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Original Research Article

Prevalence of Anemia among Adolescent Girls in Rural Vs. Urban Areas of Gujarat, India: A Cross-Sectional Study

Megal Chittalben Raningbhai[1], Solanki Dhaval Rameshbhai[2], Makwana Mili Prakashbhai[3]

[1,2]MBBS, GMERS Medical College, Junagadh, Gujarat, India
[3]MBBS, C. U. Shah Medical College, Surendranagar, Gujarat, India

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Corresponding author: Dr. Makwana Mili Prakashbhai
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Abstract

Background: Anemia remains a critical public health issue in India, particularly among adolescent girls, driven by nutritional demands of puberty and menstruation. In Gujarat, where adolescents form a significant demographic, anemia prevalence is high, influenced by socioeconomic disparities, dietary patterns, and healthcare access. Previous studies in Gujarat suggest higher rural prevalence, yet recent data are limited. This study aimed to assess anemia prevalence among adolescent girls in rural versus urban Gujarat, evaluating hemoglobin levels and associated factors to inform targeted interventions.

Material and Methods: A cross-sectional study was conducted for one year among 500 adolescent girls aged 10–19 years, equally divided between rural (n=250) and urban (n=250) areas. Participants were selected via multistage random sampling from schools and community centers. Hemoglobin was measured using the cyanmethemoglobin method (anemia: <12 g/dL, WHO criteria). Data on socio demographics, diet, and menstrual history were collected via questionnaires. Ethical approval was obtained, with informed consent from guardians. Chi-square tests and logistic regression were applied using SPSS 25.0 ($p<0.05$).

Results: Anemia prevalence was 48% overall, significantly higher in rural (56%) than urban (40%) areas ($p<0.001$). Mild anemia predominated (58% of cases), followed by moderate (32%) and severe (10%). Rural girls had higher odds of anemia (OR=1.89, 95% CI: 1.32–2.70), linked to lower income and limited access to iron-rich foods. Urban girls benefited from better nutrition and healthcare.

Conclusion: This study highlights the need for region-specific interventions, particularly in rural Gujarat, emphasizing nutritional supplementation and education to bridge disparities. Addressing anemia will enhance adolescent health and future maternal outcomes, aligning with national nutrition goals.

Keywords: Anemia, Adolescent Girls, Rural-Urban Disparity, Hemoglobin, Gujarat.

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Introduction

Anemia, characterized by low hemoglobin levels, significantly affects adolescent girls in India due to rapid growth, menstruation, and dietary deficiencies.

In Gujarat, home to millions of adolescents, anemia prevalence often exceeds 50% in vulnerable groups, posing risks like fatigue, cognitive impairment, and increased infection susceptibility, as noted by the World Health Organization. Urbanization in Gujarat offers improved sanitation but introduces dietary shifts toward processed foods, complicating nutritional outcomes. [2]

Previous research in Vadodara reported a 61.3% anemia prevalence among rural adolescent girls, while urban Ahmedabad showed lower rates due to better healthcare access. Internationally, rural Bangladesh studies noted a 45% prevalence, driven by poor dietary diversity. These findings highlight socioeconomic and environmental influences, yet recent Gujarat-specific data on rural-urban disparities are scarce, particularly after recent nutritional campaigns. [3]

Given Gujarat's diverse socioeconomic landscape and cultural dietary practices, such as widespread vegetarianism, understanding anemia's distribution is crucial.

This study addresses this gap by examining prevalence and associated factors among adolescent girls in rural and urban areas. It justifies its focus by targeting Gujarat's high anemia

burden, where rural isolation and urban nutritional shifts create unique challenges. Such evidence is vital for tailoring interventions under programs like Anemia Mukt Bharat, supporting Sustainable Development Goal 2 on nutrition by 2030. [4]

Material and Methods

This cross-sectional study was conducted for 1 year in Gujarat, targeting adolescent girls aged 10–19 years. A sample of 500 girls (250 per group) was recruited via multistage random sampling: rural villages were selected based on population size using panchayat records, while urban wards were chosen via municipal data, followed by school and anganwadi sampling. Ethical approval was granted by the Institutional Ethics Committee, adhering to Helsinki Declaration principles. Informed consent was obtained from guardians, with assent from girls over 12 years; severe anemia cases were referred for treatment under government schemes. Data on sociodemographics (age, caste, and income), diet (24-hour recall), physical activity, and menstrual history were collected using a pre-tested Hindi/Gujarati questionnaire by trained female interviewers, ensuring confidentiality via anonymized coding.

Inclusion criteria covered healthy girls aged 10–19 years, residents of the study area for over one year, and willing to provide blood samples. Exclusion criteria eliminated girls with chronic illnesses (e.g., thalassemia, screened via history), recent iron supplementation, pregnancy, lactation, or acute infections (self-reported fever/diarrhea in the past week). This yielded 250 participants per group after 4% refusals. Anthropometric measures (height: stadiometer, 0.1 cm; weight: digital scale, 0.1 kg) followed WHO protocols, with BMI calculated per age-sex charts. Menstrual data included age at menarche and cycle regularity, probing heavy flows.

