ORIGINAL ARTICLE

An Epidemiological Study to Assess the Prevalence of Anemia and Its Determinants in Women of Reproductive Age Group (15–49 Years) in an Urban Slum of a Metropolitan City

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Visual Abstract

Abstract

Background: Anemia is a serious public health concern among women of reproductive age (WRA) 15–49 years in India. The prevalence of anemia in WRA in Mumbai and the Mumbai suburban district was 45%–50%, respectively, as per National Family Health Survey-5 (NFHS-5) data. This study was done to assess the prevalence of anemia and its determinants in WRA in the urban slums of Mumbai.

Materials and methods: A total of 1,500 WRA were enrolled in this community-based cross-sectional study by the convenience sampling method. A structured validated questionnaire was used to record sociodemographic variables and determinants. Hemoglobin (Hb) estimation was done with a digital hemoglobinometer. SPSS v.18, Chi-square test, and binary logistic regression were used for analysis. The study was approved by the Institutional Ethics Committee of HBT Medical College and Dr. RN Cooper Hospital (Approval No. HBTMC/IEC/025-2025/RP/0/330/07072025/26) on 07/07/2025, and written informed consent was obtained from all participants.

Results: Prevalence of anemia in WRA was 57.9%. Significant associations were found between anemia and education level ($p = 0.004$), socioeconomic class ($p < 0.001$), gravida status ($p < 0.001$), spacing between pregnancies ($p < 0.001$), iron tablet consumption in the past 1 year ($p = 0.014$), duration of menses ($p = 0.019$), and pad changes per day ($p = 0.013$).

Conclusion: Determinants such as education level, socioeconomic class, number of pregnancies, spacing between pregnancies, iron tablet consumption, duration of menses, and pad changes per day affect the Hb level of WRA.

Keywords: Anemia, Prevalence, Urban slum, Women of reproductive age.

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Introduction

Anemia is a significant public health problem worldwide. WHO defines anemia as a condition in which the number of red blood cells or the Hb concentration within them is lower than normal.[1] Anemia affects 30% of WRA, 37% of pregnant women, and 40% of all children aged 6 to 59 months worldwide.[1] As per NFHS-5 data (2019–2021), the prevalence of anemia in WRA in India was 57%, and in Mumbai and the Mumbai suburban district was 45% and 50%, respectively.[2,3] WRA carry the highest burden of anemia across all age groups, with iron deficiency anemia as the most prevalent cause.[4–6]

As per various studies, determinants such as low education levels, lower socioeconomic class, multiple pregnancies, and inadequate spacing between pregnancies were some of the major contributors to anemia in WRA.[7–11]

The present study was conducted to estimate the prevalence of anemia and identify its sociodemographic and reproductive determinants among the WRA residing in the urban slums of Mumbai.

Aim

To assess the prevalence of anemia and its sociodemographic and reproductive determinants among women of reproductive age in an urban slum of Mumbai.

Objectives

Primary Objectives

- To estimate the prevalence of anemia in the study participants.
- To identify sociodemographic and reproductive factors associated with anemia.

Secondary objective

- To assess the sociodemographic profile of study participants.

Material and Methods

Study Design and Setting

This was a community-based cross-sectional study conducted over a period of 3 months in the urban slums of Mumbai.

Study Population

The study population comprised women aged 15–49 years residing in the selected urban slum area of Mumbai who attended community-based anemia screening camps and provided informed consent. A total of 1,500 eligible women were enrolled using a convenience sampling method.

As the study was conducted through screening camps, complete enumeration of the resident women of reproductive age was not undertaken. However, based on Census of India 2011 and NFHS-5 data, it is estimated that approximately 1–1.3 million women aged 15–49 years reside in urban slums of Mumbai.[2,3,12] This estimate is provided for contextual purposes only.

Inclusion Criteria

Women aged 15–49 years residing in the study area who attended the screening camps and were willing to participate were included in the study.

Exclusion Criteria

Women who did not provide consent or were unavailable during the screening camps were excluded from the study.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee of HBT Medical College and Dr RN Cooper Hospital (Approval No. HBTMC/IEC/025-

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2025/RP/0/330/07072025/26) on 07/07/2025. Written informed consent was obtained from all participants prior to enrollment in the study.

Sample Size Calculation

Based on data from NFHS-5, the prevalence of anemia among women aged 15–49 years in India was estimated to be 57%.[2] Using this expected prevalence, a 95% confidence level, and an absolute precision (margin of error) of 2.51%, the required sample size was calculated using the standard formula for estimation of a single proportion:

$$n = \frac{Z^2 \times p \times (1-p)}{e^2}$$

Where:

n = required sample size.

