

# Social Determinants of Anaemia among Pregnant Women in Rural Primary Health Settings: Evidence from a Gender-Sensitive Analysis

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## ABSTRACT

**Background:** Anaemia during pregnancy is a major public health concern in India, especially in rural areas, where socio-demographic, nutritional, and gender-related factors increase vulnerability. The purpose was to assess the prevalence of anaemia among pregnant women in rural Coimbatore, examine its association with social and gender-related factors, and identify key predictors.

**Methods:** A cross-sectional analytical study was conducted among 300 pregnant women attending antenatal clinics at rural PHCs in Coimbatore. Data on socio-demographics, diet, healthcare use, and gender factors (decision-making power, workload, food allocation) were collected using structured questionnaires. Haemoglobin was measured using Hemocue or Sahli's method and classified per WHO. Associations were tested with Chi-square and multivariate logistic regression.

**Results:** Anaemia prevalence was 68.3%, with moderate anaemia most common (35%). Higher prevalence occurred in adolescents (<20 years, 87.5%) and older women (≥40 years, 80%). Low education, housewife occupation, and low income were significant. Nutritional and healthcare risks included vegetarian diet, poor iron intake, irregular IFA, and <4 ANC visits. Independent gender predictors were limited decision-making (AOR=2.90), heavy workload (AOR=2.15), unequal food allocation (AOR=2.80), early marriage (AOR=1.85), and short birth spacing (AOR=2.40).

**Conclusion:** Anaemia is highly prevalent, driven by socio-demographic, nutritional, and gender inequities. Integrated interventions addressing diet, ANC, and women's empowerment are vital.

**Keywords:** Anaemia, Pregnancy, Social determinants, Gender inequities, Rural Health, India

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## INTRODUCTION

Anaemia during pregnancy remains a major public health concern in low- and middle-income countries like India, contributing to maternal morbidity, adverse pregnancy outcomes, and intergenerational health effects. According to the World Health Organization's *Global Anaemia Estimates* (2025 edition), about 35.5% of pregnant women globally were anaemic in 2023.<sup>1</sup> Despite national initiatives such as *Anaemia Mukt Bharat*, prevalence in India remains high.

Anaemia in pregnancy is not solely biomedical but is strongly influenced by social determinants, including socioeconomic status, education, nutrition, healthcare access, and health-seeking behaviour. Rural women are particularly vulnerable due to poverty, limited health resources, and patriarchal norms that restrict autonomy in nutrition and healthcare decisions.<sup>2,3</sup> Using national survey data from India, maternal education, socioeconomic status, and antenatal care utilisation have been shown to significantly influence iron-folic acid supplementation among pregnant women.<sup>4</sup>

A gendered perspective is essential, as evidence from India consistently shows that women's nutritional status is shaped by social and structural determinants such as dietary discrimination, heavy domestic and agricultural workloads, early marriage, repeated pregnancies, and inadequate birth spacing. Nationally representative data from NFHS-5 highlight persistent socio-economic and gender differentials in anaemia prevalence among pregnant women, underscoring the descriptive magnitude of the problem across population subgroups.<sup>5</sup>

Empirical and policy-oriented studies further demonstrate how women's limited autonomy in healthcare decision-making, gender norms, and broader nutrition policy environments influence maternal nutrition and anaemia risk.<sup>6-9</sup> Rural primary health settings therefore provide a critical context to examine how these gendered social determinants interact with pregnancy-related vulnerabilities. This study explores the social determinants of anaemia among pregnant women in rural primary health settings through a gendered lens.

The study aims to determine the prevalence of anaemia among pregnant women and to examine its association with socio-demographic characteristics as well as social and gender-related determinants. It also seeks to identify independent predictors of anaemia in pregnancy using multivariate logistic regression analysis.

## METHODOLOGY

A cross-sectional analytical study was conducted to assess anaemia prevalence and its association with social and gender-related determinants among preg-

nant women attending rural primary health centres in Coimbatore, Tamil Nadu, India. Antenatal women in any trimester who provided informed consent were included, while those with haemoglobinopathies or chronic conditions such as renal disease or HIV/AIDS were excluded.

A sample of 300 participants was estimated using a single proportion formula ( $p = 0.50$ ,  $Z = 1.96$ , 5.7% margin of error), with adjustment for non-response, and participants were selected through systematic random sampling from ANC registries. Data were collected using a structured, interviewer-administered questionnaire capturing socio-demographic characteristics, social determinants, gender-related factors, and health-seeking behaviours.

Gender-related variables (household decision-making power, workload during pregnancy, and food allocation) were assessed using structured, self-reported, study-specific questions adapted from prior literature. Decision-making power was categorized as low or high; workload as heavy or moderate/light; and food allocation as equal or less priority.