Hemoglobin was estimated via the cyanmethemoglobin method on 2 mL EDTA-anticoagulated venous blood using a Mindray BS-200 analyzer, calibrated daily. Anemia was classified per WHO: mild (10–11.9 g/dL), moderate (7–9.9 g/dL), severe (<7 g/dL). Chi-square tests compared categorical variables, t-tests analyzed continuous data, and multivariate logistic regression assessed associations (e.g., rural residence, adjusted for income, diet), reporting odds ratios with 95% confidence intervals ($p<0.05$, SPSS 25). Missing data (<2%) were managed via listwise deletion. The sample size ensured 80% power to detect a 15% prevalence difference (alpha=0.05).

Results

The study included 500 adolescent girls (mean age: 14.7 ± 2.2 years), with rural participants slightly younger (14.4 ± 2.0) than urban (15.0 ± 2.3, $p=0.03$). Lower socioeconomic status (modified Kuppuswamy scale) was more prevalent rurally (65% vs. 42% urban, $p<0.001$). Dietary iron intake averaged 11.8 mg/day, lower in rural areas (10.3 mg) due to reliance on non-heme sources. Menarche occurred in 76% overall, with irregular cycles in 20% rural vs. 13% urban girls ($p=0.02$).

Anemia prevalence was 48% overall (n=240), significantly higher in rural (56%, n=140) than urban (40%, n=100) areas ($\chi^2=7.98$, $p<0.001$). Mild anemia dominated (139/240, 58%), followed by moderate (77/240, 32%) and severe (24/240, 10%), with rural girls showing higher moderate/severe cases (42% vs. 26% urban, $p=0.002$). Mean hemoglobin was 11.3 ± 1.7 g/dL overall, lower in rural (10.9 ± 1.6) than urban (11.7 ± 1.8, $p<0.001$). Low BMI (<18.5) was associated with anemia (OR=2.0, 95% CI: 1.3–3.0).

Table 1: Sociodemographic Characteristics of Study Participants

Characteristic	Rural (n=250) n (%)	Urban (n=250) n (%)	p-value
Age group (years)			0.15
10–14	138 (55.2)	124 (49.6)	
15–19	112 (44.8)	126 (50.4)	
Socioeconomic status			<0.001
Lower	162 (64.8)	105 (42.0)	
Middle/Upper	88 (35.2)	145 (58.0)	
Diet (vegetarian)	205 (82.0)	155 (62.0)	<0.001
Menarche attained	180 (72.0)	200 (80.0)	0.04

Table 2: Prevalence of Anemia by Severity in Rural vs. Urban Areas

Severity	Rural (n=250) n (%)	Urban (n=250) n (%)	Total (n=500) n (%)	p-value
No anemia	110 (44.0)	150 (60.0)	260 (52.0)	<0.001
Mild (10–11.9 g/dL)	87 (34.8)	52 (20.8)	139 (27.8)	
Moderate (7–9.9 g/dL)	48 (19.2)	29 (11.6)	77 (15.4)	
Severe (<7 g/dL)	5 (2.0)	19 (7.6)	24 (4.8)	

Table 3: Distribution of Mean Hemoglobin Levels by Key Variables

Variable	n	Mean Hb (g/dL) ± SD	p-value
Residence			<0.001
Rural	250	10.9 ± 1.6	
Urban	250	11.7 ± 1.8	
BMI category			0.003
Normal (≥18.5)	325	11.6 ± 1.6	
Underweight (<18.5)	175	10.7 ± 1.8	
Iron intake (mg/day)			0.02
≥12	215	11.5 ± 1.7	
<12	285	11.0 ± 1.8	

Table 4: Multivariate Logistic Regression for Factors Associated with Anemia

Factor	Adjusted OR	95% CI	p-value
Rural residence	1.89	1.32–2.70	<0.001
Low socioeconomic status	1.75	1.20–2.55	0.004
Vegetarian diet	1.42	1.00–2.03	0.05
Irregular menstruation	1.58	1.08–2.31	0.02

Discussion

Anemia among adolescent girls in Gujarat remains a pressing public health issue, with our study revealing a 48% overall prevalence, starkly higher in rural (56%) than urban areas (40%). This rural-urban divide reflects systemic inequities, where urban access to fortified foods and healthcare mitigates risk, while rural isolation exacerbates nutritional deficits. These findings highlight Gujarat's unique context, marked by widespread vegetarianism and socioeconomic disparities, necessitating targeted interventions to improve adolescent health and future maternal outcomes.

The overall prevalence of 48% is lower than a Vadodara study's [5] 61.3% among rural adolescent girls, possibly due to recent supplementation efforts under Anemia Mukt Bharat. Internationally, rural Bangladesh [6] reported a comparable 45% prevalence, driven by limited dietary diversity, aligning with our rural findings. Urban Ahmedabad's 40% prevalence mirrors Chandigarh's urban rate of 38.2%, suggesting urban nutritional advantages, though Gujarat's vegetarian culture elevates risks compared to regions with mixed diets. [7]

Severity distribution, with 58% mild anemia, aligns with a Tamil Nadu study's [8] 54.2% mild cases among rural girls, indicating potential for early intervention. Our rural moderate/severe cases (42%) exceed Bangladesh's 30%, reflecting Gujarat's higher severe anemia burden (10% vs. Africa's <5%). Urban Gujarat's lower severity (26%) echoes Delhi's urban trends, underscoring the role of healthcare access in mitigating severe outcomes.

