

Original Research Article

PREVALENCE AND RISK FACTORS OF ANEMIA AMONG CHILDREN IN 6-59 MONTHS OF AGE IN RURAL HARYANA- A CROSS-SECTIONAL STUDY

Kiran Bhatti¹, Meena Rajput², Sadam Hussain³, Ameena Muhammed¹, Parmeet Singh¹, Dwaraka Nath¹, Kalpana⁴, Sandeep Sharma⁵

¹Junior Resident, Department of Community Medicine, Pt. B.D Sharma PGIMS, Rohtak, India.

²Professor, Department. of Community Medicine, Pt. B.D Sharma PGIMS, Rohtak, India.

³Senior Resident, Department of Community Medicine Shri Atal Bihari Vajpayee GMC, Chhainsa, Faridabad, India.

⁴Junior Resident, All India Institute of Medical Sciences, New Delhi, India.

⁵Medical Officer, District Hospital Sonapat, India.

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Corresponding Author:

Dr. Sadam Hussain,
Senior Resident, Department of
Community Medicine, Shri Atal Bihari
Vajpayee Government Medical
College, Chhainsa, Faridabad,
Haryana, India.
Email: sadamhussainmph@gmail.com

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ABSTRACT

Background: Anemia remains a major public health problem in India, particularly among children aged 6–59 months. In rural Jhajjar, Haryana, the prevalence is reported to be as high as 76.9%. Iron deficiency anemia in early childhood adversely affects cognitive, physical, and motor development. This study aimed to assess the prevalence and determinants of anemia among children aged 6–59 months in rural Jhajjar.

Materials and Methods: A community-based cross-sectional study was conducted from March 2023 to February 2024 at Community Health Center, Dighal, Jhajjar. A total of 400 children were selected through simple random sampling from 10 subcenters. Data were collected using a semi-structured questionnaire, anthropometric measurements, and hemoglobin estimation using a digital hemoglobinometer. Anemia was classified according to WHO criteria. Statistical analysis was performed using SPSS version 19.0 and logistic regression was applied to identify associated factors.

Results: Among 400 children, 75.7% were anemic: 23.5% mildly, 33% moderately, and 19.2% severely. Higher prevalence was observed among children aged 6–24 months, those with maternal anemia, low birth weight, and higher birth order. Children from joint families and OBC caste had significantly higher anemia prevalence. Stunting (twofold risk) and low MUAC (<12.5 cm; 23-fold risk) were strongly associated with anemia. Lack of deworming, inadequate IFA supplementation, and history of PICA were also significant predictors.

Conclusion: Anemia remains a severe health challenge among under-five children in rural Jhajjar. Strengthening primary care services, nutritional interventions, and caregiver awareness is essential for early identification and prevention.

Keywords: Anemia, malnutrition, iron deficiency, maternal health, child health, rural India.

INTRODUCTION

According to the World Health Organization (WHO), anemia is a severe public health problem with a prevalence of 40% or more.^[1] As the National Family Health Survey-5, the prevalence of anemia in children of 6-59 months age group is 67.1% (68.3% in rural and 64.2% in urban) in India. The

prevalence in Haryana is 70.4% in (71.5% in rural and 68.1% in urban).^[2] In rural areas of Jhajjar district, the prevalence is 76.9% with 44.8% having moderate to severe Anemia.^[3]

Anemia is an indicator of poor nutrition and health. Evidence suggests that anemia creates a vicious cycle in which it causes and is caused by a complex of multiple factors, such as malnutrition, infectious

diseases, and other factors, which leads to a major challenge in effectively addressing anemia and its determinants. This challenge is complicated by differences in environmental and demographic factors across populations. More than half of all anemia cases are due to iron deficiency. Iron deficiency anemia affects cognitive function, motor development, school performance, and physical and behavioral growth in children. The effects are most severe in infancy and early childhood leading to increase in morbidity and mortality.^[4,5]

Addressing Anemia in this vulnerable age group is a pressing issue that warrants thorough investigations and targeted interventions that require a multifaceted approach involving Govt. initiatives, community engagement, and individual efforts to ensure a healthier future for children. National policies and programs have been making intensive efforts to reduce the burden of anemia in the last five decades. However, little progress has been made in combating anemia, despite rapid economic growth in the country.