Haemoglobin was measured using the HemoCue method as per *Anaemia Mukt Bharat* guidelines, with Sahli's method used where required, and anaemia classified according to World Health Organization haemoglobin cut-offs.<sup>10,11</sup>

Data were analysed using SPSS version 26. Descriptive statistics (frequency and percentage) were used to summarize participant characteristics and anaemia prevalence. Associations between anaemia and categorical variables were assessed using the Chi-square test. Variables significant at  $p < 0.05$  in bivariate analysis, along with a priori relevant covariates (maternal age, parity, and trimester of pregnancy), were entered into the multivariable logistic regression model. The model included maternal education, household income, IFA supplementation compliance, number of ANC visits, age at marriage, birth spacing, household decision-making power, work load during pregnancy, food allocation practices, maternal age, parity, and trimester. Adjusted odds ratios (AORs) with 95% confidence intervals were reported, with statistical significance set at  $p < 0.05$ .

Permission for the study was obtained from Office of the **Directorate of Health Services**, Coimbatore. Ethical principles, including **informed consent, confidentiality, and voluntary participation**, were strictly maintained throughout the study. Participants were fully informed about the study objectives, procedures, and their right to withdraw at any time.

## RESULTS

Most participants were aged 20-29 years (69.3%). Over half had undergraduate or postgraduate education, though a small proportion had low literacy. The majority were housewives (73%) and lived in joint

families (63.3%). More than half reported moderate income (₹20,001-40,000), with only 2% in the lowest income group.

Anaemia was highly prevalent, affecting 68.3% of pregnant women. Moderate anaemia (35.0%) was the most common, followed by mild (27.3%) and severe cases (6.0%). Only about one-third (31.7%) of women had normal haemoglobin levels, indicating a major public health concern.

Anaemia showed significant associations with age, education, occupation, and income. It was more

common among adolescents (<20 years, 87.5%) and women ≥40 years (80%). Prevalence declined with higher education (90.9% in illiterate/primary vs. 63.1% in undergraduates and above,  $p=0.01$ ). Housewives (73.1%) and women in agriculture/business (77.8%) had higher anaemia rates compared to those in private/government jobs (44.4%,  $p=0.02$ ). Anaemia was strongly linked with low income (100% in <₹20,000 vs. 59.5% in >₹40,000,  $p=0.003$ ). Family type showed no significant association ( $p=0.06$ ) (table 1).

**Table 1: Association of Social and Gender Factors with Anaemia**

Determinant	Anaemic (n %)	Non anaemic (n%)	$\chi^2$ / p-value
<b>Dietary Pattern</b>			
Vegetarian (n=48)	40 (83.3)	8(16.7)	P = 0.02*
Mixed diet (n= 252)	165 (65.5)	87 (34.5)	
<b>Iron - rich food intake (≥3times/week)</b>			
Yes (n=112)	65 (58.0)	47 (42.0)	P = 0.004*
No (n=188)	140 (74.5)	48 (25.5)	
<b>IFA supplementation compliance</b>			
Regular (n=160)	95 (59.4)	65 (40.6)	p<0.001*
Irregular /Not taken (n=140)	110 (78.6)	30 (21.4)	
<b>ANC visits</b>			
<4 visits (n=174)	134 (77.0)	40 (23.0)	p<0.001*
≥4 visits (n=126)	71 (56.3)	55 (43.7)	
<b>Decision-making power in household</b>			
Low (n= 180)	140 (77.8)	40 (22.2)	p<0.001*
High (n=120)	65 (54.2)	55 (45.8)	
<b>Workload</b>			
Heavy (n=90)	75 (83.3)	15 (16.7)	p<0.001*
Moderate/Light (n=210)	130 (61.9)	80 (38.1)	
<b>Food allocation (during pregnancy)</b>			
Equal priority (n=125)	70 (56.0)	55 (44.0)	p<0.001*
Less priority (n=175)	135 (77.1)	40 (22.9)	
<b>Age at marriage</b>			
<18 years (n=72)	58 (80.6)	14 (19.4)	P = 0.01*
≥ 18 years (n=228)	147 (64.5)	81 (35.5)	
<b>Birth spacing</b>			
<2 years (n=95)	77 (81.1)	18 (18.9)	P = 0.002*
≥ 2 years (n=205)	128 (62.4)	77 (37.6)	