Z = Z-score corresponding to 95% confidence level (1.96).

p = expected prevalence of anemia (0.57).

e = margin of error (0.0251).

Substituting the values:

$$n = \frac{(1.96)^2 \times 0.57 \times (1-0.57)}{(0.0251)^2}$$

$$n = \frac{0.9417}{0.000630}$$

$$n \approx 1495$$

The sample size was therefore rounded off to 1,500 participants to ensure better statistical precision.

Data Collection

Participants were screened through community-based anemia screening camps conducted at the local Anganwadi Centers (AWCs) with the help of Accredited Social Health Activists (ASHAs) and Anganwadi Workers (AWWs).

A pretested structured questionnaire was used to record sociodemographic data of all the participants. Data on potential determinants such as type of diet, iron folic acid (IFA) tablet consumption, menstrual history, and obstetric history were also recorded.

Hb estimation was done by using a digital hemoglobinometer (TRUEHb, by Wrig Nano System, with ASIN-B0C28CHXDN), and the WHO classification of anemia was used for identifying the anemia cases. All participants diagnosed with anemia were provided IFA tablets as per the standard guidelines.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS V.18. Descriptive statistics were performed for qualitative variables. Quantitative data were represented using mean ± SD. The association between the

Table 1: Distribution of women according to sociodemographic characteristics, dietary pattern, menstrual and obstetric information

Variable	*Category*	*Total, n (%)*
Age group (years)	15–24	660 (44.0)
	25–34	605 (40.3)
	35–44	203 (13.5)
	≥45	32 (2.1)
Education level	Illiterate	166 (11.1)
	Primary	319 (21.3)
	Secondary	525 (35.0)
	Higher secondary	313 (20.9)
	Graduate	155 (10.3)
	Postgraduate	22 (1.5)
Marital status	Married	1006 (67.1)
	Unmarried	476 (31.7)
	Separated	14 (0.9)
	Widowed	4 (0.3)
Religion	Hindu	192 (12.8)
	Muslim	1305 (87.0)
	Christian	3 (0.2)
BG Prasad SES (2025)	Class II	194 (12.9)
	Class III	490 (32.7)
	Class IV	816 (54.4)
Diet	Vegetarian	28 (1.9)
	Mixed diet	1472 (98.1)
Duration of menses (days)	1	11 (0.7)
	2	60 (4.0)
	3	346 (23.1)
	4	359 (23.9)
	5	421 (28.1)
	6	164 (10.9)
	7	131 (8.7)
	8	8 (0.5)
Sanitary pad changes per day	1	150 (10.0)
	2	623 (41.5)
	3	449 (29.9)
	4	188 (12.5)
	5	86 (5.7)
	6	4 (0.3)
Iron tablet consumption in the past 1 year	Yes	313 (20.9)
	No	1187 (79.1)
Pregnancy status	Pregnant	70 (4.7)
	Nonpregnant	1430 (95.3)
Number of pregnancies (n = 932)	1	170 (18.2)
	2	279 (29.9)
	3	237 (25.4)
	≥4	246 (26.4)
Spacing between pregnancies (years) (n = 762)	<1	407 (53.4)
	1–2	66 (8.7)
	2–3	115 (15.1)
	>3	174 (22.8)

SES, socioeconomic status

qualitative variables was assessed by the Chi-square test. Binary logistic regression was performed to find out the association between various determinants and a 95% confidence interval. A *p*-value of < 0.05 was considered significant for all statistical purposes.

Results

The results are summarized in Tables 1 to 5.

Discussion

This study revealed an anemia prevalence of 57.9%, which is higher than the NFHS-5 (2019–21) rates for Mumbai (45%) and Mumbai Suburban District (50%). Among the anemic participants, moderate anemia was most prevalent (31.8%), followed by mild anemia (17.5%) and severe anemia (8.5%). These findings contrast with several studies conducted in similar urban slum settings. Lilare et al. reported a lower prevalence of 49.5% among WRA in Mumbai's urban slums. Also, mild anemia was predominant (37.1%) in their study.[7] Panigrahi et al. found a higher prevalence of 60.8% in Bhubaneswar's urban slums, with the majority of cases of mild anemia (39.6%).[8] Pande et al. also reported a higher prevalence of 61% among WRA in Indore's urban slums, with 33.25% having mild anemia.[13] Sharif et al. also found that the prevalence of moderate anemia was higher than that of mild and severe anemia in the NFHS-5 data.[14] These comparative findings suggest that while anemia remains a widespread public health issue among WRA in urban slums of different cities, the distribution of severity varies.[15–19]

