Rs. 30,001–50,000)	35	25.9%
	Upper-Middle and High Income (>Rs. 50,000)	20	14.8%
Recent Morbidity (Diarrhea)	Present	30	22.2%
	Absent	105	77.8%

The association between anemia severity and risk factors revealed several significant trends. Children with younger mothers (<24 years) showed higher rates of moderate anemia, with 47.6% of such children falling into this category (p = 0.045). Poor breastfeeding practices were another significant contributor, with 50% of children in this group having moderate anemia (p = 0.025). Low maternal education emerged as a strong determinant, as more than half of these children had moderate anemia (p = 0.012). Socioeconomic status also had a notable impact, with 52.5% of children from low-income households showing moderate anemia and 12.5% having severe anemia (p = 0.009). Lastly, recent diarrhea episodes contributed significantly to anemia severity, particularly among those with severe anemia (p = 0.041). These findings underscore the importance of addressing modifiable risk factors, such as improving maternal education and promoting adequate breastfeeding, to mitigate the impact of anemia.

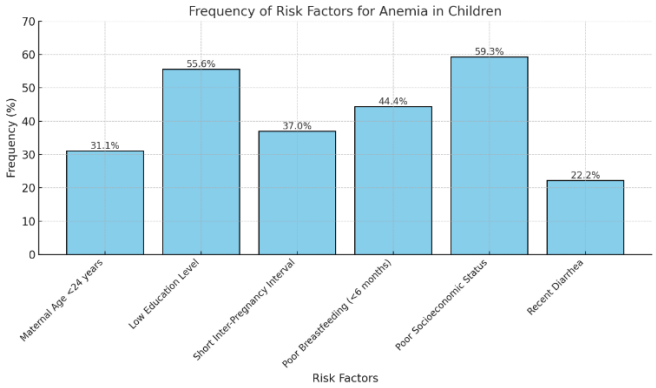
Table 3

Association between Risk Factors and Severity of Anemia

Risk Factor	Mild Anemia (10–11 g/dL)	Moderate Anemia (7–9.9 g/dL)	Severe Anemia (<7 g/dL)	P-value
Maternal Age	15 (35.7%)	20 (47.6%)	7 (16.7%)	0.045
Maternal Education	25 (33.3%)	40 (53.3%)	10 (13.4%)	0.012
Inter-Pregnancy Interval	18 (36.0%)	25 (50.0%)	7 (14.0%)	0.032
Breastfeeding Duration	22 (36.7%)	30 (50.0%)	8 (13.3%)	0.025
Socioeconomic Status	28 (35.0%)	42 (52.5%)	10 (12.5%)	0.009
Morbidity (Diarrhea)	10 (33.3%)	15 (50.0%)	5 (16.7%)	0.041

This study highlights the multifactorial nature of anemia in children, with maternal, socioeconomic, and child-specific factors all playing vital roles. The most 'prevalent risk factors, such as poor socioeconomic status and low maternal education, point to the need for targeted public health interventions'. Addressing these underlying determinants through education, breastfeeding promotion, and socioeconomic support could significantly reduce anemia's prevalence and severity in this vulnerable population.

Figure 1



The bar chart highlights the frequency of risk factors for anemia in children. Poor socioeconomic status (59.3%) and low maternal education (55.6%) were the most prevalent factors, indicating financial and educational limitations significantly contribute to anemia.

Poor breastfeeding practices **(**44.4%) and short inter-pregnancy intervals (37.0%) further emphasize the importance of proper maternal and childcare. Younger maternal age (<24 years, 31.1%) and recent diarrhea episodes (22.2%) also play critical roles, reflecting the impact of maternal inexperience and child infections on anemia.

The graph underscores the multifaceted nature of anemia, pointing to socioeconomic, maternal, and health-related factors as key targets for intervention.

DISCUSSION

This study aimed to identify the risk factors associated with anemia in children aged 6 months to 5 years presenting to Qazi Hussain Ahmad Medical Complex, Nowshera. The findings highlighted the significant role of socioeconomic, maternal, and child-related factors in the prevalence and severity of anemia, aligning with previous research conducted in similar findings (7-9).

One of the most prominent risk factors observed was poor socioeconomic status, present in 59.3% of the study population. This finding corroborates studies conducted in Ethiopia and India, where low income was strongly associated with anemia due to limited access to nutrient-rich foods and healthcare services (9-11). Families from lower socioeconomic backgrounds often struggle to provide iron-rich diets, increasing the risk of iron deficiency anemia in children.

Low maternal education was another critical factor, affecting 55.6% of the participants. Mothers with less education are less likely to be aware of proper nutrition, breastfeeding practices, and the importance of timely

healthcare interventions. Similar findings were reported in studies, which emphasized the role of maternal education in improving child health outcomes and reducing anemia prevalence (12-14).

Poor breastfeeding practices, specifically exclusive breastfeeding for less than six months, were noted in 44.4% of cases. Breastfeeding provides essential nutrients, including iron, during the critical early months of life. Inadequate breastfeeding has been linked to anemia in numerous studies, including those from South Asia, which highlight the protective effects of exclusive breastfeeding against iron deficiency (7, 15, 16).

Short inter-pregnancy intervals (<2 years) were reported in 37% of cases, suggesting that insufficient time between pregnancies depletes maternal nutrient reserves, increasing the likelihood of anemia in subsequent children. This observation was consistent with findings from studies in developing countries, where short intervals between pregnancies were linked to poor maternal and child health outcomes (17, 18).

Younger maternal age (<24 years) was a significant contributor to anemia, seen in 31.1% of the participants. Young mothers may lack the experience, resources, or physical maturity required to ensure optimal child nutrition. 'This finding aligns with studies which have shown that maternal age plays a crucial role in determining child health' (19, 20).

Recent diarrhea episodes, reported in 22.2% of children, were significantly associated with anemia. Diarrhea leads to nutrient loss and impaired absorption, exacerbating iron deficiency in vulnerable children. Studies have also demonstrated a strong link between recurrent diarrhea and anemia in children under five years of age (21, 22).

Overall, the findings of this study align with global research highlighting the multifaceted nature of anemia in children. The significant associations between anemia and factors such as low socioeconomic status, maternal education, breastfeeding practices, and morbidity underscore the need for comprehensive interventions. Strategies should include community-based education programs to improve maternal knowledge, promotion of exclusive breastfeeding, and addressing underlying socioeconomic challenges.

Strengths and Limitations

This study provides valuable insights into the risk factors of anemia in a specific population, contributing to the growing body of evidence on the subject. However, the cross-sectional design limits the ability to establish causation. 'Future longitudinal studies are recommended to better understand the causal relationships between these risk factors and anemia'.

CONCLUSION

This study highlights the significant risk factors contributing to anemia in children aged 6 months to 5 years. Poor socioeconomic status, low maternal education, inadequate breastfeeding practices, short inter-pregnancy intervals, younger maternal age, and recent episodes of diarrhea emerged as key contributors. These findings underscore the multifactorial nature of childhood anemia, with both maternal and environmental factors playing critical roles.

Addressing these risk factors requires a comprehensive approach, including improved maternal education, promotion of exclusive breastfeeding, addressing food insecurity, and enhancing access to healthcare services. Targeted interventions focusing on public health awareness and nutritional support can significantly reduce the prevalence and severity of anemia. By implementing these strategies, the growth, development, and survival outcomes of children in vulnerable populations can be substantially improved, contributing to broader societal and economic benefits.

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