So, keeping this in view, this study aims to provide a comprehensive analysis of the prevalence of Anemia and its determinants among children in 6-59 months age group in rural areas of Jhajjar, Haryana, India.

MATERIALS AND METHODS

This community-based cross-sectional study was conducted at the Community Health Centre, Dighal (District Jhajjar), with 20 subcenters, out of which 10 were selected randomly. The Auxiliary Nurse Midwife (ANM) was contacted, and a line listing of children in 6-59 months of age group was prepared from the Routine Immunization Register of the subcenter. A total of 40 study subjects were selected from each subcenter using a simple random sampling technique, thus making the total sample size 400, which was calculated using the formula- $n = \frac{4pq}{l^2}$ (where n = sample size, p = 70.5%, the prevalence of anemia according to NFHS-5 data, l = absolute error 5%) and adding 10% non-response rate.

Study participants residing in the area for at least 6 months were included. Patients who were chronically ill, hospitalized, or had a history of bleeding disorders were excluded from the study. The duration of the study was one year from March 2023 to February 2024.

Data were collected using a predesigned, pretested, and semi-structured questionnaire through interviews, after obtaining informed written consent. Socio-demographic characteristics were recorded, and nutritional assessment of the selected subjects was performed by taking anthropometric measurements such as height, weight, and Mid Upper Arm Circumference as per standard protocols. Following a comprehensive physical examination, the hemoglobin level was tested using

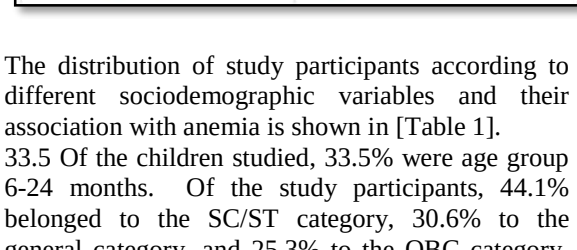
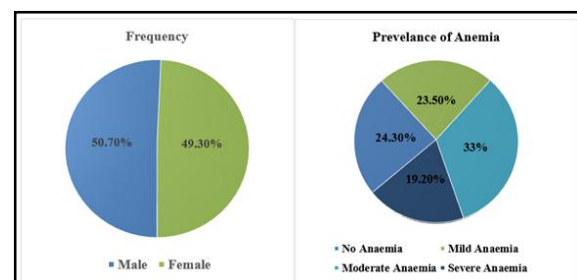
a digital hemoglobinometer (true hemoglobinometer)⁶ by the investigator herself, after taking all aseptic precautions. Study subjects reporting symptoms of severe anemia, such as irritability, failure to thrive, or weight loss, were referred to the nearest health center for further management.

Categorisation of Anemia was done using WHO criteria where Normal is 11g/dL or more, mild Anemia- 10.0-10.9 g/dL, moderate Anemia- 7.0-9.9 g/dL and severe Anemia- less than 7.0 g/dL.^[7]

Data analysis: Collected data were entered in the MS Excel spreadsheet, and data analysis was performed using Statistical Package for Social Sciences (SPSS) for Windows (version 19.0; SPSS Inc.). Odds ratios (OR) with 95% confidence intervals (CI) were calculated using binary logistic regression.

RESULTS

Of the 400 study participants age group-6-59 months, 50.7% were males and 49.3% were females [Figure 1]. The prevalence of anemia [Figure 2] according to the WHO criteria was 75.7%, 23.5% had mild anemia, 33% had moderate anemia, and 19.2% had severe anemia.



The distribution of study participants according to different sociodemographic variables and their association with anemia is shown in [Table 1].

