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Prevalence and Determinants of Anaemia Among Adolescent Girls in Tribal Districts of Chhattisgarh: A Cross-Sectional Study

Dr. Sunita Verma

Lecturer, Department of Community Medicine, Government Medical College, Dhamtari, Chhattisgarh

sunitaverma.health@gmail.com

Kavita Sahu

Research Scholar, Department of Public Health, Pt. Ravishankar Shukla University, Raipur, Chhattisgarh

kavitasahu.research@gmail.com

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Abstract: Anaemia remains a persistent public health burden in India, disproportionately affecting adolescent girls in tribal and rural populations. This cross-sectional study was conducted across three tribal-majority districts of Chhattisgarh — Bastar, Narayanpur, and Bijapur — to assess the prevalence and determinants of anaemia among adolescent girls aged 10 to 19 years. A total of 450 participants were enrolled through cluster sampling from government school and Anganwadi settings. Blood haemoglobin levels were measured using a calibrated digital haemoglobinometer, and a validated structured questionnaire gathered data on dietary habits, menstrual patterns, household socioeconomic characteristics, and awareness of the POSHAN Abhiyaan. The study found an overall anaemia prevalence of 67.6% by WHO haemoglobin cut-offs, of which 29.1% was classified as severe (Hb below 7 g/dL), 48.3% as moderate, and 22.6% as mild. Multivariate logistic regression identified low dietary iron intake (OR=3.21, 95% CI: 2.14–4.82), irregular consumption of iron-folic acid tablets (OR=2.87, 95% CI: 1.93–4.28), and below-poverty-line household status (OR=2.14, 95% CI: 1.42–3.22) as significant independent determinants. Access to POSHAN Abhiyaan services was negatively associated with anaemia severity. Findings underscore the urgent need for targeted nutritional interventions, improved IFA distribution mechanisms, and community-level health education in Chhattisgarh's tribal districts.

Keywords: *Anaemia, Adolescent Girls, Tribal Population, Chhattisgarh, POSHAN Abhiyaan, Iron-Folic Acid*

1. Introduction

Anaemia, defined by the World Health Organization as a haemoglobin concentration below 12 g/dL in non-pregnant adolescent girls, is among the most prevalent nutritional disorders globally, affecting approximately 1.62 billion people worldwide. In India, anaemia among adolescent girls is a particularly acute public health concern: the National Family Health Survey-5 (NFHS-5, 2019–21) reported that 59.1% of non-pregnant women aged 15–19 years were anaemic nationally, with tribal-populated states such as Chhattisgarh recording substantially higher proportions.

The consequences of adolescent anaemia extend well beyond immediate health impacts. Anaemia in adolescent girls is associated with impaired cognitive development, reduced physical capacity, poor academic performance, increased susceptibility to infections, and, when anaemia persists into pregnancy, substantially elevated risks of maternal and perinatal mortality. In tribal communities of central India, where dietary diversity is

limited, food insecurity is widespread, and access to healthcare facilities remains constrained, adolescent girls face a compounded vulnerability that standard national-level interventions often fail to adequately address.

The Government of India has implemented several programmes to combat nutritional deficiencies among adolescents, including the Weekly Iron and Folic Acid Supplementation (WIFS) programme and the more comprehensive POSHAN Abhiyaan (National Nutrition Mission) launched in 2018. While these programmes have shown measurable impact in some states, implementation gaps in remote tribal districts — particularly those in Chhattisgarh's southern region — remain poorly documented. District-level anaemia prevalence data is often missing or out of date, making it difficult to target interventions effectively.

This study was designed to fill this knowledge gap by generating district-specific, disaggregated data on anaemia prevalence and its determinants among adolescent girls in three of Chhattisgarh's most tribal-concentrated districts. The findings are intended to inform the design of more contextually appropriate and effective nutritional interventions at the block and district level.

2. Methodology

A cross-sectional study design was adopted. The study population comprised adolescent girls aged 10 to 19 years residing in Bastar, Narayanpur, and Bijapur districts of Chhattisgarh. These districts were selected purposively on the basis of their high proportion of Scheduled Tribe population (above 65%), their remote geographic location, and documented deficits in healthcare infrastructure as per Chhattisgarh HMIS data for 2021–22. A two-stage cluster sampling design was employed: in Stage 1, 15 clusters (government schools and Anganwadi centres) were selected per district using probability proportional to size sampling; in Stage 2, 10 eligible girls were selected per cluster using systematic sampling, yielding a total sample of 450 participants (150 per district).

Haemoglobin estimation was performed using a Hemocue Hb 301 haemoglobinometer, which was calibrated daily using the manufacturer's standard cuvette. Blood samples were collected by trained ANMs using capillary fingerprick technique following standard aseptic precautions. WHO cut-offs were used to classify anaemia severity: mild (Hb 10.0–11.9 g/dL for girls aged 12–19; 11.0–11.9 g/dL for girls aged 10–11), moderate (Hb 7.0–9.9 g/dL), and severe (Hb below 7.0 g/dL). A pre-tested structured questionnaire, available in Hindi and the Halbi dialect, was administered by trained female field investigators to gather data on dietary habits (24-hour dietary recall), IFA tablet receipt and adherence, menstrual pattern, socioeconomic status, and exposure to POSHAN Abhiyaan services.