Anemia was more common in the age group (35–44 years), with 63.5% of its participants having anemia. However, there was no statistically significant (p = 0.133) association between anemia and the age groups. Panigrahi et al. also reported a higher prevalence of anemia (75%) in the 31–40 years age group.[8] Viveki et al. also found a very high prevalence of 97.7% in participants above 26 years of age in their study.[20] In contrast, Lilare et al. found that anemia was more common in the 15–25 years age group, with 76 (54.3%) participants.[7] Sharif et al. also found a higher prevalence of anemia in the 15–24 years age group compared to the other age groups.[14]

The prevalence of anemia among WRA was found to be significantly correlated (p = 0.004) with educational status in the current study. Women with only primary (58.7%) or secondary (63%) education and those who were illiterate (59.8%) were more likely to suffer from anemia than those with graduate (46.4%) or postgraduate (42%) education. According to Panigrahi et al., the prevalence of anemia was 41.2% among women with higher secondary education and above, compared to 74.6% among illiterate women and 62.2% among those with only a primary education.[8] Similarly, a prevalence of 69.75% was found by Lilare et al. in women with only a primary education, which is significantly higher than the 21.1% found in women with graduate-level education.[7] According to Sharif et al., women with only primary or no formal education had a significantly higher prevalence of anemia than women with secondary or higher education.[14]

In this study, those in class IV of the modified BG Prasad Socioeconomic Scale (2025) had a high prevalence of anemia (51.6%). Anemia prevalence and socioeconomic status (SES) were found to be statistically significantly correlated (p < 0.001), suggesting that a lower SES is a major factor in anemia. Lilare et al. also found a strong correlation between socioeconomic status and anemia.[7] Similar findings were

Table 2: Distribution of women as per WHO classification for anemia

Anemia category	*Frequency*	*Percentage (%)*	*Anemic/nonanemic (%)*
Normal	632	42.1	42.1
Moderate	477	31.8	57.9
Mild	263	17.5	
Severe	128	8.5	
Total	1500	100.0	100.0

WHO, World Health Organization

Table 3: Association of anemia with sociodemographic determinants in WRA

Variable	*Category*	*Nonanemic, n (%)*	*Anemic, n (%)*	*Total, n (%)*	*Chi-square test*
Age group (years)	15–24	273 (41.4)	387 (58.6)	660 (100.0)	$\chi^2 = 5.59$, df = 3, $p = 0.133$, $N = 1500$
	25–34	268 (44.3)	337 (55.7)	605 (100.0)	
	35–44	74 (36.5)	129 (63.5)	203 (100.0)	
	≥45	17 (53.1)	15 (46.9)	32 (100.0)	
Education level	Illiterate	66 (39.8)	100 (60.2)	166 (100.0)	$\chi^2 = 18.1$, df = 5, $p = 0.003$, $N = 1500$
	Primary	131 (41.1)	188 (58.9)	319 (100.0)	
	Secondary	194 (37.0)	331 (63.0)	525 (100.0)	
	Higher secondary	147 (47.0)	166 (53.0)	313 (100.0)	
	Graduate	82 (52.9)	73 (47.1)	155 (100.0)	
	Postgraduate	12 (54.5)	10 (45.5)	22 (100.0)	
Marital status	Married	434 (43.1)	572 (56.9)	1006 (100.0)	$\chi^2 = 4.03$, df = 3, $p = 0.258$, $N = 1500$
	Unmarried	191 (40.1)	285 (59.9)	476 (100.0)	
	Separated	4 (28.6)	10 (71.4)	14 (100.0)	
	Widowed	3 (75.0)	1 (25.0)	4 (100.0)	
Religion	Hindu	66 (34.4)	126 (65.6)	192 (100.0)	$\chi^2 = 6.11$, df = 2, $p = 0.047$, $N = 1500$
	Muslim	564 (43.2)	741 (56.8)	1305 (100.0)	
	Christian	2 (66.7)	1 (33.3)	3 (100.0)	
BG Prasad SES (2025)	Class II	114 (58.8)	80 (41.2)	194 (100.0)	$\chi^2 = 26.8$, df = 2, $p < 0.001$, $N = 1500$
	Class III	205 (41.8)	285 (58.2)	490 (100.0)	
	Class IV	313 (38.4)	503 (61.6)	816 (100.0)	