33.5 Of the children studied, 33.5% were age group 6-24 months. Of the study participants, 44.1% belonged to the SC/ST category, 30.6% to the general category, and 25.3% to the OBC category. There were 42.2% of children born to mothers who were illiterate, whereas the remaining children were born to mothers with primary, secondary, or higher education. The majority of the children studied were from a joint family (62.7%), and 39.8% of the children belonged to the lower-middle socioeconomic class.

Among the mothers of the study participants, 32.7% had a history of anemia during pregnancy and 40% had a birth order of three or more. A total of 51.6% had a lower birth weight than normal birth weight, and 2.3% belonged to the Very Low birth weight category.

In the past year, 55.2% did not have biannual deworming with albendazole, whereas 50.8% did not receive Iron Folic Acid supplementation. Among the children studied, 19.8% had a history of PICA.

Considering the anthropometric measurements performed in the study subjects, according to WHO criteria⁸, 29.1% were underweight, 28.1% were stunted, and 3.2% had a mid-upper arm circumference of less than 12.5 cm, suggesting malnutrition.

The distribution of anemia was similar in both male and female children. Children in the age group of 6-24 months were significantly more anemic than children in other age groups. Anemia was significantly higher among children age group 5-24

months and among those who belonged to the OBC caste or a joint family.

The prevalence of anemia was significantly higher among children with a history of anemia during pregnancy. There was an inverse relationship between birth weight and prevalence of anemia in children. With an increase in birth order, the prevalence of anemia has significantly increased. A history of PICA and the practice of not taking IFA supplementation were significantly associated with the prevalence of anemia.

Table 2: Socio-demographic profile and Prevalence of Anemia in children in the 6-59 months age group

Variables	Distribution (N=400)	Prevalence of Anemia	Mild	Moderate	Severe	p-value
Gender						
Males	50.7%	38.5%	11.5%	15.5%	11.5%	0.1
Females	49.3%	37.2%	12%	17.5%	7.7%	
Age						
6-24 months	37%	28.7%	6.7%	13.5%	8.5%	0.02
25-42 months	33.5%	25.5%	9.5%	10%	6%	
43-59 months	29.5%	21.5%	7.2%	9.5%	4.7%	
Caste						
General	30.6%	25%	10.5%	11%	3.5%	0.000
OBC	25.3%	18.5%	3.3%	10.2%	5%	
SC/ST	44.1%	32.2%	9.7%	11.8%	10.7%	
Type of family						
Nuclear	37.3%	28.5%	8%	14%	6.5%	0.004
Joint	62.7%	47.2%	15.5%	19%	12.7%	
Educational status of mother						
Illiterate	42.2%	47.5%	32.6%	41.6%	25.6%	0.1
Up to 5th class	20.7%	19.4%	23.7%	57.6%	18.6%	
Up to 12th class	23.1%	22.4%	27.9%	4.4%	26.4%	
Graduate	14%	10.5%	31.1%	21.8%	34.3%	
Socio-economic status						
Upper class I	22.5%	21.4%	5.5%	7.3%	8.7%	0.5
Upper middle class II	16%	11.2%	2.5%	4.7%	4%	
Middle III	13.7%	9%	3.3%	4.7%	1%	
Lower Middle IV	39.8%	35%	11.3%	15%	8.7%	
Lower class V	8%	3%	1%	1.2%	0.8%	
H/o Anemia in mother during pregnancy						
Yes	32.7%	35.6%	35.2%	33.3%	31.5%	0.02
No	67.3%	64.3%	28.7%	49.2%	22.1%	
Birth order						
First	22.5%	19.1%	36.2%	43.1%	20.6%	0.007
Second	37.5%	38.9%	34.7%	34.7%	30.5%	
Multi	40%	41.9%	25.1%	51.9%	22.8%	
Birth weight						
<1.5kg	2.3%	2.9%	22.2%	33.3%	44.4%	0.1
1.5-2.5kg	49.3%	49.1%	25.5%	45.6%	28.8%	
>2.5kg	48.4%	48.1%	36.9%	41.7%	20.5%	
History of PICA						
Yes	19.8%	23.7%	23.6%	37.6%	38.8%	0.01
No	80.2%	76.2%	33.5%	45.4%	21.1%	
H/o intake of IFA syrup						
Never	50.8%	47.8%	30.3%	43.4%	26.2%	0.003
Biweekly	43.5%	46.3%	27.8%	46.4%	25.7%	
Others	5.7%	5.9%	61.1%	22.2%	16.6%	
H/o Albendazole intake						
Biannually	44.8%	45.2%	31.3%	44.5%	24.1%	0.3
Annually	22.9%	20.1%	39.3%	40.9%	19.6%	
Never	32.3%	34.7%	25.7%	43.8%	30.7%	
Height for Age						
< -1SD	27.8%	28.3%	29.0%	40.6%	30.2%	0.1
< -2SD	16.3%	18.8%	38.5%	31.5%	29.8%	
< -3SD	11.8%	14.5%	27.2%	40.9%	31.8%	
Normal	44.1%	38.2%	30.1%	52.5%	17.2%	
Weight for Age						
< -1SD	31.6%	33.3%	30.6%	36.6%	32.6%	0.000
< -2SD	19.8%	21.4%	33.8%	38.4%	27.6%	
< -3SD	9.3%	12.3%	18.9%	54.1%	27.1%	
Normal	39.3%	33%	34%	50%	16%	