**Table 2 Multivariate Logistic Regression Analysis of Anaemia Predictors**

Determinants	Adjusted Odds Ratio (AOR) (95% CI)	p-value
<b>Low maternal education (≤ high school vs.≥ higher secondary)</b>	2.10 (1.20-3.67)	0.008*
<b>Low income (&lt;Rs.20,000 vs.&gt; Rs.40,000)</b>	3.25 (1.05-10.04)	0.041*
<b>Irregular/no IFA intake</b>	2.75 (1.60-4.73)	<0.001*
<b>&lt;4 ANC visits</b>	2.20 (1.25-3.85)	0.006*
<b>Limited household decision-making power</b>	2.90 (1.65-5.09)	<0.001*
<b>Heavy workload</b>	2.15 (1.12-4.11)	0.021*
<b>Unequal food allocation in family</b>	2.80 (1.55-5.04)	<0.001*
<b>Early marriage (&lt;18 years)</b>	1.85 (1.01-3.40)	0.045*
<b>Short birth spacing (&lt;2 years)</b>	2.40 (1.28-4.48)	0.006*
<b>Trimester (ref First trimester)</b>		
Second	1.10 (0.67-1.79)	0.70
Third	0.95 (0.47-1.93)	0.89
<b>Multi Gravida</b>		
<b>Age group (Ref 20-29 yrs)</b>		
<19 yrs	1.50 (0.52-4.31)	0.45
30-39 yrs	1.35 (0.83-2.21)	0.22
40+ yrs	0.30 (0.04-2.38)	0.25

Anaemia was significantly associated with nutritional, healthcare, and gender-related determinants. Higher prevalence was observed among women following a vegetarian diet (83.3%), consuming iron-rich foods infrequently (74.5%), having poor IFA compliance (78.6%), and attending fewer than four ANC visits (77.0%). Gender inequities contributed substantially, with higher anaemia among women with limited decision-making power (77.8%), heavy workload (83.3%), and lower priority in household food allocation (77.1%). Early marriage (<18 years; 80.6%) and short birth spacing (<2 years; 81.1%) were further increased vulnerability, underscoring the intersection of nutrition, healthcare access, and gender disadvantage in anaemia among pregnant women.

Table 2 presents the multivariate logistic regression analysis identifying key predictors of anaemia among pregnant women. Significant factors associated with increased odds of anaemia included low maternal education (AOR=2.10), low income (AOR=3.25), irregular or no intake of iron-folic acid supplements (AOR=2.75), fewer than four antenatal care visits (AOR=2.20), limited household decision-making power (AOR=2.90), heavy workload (AOR=2.15), unequal food allocation within the family (AOR=2.80), early marriage before 18 years (AOR=1.85), and short birth spacing under two years (AOR=2.40), all with statistically significant p-values ( $p < 0.05$ ). In contrast, trimester of pregnancy, gravida status, and age group showed no significant associations with anaemia after adjustment, indicating that these factors did not independently influence anaemia risk in this population.

## DISCUSSION

The findings indicate that anaemia among pregnant women in rural Coimbatore is closely linked to socio-economic disadvantage and gender-related constraints rather than biological factors alone. The independent associations of low maternal education, low household income, irregular iron-folic acid supplementation, and inadequate antenatal care reflect barriers to effective utilisation of available maternal health services. Similar associations have been reported in previous studies by Hailu T et al<sup>12</sup> (2019) and Ali SA et al<sup>13</sup> (2020), underscoring the persistent influence of social determinants on maternal nutrition.

Gender-related factors remain particularly relevant in this rural setting, where women's limited autonomy, unequal intra-household food allocation, and heavy domestic workload restrict their ability to adhere to nutritional and care recommendations. Consistent with Batura N et al<sup>6</sup> (2022), these findings highlight how gender norms shape access to nutrition and healthcare during pregnancy. Addressing anaemia in such contexts therefore requires approaches that integrate nutritional and antenatal in-

terventions with strategies to improve women's autonomy and intra-household equity.

## STRENGTHS AND LIMITATIONS

This study's strengths include the use of primary health centre-based data, which enhances the relevance of findings to routine rural antenatal care settings, and the inclusion of gender-related variables, allowing examination of social and autonomy-related determinants of anaemia. However, the cross-sectional design limits causal inference between identified factors and anaemia. Self-reported information on diet, supplementation adherence, and household dynamics may be subject to recall and social desirability bias. Additionally, findings may not be generalisable beyond similar rural primary care contexts.

## CONCLUSION

Anaemia among pregnant women in rural Coimbatore was associated with low maternal education, low household income, irregular iron-folic acid intake, and fewer antenatal care visits. Limited decision-making autonomy and high domestic workload were also independently associated with anaemia. These findings underscore the combined role of socio-economic and gender-related factors, highlighting the need to strengthen antenatal care and address gender-related constraints.

**Patient Consent:** All participants provided written informed consent after being informed about the purpose of the study, procedures involved, potential risks and benefits. Confidentiality and anonymity were assured, and participation was entirely voluntary.

**Individual Authors' Contributions:** KV designed the study, collected and analyzed the data and drafted the manuscript. HC supervised the research and revised the manuscript critically. Both authors approved the final version.

**Availability of Data:** The data supporting the findings of this study are available from the corresponding author upon reasonable request.

**Declaration of Non-use of Generative AI Tools:** This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

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