WRA, women of reproductive age; SES, socioeconomic status; df, degrees of freedom

Table 4: Association of anemia with other determinants in WRA

Variable	*Category*	*Nonanemic, n (%)*	*Anemic, n (%)*	*Total, n (%)*	*Chi-square test*
Diet	Vegetarian	10 (35.7)	18 (64.3)	28 (100.0)	$\chi^2 = 0.482$, df = 1, $p = 0.487$, $N = 1500$
	Mixed diet	622 (42.3)	850 (57.7)	1472 (100.0)	
Duration of menses (days)	1	8 (72.7)	3 (27.3)	11 (100.0)	$\chi^2 = 16.8$, df = 7, $p = 0.019$, $N = 1500$
	2	22 (36.7)	38 (63.3)	60 (100.0)	
	3	138 (39.9)	208 (60.1)	346 (100.0)	
	4	159 (44.3)	200 (55.7)	359 (100.0)	
	5	192 (45.6)	229 (54.4)	421 (100.0)	
	6	70 (42.7)	94 (57.3)	164 (100.0)	
	7	42 (32.1)	89 (67.9)	131 (100.0)	
	8	1 (12.5)	7 (87.5)	8 (100.0)	
Sanitary pad changes per day	1	63 (42.0)	87 (58.0)	150 (100.0)	$\chi^2 = 14.4$, df = 5, $p = 0.013$, $N = 1500$
	2	292 (46.9)	331 (53.1)	623 (100.0)	
	3	174 (38.8)	275 (61.2)	449 (100.0)	
	4	75 (39.9)	113 (60.1)	188 (100.0)	
	5	28 (32.6)	58 (67.4)	86 (100.0)	
	6	0 (0.0)	4 (100.0)	4 (100.0)	
Iron tablet consumption in the past 1 year	Yes	151 (48.2)	162 (51.8)	313 (100.0)	$\chi^2 = 6.06$, df = 1, $p = 0.014$, $N = 1500$
	No	481 (40.5)	706 (59.5)	1187 (100.0)	
Pregnancy status	Pregnant	32 (45.7)	38 (54.3)	70 (100.0)	$\chi^2 = 0.386$, df = 1, $p = 0.534$, $N = 1500$
	Nonpregnant	600 (42.0)	830 (58.0)	1430 (100.0)	
Number of pregnancies	1	94 (55.3)	76 (44.7)	170 (100.0)	$\chi^2 = 25.8$, df = 3, $p < 0.001$, $n = 932$
	2	124 (44.4)	155 (55.6)	279 (100.0)	
	3	95 (40.1)	142 (59.9)	237 (100.0)	
	≥4	76 (30.9)	170 (69.1)	246 (100.0)	
Spacing between pregnancies (years)	<1	142 (34.9)	265 (65.1)	407 (100.0)	$\chi^2 = 18.9$, df = 3, $p < 0.001$, $n = 762$
	1–2	32 (48.5)	34 (51.5)	66 (100.0)	
	2–3	49 (42.6)	66 (57.4)	115 (100.0)	
	>3	93 (53.4)	81 (46.6)	174 (100.0)	

WRA, women of reproductive age; df, degrees of freedom

Table 5: Binomial logistic regression analysis of determinants of anemia

Predictor	*B*	*SE*	*Wald*	*df*	*p-value*	*OR*	*95% CI lower*	*95% CI upper*
Primary vs graduate	0.45	0.21	4.63	1	0.031	1.57	1.04	2.38
Secondary vs graduate	0.63	0.20	9.76	1	0.002	1.87	1.25	2.80
Duration of menses: 1 vs 8 days	−3.59	1.30	7.64	1	0.006	0.03	0.00	0.29
BG Prasad SES: class II vs III	−0.63	0.18	12.14	1	<0.001	0.53	0.37	0.75
Number of pregnancies: 1 vs 3	−0.99	0.23	19.33	1	<0.001	0.37	0.24	0.56
Spacing between pregnancies: <1 year vs >3 years	0.85	0.19	19.85	1	<0.001	2.35	1.61	3.43

B, regression coefficient; SE, standard error; df, degrees of freedom; OR, odds ratio; CI, confidence interval; SES, socioeconomic status

made by Panigrahi et al., who discovered that the prevalence of anemia peaked in Class IV (71.1%) and gradually declined as SES improved, reaching its lowest in class II (51.9%) ($p < 0.05$).[8] Sharif et al. also found that anemia was more prevalent in the poorest and poorer categories compared to the richer and richest groups.[14]

In the current study, anemia was more common in women who followed a vegetarian diet (64.3%) than in those who followed a mixed diet (57.7%), however, this difference was not statistically significant. Lilare et al. found no statistically significant difference in the prevalence of anemia between vegetarian women (64.4%) and women consuming a mixed diet (47.4%).[7] Similarly, Viveki et al. found that vegetarians had a significantly higher prevalence of anemia (86.8%), but the association was not statistically significant.[20] These findings were corroborated by Panigrahi et al., who found that people who consume insufficient amounts of nonvegetarian foods, pulses, green leafy vegetables, and milk and milk products are more likely to suffer from anemia.[8] These results imply that vegetarian diets might raise the risk of anemia.