Mid Upper Arm Circumference						
<12.5cm	3.2%	4.3%	23.1%	53.8%	23.1%	
12.5-13.5cm	27.2%	33%	32%	39%	29%	
>13.5cm	69.5%	62.7%	31.1%	45.2%	23.6%	0.001

Logistic regression tests were performed on the significant results to calculate the strength of the association, as shown in [Table 2]. Children in the OBC category had a 1.7 times risk of developing anemia than those in the general category. Mothers with a history of anemia during pregnancy were found to have a 1.7 times risk of anemia. The prevalence of Anemia is 3.9 times in children with a

history of PICA. Children who took albendazole tablets in the past year, either annually or biannually, were found to have a 0.5 times and 0.8 times risk compared to those who did not. Anemia was 2.0 times prevalent in children with stunting, while those with MUAC less than 12.5 cm, suggesting malnutrition, had 23 times risk of anemia prevalence.

Table 2: Logistic regression estimates for children aged 6- 59 months with Anemia by their significant background characteristics

Variables	Categories	Anemia (N=400)	Unadjusted Odds ratio	p-value	95% confidence interval
Sex of child	Male Female	154(38.5%) 149(37.2%)	1.1	0.5	0.7- 1.8
Caste	General OBC SC/ST	100(25%) 74(18.5%) 129(32.2%)	1.7 1.0	0.05 0.9	0.9 – 3.1 0.5-1.7
Mid-Upper Arm Circumference	Normal <12.5cm 12.5-13.5cm	190(47.5%) 13(3.2%) 100(25%)	23 3.1	0.9 0.004	0.000 1.4 – 6.6
Weight for age	Normal <-1SD <-2SD	100(25%) 101(25.2%) 65(16.2%)	1.3 1.0	0.4 0.8	0.6 – 2.5 0.4 – 2.4
Height for age	Normal <-1SD <-2SD	116(29%) 86(21.5%) 57(14.2%)	1.2 2.0	0.1 0.4	0.6 – 2.4 0.8 – 5.0
History of Pica	No Yes	231(57.7%) 72(18%)	3.9	0.001	1.7 – 8.9
Albendazole intake	Never Biannually Annually	105(26.2%) 137(34.2%) 61(15.3%)	0.8 0.5	0.7 0.06	0.5 – 1.6 0.2 – 1.0
Mother's Anemia during pregnancy	No Yes	195(48.7%) 108(27%)	1.7	0.04	1.0 – 2.8

DISCUSSION

The prevalence of anemia was found to be 75.7%, with mild, moderate, and severe anemia at 23.5%, 33%, and 19.2%, respectively. These findings were comparable with the NFHS-5 (2019-21, Haryana) data, in which the prevalence of anemia in children (6-59 months) was 70.4% in Haryana.

