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Original Research Article

Prevalence, severity and correlates of anemia among adolescent girls in an urban village of Delhi: a cross-sectional study

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ABSTRACT

Background: Anemia is a major public health problem among adolescents in India, affecting growth and academic performance. Despite weekly iron folic acid supplementation (WIFS) program, data from urban villages is limited. Objective: To estimate prevalence, severity and assess socio-demographic, nutritional and knowledge correlates of anemia among adolescent girls in an urban village of Delhi.
Methods: A community-based cross-sectional study was conducted among 400 adolescent girls aged 10-19 years in Aali village, Delhi from 01 January 2025 to 31 March 2026. Multi-stage sampling was used. Haemoglobin was estimated using digital hemoglobinometer. Anemia was defined as Hb<12 g/dl. Data was analysed using SPSS v26. Chi-square and univariate logistic regression were used. $p<0.05$ was considered significant.
Results: Prevalence of anemia was 67.2%. Mild, moderate and severe anemia was 42.5%, 22.0% and 2.7% respectively. Prevalence was higher in 15-19 years 73.6% vs 10-14 years 59.4%, OR 1.86, $p=0.003$. Mother's illiteracy OR 2.61, $p<0.001$ and early menarche <13 years OR 1.74, $p=0.013$ were significant. Underweight girls had 4.67 times higher odds, $p<0.001$. Vegetarian diet OR 2.12, $p<0.001$. Non-consumption of IFA OR 4.52, $p<0.001$. Poor knowledge had highest odds OR 6.02, $p<0.001$.
Conclusions: Anemia burden is high. Modifiable factors like undernutrition, poor IFA compliance and poor knowledge are key drivers. A multi-sectoral approach strengthening WIFS, nutrition and targeted IEC through schools and mothers is needed.

Keywords: Adolescent girls, Anemia, Nutritional status, Knowledge, Delhi, WIFS

INTRODUCTION

Adolescence is a critical period of rapid growth and development, second only to infancy.[1] Anemia during this period is a major public health problem in India affecting physical growth, cognitive development and academic performance.[2] According to National Family Health Survey-5 (NFHS-5), 59.1% of adolescent girls aged 15-19 years are anemic nationally, and 62.6% in Delhi.[3] Iron deficiency is reported as the commonest cause of anemia globally.[4]

Adolescent girls are particularly vulnerable due to increased iron requirements for growth spurt and menstrual blood losses.[5] Several studies have reported high prevalence of anemia among adolescent girls in rural and urban settings ranging from 45% to 85%.[6-8] Anemia leads to fatigue, poor concentration, reduced productivity and increased susceptibility to infections.[9]

The Government of India launched WIFS program in 2013 to cover adolescent girls.[10] The program is supported by Anemia Mukt Bharat strategy 2018 and

Rashtriya Kishor Swasthya Karyakram (RKSK) 2014 for holistic adolescent health.[11,12] However, compliance and awareness remain challenges, especially in urban villages where health infrastructure is poor.[13]

Clinically reported studies have shown that socio-demographic factors such as mother's education and socioeconomic status are important correlates of anemia.[14,15] Few studies have explored knowledge as determinant of anemia in Delhi slums.[16] There is limited recent data from urban villages of Delhi. Hence this study was undertaken.

METHODS

Study design and setting

A community-based cross-sectional study was conducted in Aali village, an urban village in South-East district of Delhi.

Study period

Exact study period was from 01 January 2025 to 31 March 2026. Field data collection was carried out from 01 June 2025 to 30 November 2025. Data analysis and report writing was done from December 2025 to March 2026.

Study population

Adolescent girls aged 10-19 years residing in Aali village.

Inclusion criteria

Adolescent girls aged 10-19 years at time of survey, residing in Aali village for more than 6 months, willing to participate with written parental consent and assent from girl if <18 years, or self-consent if ≥18 years and available at home during house-to-house survey were included in the study.

Exclusion criteria

Girls with known haematological disorders like thalassemia, sickle cell anemia, girls who received blood transfusion in last 3 months, girls with acute febrile illness or chronic illness at time of survey, girls who are currently pregnant and girls who did not give consent or assent were excluded from the study.

Sample size

Calculated using prevalence 62.6% from NFHS-5 Delhi, 10% relative precision, 95% CI, design effect 1.5 and 10% non-response, the final sample was 400.[3]

Sampling

It was a multi-stage sampling.

Stage 1 was Aali village purposively selected. Stage 2 were 10 lanes randomly selected from 25 lanes by lottery. Stage 3 were all eligible girls in selected lanes included by house-to-house survey till 400 achieved.