The prevalence of anemia was marginally higher among nonpregnant women (58%) in the current study than among pregnant women (54.3%), although this difference was not statistically significant. Mishra et al. found that there was no discernible difference in the prevalence of anemia between non-pregnant (96.8%) and pregnant women (96.4%).[21] On the contrary, Lilare et al. discovered that pregnant women had a greater prevalence of anemia (54.2%) than nonpregnant women (48.7%).[7]

The prevalence of anemia and gravida status was found to be statistically

significantly correlated in the current study ($p < 0.001$). Primigravida women had the lowest prevalence (44.7%), while multigravida women (≥4 pregnancies) had the highest prevalence (69.1%). Lilare et al. discovered that women with parity three or more had a higher prevalence of anemia (65.9%) than women with parity one (52.2%) although the difference was not statistically significant.[7] Panigrahi et al. also found that women who had two or more pregnancies had a higher likelihood of being anemic than those who had one or none, although the difference was not statistically significant.[8] According to Viveki et al., the prevalence of anemia increased gradually as parity increased, but this trend was also not statistically significant.[20]

The current study discovered a statistically significant correlation ($p < 0.001$) between the prevalence of anemia and the spacing between pregnancies. Anemia was significantly more common in women with less than a year gap between pregnancies (65.1%) than in those with more than three years (46.6%). Lilare et al. reported similar findings, showing that the prevalence of anemia was significantly higher (77.6%) among women who had ≤1 year gap between pregnancies than among those who had >3 years (34.1%) gap.[7] According to a study by Viveki et al., the prevalence of anemia was significantly higher (90.9%) in cases where the interval between the index and prior pregnancies was less than 2 years.[20]

In the current study, the prevalence of anemia was lower in women who had taken iron and folic acid (IFA) tablets in the previous year (51.8%) than in those who had not (59.5%). This association was found to be statistically significant ($p = 0.014$). The study by Viveki et al. provides supporting evidence, revealing a significantly higher prevalence of anemia (88.15%) among women who had recently received IFA tablets for less than two months.[20]

The length of menstruation and the prevalence of anemia were found to be statistically significantly correlated in this study ($p = 0.019$). Anemia was more common in women with longer menstrual periods (≥7 days) than in those with shorter ones (≤5 days), with a prevalence of 67.9%. Panigrahi et al. found a significant correlation ($p = 0.01$) between anemia and a history of excessive menstrual bleeding.[8] Additionally, Pande et al. observed that 13.11% of the 244 nonpregnant anemic women had heavy periods, suggesting that menstrual blood loss may be a contributing factor to anemia in this population.[13]

The average number of sanitary pad changes per day and the prevalence of anemia were found to be statistically significantly correlated in this study ($p = 0.013$). Anemia was more common in women who reported using ≥3 sanitary pads per day (61.2%) than in those who reported using ≤2 pads per day (53.1%).

Limitations

The study was done using convenience sampling through anemia screening camps. This might limit the generalizability of the findings of the study. Also, complete enumeration of the study population was not done. Moreover, as it is a cross-sectional study, no cause-effect relationship can be established.

Conclusion

This study shows a higher prevalence of anemia (57.9%), among WRA living in Mumbai's urban slums compared to the NFHS-5 data. With notable correlations found between anemia and factors like educational attainment, socioeconomic status, gravida status, spacing between pregnancies, IFA tablet use, and menstrual characteristics, the results highlight anemia as a multifactorial public health concern.

The study confirms that anemia is significantly influenced by socioeconomic status and lower levels of education. The risk is further increased by poor adherence to IFA supplementation and insufficient spacing between pregnancies.

Community-based screening, health education, nutritional support, and reproductive health services in underprivileged areas must be given priority in intensive interventions under programs like Anemia Mukt Bharat in order to lower anemia and enhance maternal health among vulnerable urban populations.

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Conflict of Interest

None.

Source of Support

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