The prevalence was similar in both male and female genders, which is comparable to the study conducted by Yadav et al. (2024)⁹ suggesting that there is no gender-specific risk factors for anemia in this age group.

The study results showed that the prevalence of anemia was significantly associated with age. With increasing age, the risk of anemia decreases. This is similar to the findings of a study conducted by Dutta et al in 2020 and Osorio et al.^[10,11] This could likely be due to the higher incidence of maternal micronutrient deficits, as well as low concentrations of iron in breast milk due to anemia in mothers, which is insufficient to meet the daily requirements of iron for children. In addition, iron intake improves when the child starts a varied diet with hemoglobin-rich foods.

The prevalence of Anemia was 1.7 times in children in the OBC category, while it was surprisingly the same in the General and SC/ST categories. This might be the outcome of national nutritional programs and policies that focused on marginalized SC/ST categories to ensure their equitable access to healthcare services. Children belonging to joint families had a significantly higher prevalence of anemia, likely due to the lack of individual attention and care compared with nuclear families.

The prevalence of Anemia was 1.7 times in children with a history of anemia during pregnancy. This is attributable to the fact that anemia in pregnancy leads to decreased iron stores in newborns persisting up to one year resulting in iron deficiency anemia.^[12] This warrants the need to focus on routine maternal iron supplementation and prompt correction of anemia at the earliest.

The study participants who were stunted were at 2 times the risk of Anemia and those with MUAC <12.5 cm were 23 times more likely to have anemia. Similar findings were reported by Larson et al. (2024),^[13] Kundu R.N. et al (2023),^[14] and Akhtarul Islam et al. (2022),^[15] found a significant association

between anemia and key indicators of malnutrition, stunting, wasting, and underweight.

Children who did not receive Iron Folic Acid supplementation in the past year had a significantly higher risk of developing anemia than those who did. This emphasizes the need for the proper implementation of national programs and promoting awareness to ensure compliance.

The study participants with a history of PICA are 3.9 times more at risk of anemia, which is comparable with a study conducted by Islam et al. (2022),^[15] showing a significant association between the history of PICA with Anemia. This can be attributable to the theory that PICA substances inhibit the absorption of dietary nutrients required for the production of hemoglobin.^[16] PICA could also cause Anemia if it is a vector for nematode infections.^[17]

The study participants taking albendazole tablets biannually were found to be 0.8 times anaemic than those who did not, which is similar to the results of studies conducted by Yadav et al. (2024).^[9] Albendazole helps in deworming, which reduces intestinal blood loss due to hookworm infection, in turn reducing the risk of anemia.

CONCLUSION

This study highlights the prevalence of anemia among children age group 6-59 months, which is a severe public health challenge in India. The findings of this study underscore the urgent need for targeted interventions aimed at the prevention, screening, and treatment to mitigate the burden of anemia in this vulnerable population. Addressing nutritional deficiencies, improving access to healthcare services, and raising awareness among caregivers are crucial steps in combating anemia and promoting the well-being of children in the region. By addressing the determinants identified in this study and implementing evidence-based interventions, we can work towards improving the health outcomes and quality of life of the youngest members of society in rural areas of the district of Jhajjar, Haryana.

Limitations: The sample size in the present study was small, and a larger sample size could have reduced bias. Long-term follow-up is necessary in iron deficiency patients to record long-term neurodevelopmental outcomes, which was not performed in this study. Underlying undiagnosed diseases may be a contributing factor to iron deficiency anemia, which was not accounted for in our study. However, a detailed etiological diagnosis was not made because of a lack of investigation facilities.

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