Study tools

Pre-tested semi-structured questionnaire with 4 sections - socio-demographics, dietary pattern, IFA consumption in last 90 days, knowledge about anemia with 10 questions. Knowledge scored as Poor <4, Average 4-7, Good >7.

Validity

Content validity established by 5 experts. Content validity index 0.87. Pre-testing done on 20 girls. Reliability r=0.82.

Hemoglobin assessment

Hemoglobin concentration was estimated using a digital hemoglobinometer following the manufacturer's instructions and standard infection prevention and control measures. Capillary blood was collected under aseptic conditions, and hemoglobin values were recorded in grams per decilitre (g/dl).

Based on the measured hemoglobin concentration, participants were classified into severe, moderate, mild, and non-anemic categories according to the classification adopted for the study.

Anthropometric assessment

Height was measured in meters using a standard measuring scale, and weight was recorded in kilograms using a calibrated weighing scale. Body mass index (BMI) was calculated using the following formula:

BMI=Weight (kg)/Height (m^2)

Data collection procedure

Prior to data collection, permission was obtained from the concerned authorities. The purpose of the study was explained to all eligible participants. Written informed consent was obtained from participants aged 18 years and above. For participants below 18 years of age, assent from the adolescent and written consent from a parent or legal guardian were obtained. Data were collected through face-to-face interviews using the structured interview schedule. Anthropometric measurements were recorded, and hemoglobin estimation was performed using a digital hemoglobinometer under standard hygienic conditions.

Ethical approval

IEC approval was taken HFM/IEC/2025/12 dated 10/01/2025.

Statistical analysis

MS excel and SPSS v26. Chi-square and univariate logistic regression for OR with 95% CI, p<0.05 significant.

RESULTS

Baseline characteristics

This study evaluated 400 girls, finding that the majority were aged 15-19 (55.0%), practiced Hinduism (80.0%), and belonged to lower socioeconomic classes (65.0%). Notably, nutritional and health indicators were poor, with 35.0% being underweight, 55.0% following a vegetarian diet, and a striking 62.0% failing to consume iron and folic acid (IFA) supplements (Table 1).

Prevalence and severity

The overall prevalence of anemia was alarmingly high at 67.2%, meaning nearly two-thirds (269 out of 400) of the surveyed girls were anemic. Among those affected, mild anemia was the most common form at 42.5%, followed by moderate anemia at 22.0% and severe anemia at 2.7% (Table 2 and Figure 1).

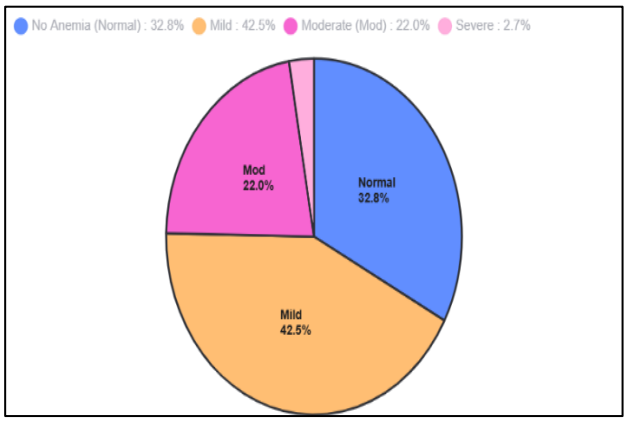


Figure 1: Prevalence and severity.

Association with socio-demographic factors

Socio-demographic analysis revealed that late adolescence (15–19 years) significantly increased anemia risk compared to early adolescence (OR 1.86, p=0.003). Additionally, having an illiterate mother more than doubled the odds of anemia (OR 2.61, p<0.001), while early menarche (<13 years) also acted as a prominent biological risk factor (Table 3).

Association with nutritional factors

Nutritional habits and awareness emerged as the strongest determinants of anemia, led by poor health knowledge, which multiplied the odds of anemia by 6 times (OR 6.02, p<0.001). Being underweight (OR=4.67) and skipping IFA supplements (OR=4.52) also served as critical risk factors, alongside a vegetarian diet (OR=2.12) (Table 4).

Table 1: Baseline characteristics of the study participants (n=400).