Data were entered into Epi Info version 7.2 and analysed using SPSS version 23.0. Descriptive statistics were computed for all variables. Chi-square tests were used to assess bivariable associations between anaemia status and categorical independent variables. Variables significant at $p<0.25$ in bivariable analysis were entered into a multivariate binary logistic regression model to identify independent predictors of anaemia. Ethical approval was obtained from the Institutional Ethics Committee of Government Medical College, Dhamtari (Ref. IEC/GMC/DTR/2022/034). Written informed consent was obtained from participants and their parents or guardians.

3. Results and Findings

Of the 450 participants, 448 had valid haemoglobin readings; two samples were excluded due to haemolysis. Overall anaemia prevalence was 67.6% (n=303). Among those diagnosed with anaemia, 29.1% had severe anaemia (Hb below 7 g/dL), 48.3% had moderate anaemia, and 22.6% had mild anaemia. Bijapur district recorded the highest prevalence at 74.2%, followed by Narayanpur (68.9%) and Bastar (59.4%). The mean haemoglobin value for the entire sample was 9.8 g/dL (SD=2.1), significantly below the WHO threshold for all age-sex categories represented.

On dietary assessment, 72.4% of anaemic girls reported consuming iron-rich foods (leafy vegetables, legumes) less than three times per week. Among the 448 participants, 241 (53.8%) reported receiving IFA tablets from school or Anganwadi sources in the preceding three months; of these, only 118 (49.0%) reported consuming the tablets regularly as advised, with common reasons for non-adherence including forgetfulness (42%), side effects (nausea and constipation) (31%), and loss of tablets (18%). Menstrual irregularity was reported by 38.4% of severely anaemic girls. Prevalence of anaemia among girls from BPL households was 76.3% compared to 54.1% among non-BPL households ($p<0.001$).

Multivariate logistic regression identified four independent significant predictors of anaemia: low dietary iron intake (OR=3.21; 95% CI: 2.14–4.82; $p<0.001$), irregular IFA tablet consumption (OR=2.87; 95% CI: 1.93–4.28; $p<0.001$), BPL household status (OR=2.14; 95% CI: 1.42–3.22; $p<0.001$), and absence of access to POSHAN Abhiyaan Anganwadi services (OR=1.78; 95% CI: 1.18–2.68; $p=0.006$). Age, district of residence, and school enrolment status were not independently significant after controlling for other covariates in the multivariate model.

4. Discussion

The anaemia prevalence of 67.6% documented in this study is substantially higher than the national average reported by NFHS-5 (59.1%) and aligns with the pattern of elevated anaemia burden observed in remote tribal populations of central India. The high proportion of severe anaemia (29.1%) is particularly concerning from a clinical standpoint, as it indicates not merely a dietary deficiency but a compounded nutritional and possibly parasitic disease burden that requires multi-modal therapeutic intervention rather than supplementation alone.

The finding that approximately half of all IFA recipients did not adhere to the prescribed supplementation schedule is consistent with evidence from other tribal contexts in Jharkhand and Odisha and reflects a systemic failure in demand-side health promotion as much as supply-side distribution. Side effects of IFA tablets — particularly gastrointestinal discomfort — are a frequently reported barrier and can be mitigated by administering tablets after meals, a simple behavioural modification that requires better frontline counselling. The low dietary iron intake is structurally linked to food insecurity and limited dietary diversity in tribal communities, issues that require agricultural and livelihood interventions alongside health programming.

The positive protective association of POSHAN Abhiyaan access with reduced anaemia severity suggests that the programme's multi-dimensional approach — combining nutrition supplementation, dietary counselling, and community mobilisation — has measurable benefits in tribal settings. However, coverage gaps remain significant in the remoter blocks of Bijapur and Narayanpur where road connectivity limits Anganwadi outreach. Innovative delivery mechanisms including mobile health vans and community health volunteers should be explored to extend POSHAN Abhiyaan services to the hardest-to-reach populations.

5. Conclusion

This cross-sectional study documents a high and clinically alarming prevalence of anaemia among adolescent girls in three tribal districts of Chhattisgarh, with severe anaemia affecting nearly three in ten anaemic girls. Low dietary iron intake, IFA non-adherence, poverty, and limited access to POSHAN Abhiyaan services emerged as significant, modifiable determinants.

The study recommends: (i) strengthening IFA tablet supply chain and daily school-based supervised supplementation rather than take-home distribution; (ii) deploying trained female community volunteers to deliver targeted dietary counselling in Halbi and Gondi languages; (iii) integrating deworming programmes with IFA distribution to address compound anaemia aetiology; (iv) expanding POSHAN Abhiyaan coverage to remote hamlets through mobile Anganwadi services; and (v) establishing a district-level nutritional surveillance system for

real-time monitoring of adolescent anaemia. A convergent, multi-sectoral approach addressing both dietary and structural determinants is essential for meaningful reduction of anaemia burden in Chhattisgarh's tribal belt.

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