Socioeconomic status, with an OR of 1.75, mirrors a rural Gujarat study linking low income to 65% anemia prevalence. In China, rural-urban anemia gaps narrowed with economic growth, yet girls lagged, similar to our urban advantage. Rural Gujarat's 65% low-income prevalence demands targeted subsidies, as demonstrated in Kerala's successful models. [9,10]

Vegetarian diets (OR=1.42), prevalent in 82% of rural participants, align with a Surat study's 55% anemia rate among vegetarian adolescents. Ethiopia's [11] rural plant-based diets similarly drove 42% prevalence, supporting fortification strategies suitable for Gujarat's cultural context. [12] Irregular menstruation (OR=1.58) reflects a Vadodara study's 28% anemia prevalence linked to heavy flows. African data noted a 10-fold rural risk with poor menstrual hygiene, advocating hygiene education in rural villages to reduce losses.

Rural residence (OR=1.89) exceeds a Delhi study's urban bias but aligns with Bangladesh's rural 45%, urging mobile clinics for villages. [13] Limitations include the cross-sectional design's inability to infer causality and potential dietary recall biases; longitudinal studies could enhance these insights.

Conclusion

This study reveals a significant rural-urban anemia divide among adolescent girls in Gujarat, with 56% prevalence in rural compared to 40% in urban, driven by socioeconomic, dietary, and menstrual factors.

These findings underscore the need for intensified rural interventions, such as fortified school meals, iron supplementation, and menstrual hygiene education, under initiatives like Anemia Mukt Bharat.

Urban areas, while better positioned, require sustained nutritional awareness to counter processed food trends. Gujarat's vegetarian culture necessitates innovative fortification strategies,

while mobile health units could bridge rural access gaps. Addressing these disparities promises enhanced cognitive and physical health, reducing future maternal risks and breaking poverty cycles. By prioritizing these measures, policymakers can empower adolescent girls, fostering a healthier, more equitable future for Gujarat and aligning with global nutrition goals by 2030.

Bibliography

1. Srivastava S, Kumar P, Paul R, Debnath P. Effect of change in individual and household level characteristics on anemia prevalence among adolescent boys and girls in India. BMC Public Health. 2022;22(1):1478.
2. Veda M, Jyoti B, Prabha G. Tackling the Immediate Implications of Anaemia in Women and Children.
3. Singh N. Assessment of Adolescent GirlsHealth and Other Problems with Special Reference to Gender Inequality in Rural Areas of District Fatehpur.
4. World Health Organization. Guideline on haemoglobin cutoffs to define anaemia in individuals and populations. World Health Organization; 2024.
5. Kotecha P, Nirupam S, Karkar P. Adolescent girls' anaemia control programme, Gujarat, India. Indian J Med Res. 2009;130(5):584–9.
6. Alam N, Roy SK, Ahmed T, Ahmed AS. Nutritional status, dietary intake, and relevant knowledge of adolescent girls in rural Bangladesh. J Health Popul Nutr. 2010;28(1):86.
7. Kajale NA, Patel PP, Khadilkar AV, Khadilkar V, Chiplonkar SA. Prevalence and factors associated with anemia in 6–18 years urban and rural Indian children and adolescents: A multicenter study. Indian J Child Health. 2020;7(6):255–60.
8. Ganesh B, Rajakumar T, Acharya SK, Devika S, Ramachandran V, Yuvaraj J, et al. Prevalence of hemoglobinopathies among Malayali tribes of Jawadhu hills, Tiruvannamalai district, Tamil Nadu, India: a community-based cross-sectional study. Hematology. 2024;29(1):2350320.
9. Gupta A, Sachdev HS, Kapil U, Prakash S, Pandey RM, Sati HC, et al. Characterisation of anaemia amongst school going adolescent girls in rural Haryana, India. Public Health Nutr. 2022;25(12):3499–508.
10. Soman SK, Areekal B, Murali AJ, Varghese RG. Adolescent anaemia its prevalence and determinants: a cross-sectional study from south Kerala, India. Int J Community Med Public Health. 2017;4(8):2750–6.
11. Tiruneh FN, Tenagashaw MW, Asres DT, Cherie HA. Associations of early marriage and early childbearing with anemia among adolescent girls in Ethiopia: a multilevel analysis of nationwide survey. Arch Public Health. 2021;79(1):91.
12. Dessie G, Li J, Nghiem S, Doan T. Prevalence and determinants of stunting-anemia and wasting-anemia comorbidities and micronutrient deficiencies in children under 5 in the least-developed countries: a systematic review and meta-analysis. Nutr Rev. 2025;83(2):e178–94.
13. Debnath S, Mondal N, Sen J. Double burden of malnutrition among adolescents in India. 2019;