Variables	N	%
Age group (in years)		
10-14	180	45.0
15-19	220	55.0
Religion		
Hindu	320	80.0
Others	80	20.0
Mother's education		
Illiterate	170	42.5
Literate	230	57.5
Socioeconomic status		
Lower class (IV-V)	260	65.0
Upper/middle class (I-III)	140	35.0
Age at menarche		
Early (<13 years)	160	40.0
Normal (≥13 years)	240	60.0
Dietary pattern		
Vegetarian	220	55.0
Mixed	180	45.0
BMI		
Underweight	140	35.0
Normal	240	60.0
Overweight/obese	20	5.0
IFA tablet consumption		
Consumed	152	38.0
Did not consume	248	62.0
Knowledge regarding anemia		
Poor	160	40.0
Average	180	45.0
Good	60	15.0

Table 2: Prevalence and severity of anemia among adolescents (n=400).

Anemia status/ severity	Prevalence	%
No anemia	131/400	32.8
Anemic (overall prevalence)	269/400	67.2
Mild anemia	170/400	42.5
Moderate anemia	88/400	22.0
Severe anemia	11/400	2.7

Table 3: Association of socio-demographic and nutritional risk factors with anemia.

Risk factor category	Anemia prevalence	OR	95% CI	P value
Age group: Late (15-19) vs early (10-14)	73.6% vs 59.4%	1.86	1.23-2.81	0.003
Mother's education: Illiterate vs literate	76.5% vs 60.4%	2.61	1.68-4.05	<0.001
Menarche: Early (<13 years) vs normal (≥13 years)	74.4% vs 62.5%	1.74	1.12-2.70	0.013

Table 4: Associations with nutritional and knowledge risk factors (n=400).

Nutritional and knowledge factor	High risk category (%)	Comparison category (%)	OR	95% CI	P value
Knowledge levels	Poor knowledge (87.5)	Average/good (53.8)	6.02	3.54-10.26	<0.001
Nutritional status (BMI)	Underweight (85.7)	Normal/overweight (57.3)	4.67	2.85-7.64	<0.001
Ifa pill consumption	Non-consumption (77.0)	Consumers (51.3)	4.52	2.89-7.07	<0.001
Dietary habits	Vegetarian (74.1)	Mixed diet (58.9)	2.12	1.38-3.25	<0.001

DISCUSSION

Prevalence 67.2% higher than NFHS-5 Delhi 62.6% and national 59.1%, indicating urban villages high burden pockets.[2,3] Similar to Singh et al 68.5% in Delhi and higher than Kaur et al 59% in Wardha.[14,15] Basu et al 45% in Chandigarh lower due to better SES.[7] Barua et al 77% in Jharkhand higher.[8]

Severity mild predominance 42.5% similar to Choudhary et al and Biradar et al.[18,19]

Mother's illiteracy OR 2.61 strongest socio-demographic predictor, consistent with Goel et al and Gupta et al.[16,20] Late adolescence OR 1.86 and early menarche OR 1.74 reflect increased iron demand and menstrual loss, similar to Bhattacharya et al and Seshadri et al.[21,22]

Underweight OR 4.67 shows anemia-undernutrition cycle, similar to Toteja et al. Vegetarian OR 2.12 due to poor bioavailability, consistent with Ahmed et al.[23,25]

Strongest predictors poor knowledge OR 6.02 and non-consumption IFA OR 4.52. Only 38% consumed IFA despite WIFS, compliance gap reported by Kapil et al.[10,13] Poor knowledge despite Anemia Mukt Bharat highlights need for IEC.[11]

Strengths

Community-based with objective Hb, program factors, multi-stage sampling.

Limitations

Cross-sectional cannot establish causality. Recall bias possible. No worm infestation assessment.

CONCLUSION

Anemia is a severe public health problem with prevalence of 67.2% among adolescent girls in this urban village of Delhi, with mild anemia predominant and modifiable factors like undernutrition, poor IFA compliance and poor knowledge as key drivers with highest odds, along with mother's illiteracy, late adolescence and early menarche. This study advances understanding that despite national programs like WIFS, anemia Mukt Bharat and RKSK, knowledge-behaviour gap remains major barrier in urban villages, requiring girl-centered multi-sectoral approach beyond only supplementation.

Recommendations

We recommend a girl-centered 5-point strategy:

Strengthen WIFS

Direct observed weekly IFA in schools, peer educators and mothers meetings.

Nutrition

Promote iron-rich foods with lemon, target underweight with take-home rations, school kitchen gardens.

Menstrual health education

RKSK sessions on anemia and hygiene, break myths.

Screening

Quarterly school Hb camps using digital hemoglobinometer, treat moderate/severe for 3 months, deworming and linkage to RKSK clinics.

Community

Involve mothers and ASHA, use women's groups for BCC, community monitoring via "Anemia Mitras".

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Ethical approval: The study was approved by the Institutional Ethics Committee

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