

Prevalence of Anemia among Antenatal Women: A Cross Sectional Study from North Western India

Abstract

Background: Anemia during pregnancy is a global public health concern that can negatively impact maternal and fetal outcomes. It is a major health concern among antenatal mothers in India, and there is substantial variation in the prevalence of anemia in different parts of India. Understanding the problems in the regions of the country can help devise locally viable plans to mitigate the problem, and this study aimed to assess the prevalence of anemia among antenatal women in north-western India. **Materials and Methods:** A cross-sectional study involving convenient selection of antenatal women was conducted in selected hospitals in Punjab, India, between July 2022 and December 2022. The data were collected using structured questionnaires. The prevalence of anemia and its contributing factors were ascertained using descriptive statistics as well as bivariate and multivariate statistical analyses. **Results:** Out Of 300 pregnant women evaluated for anemia, 70.7% had anemia; 35.71%, 27.33%, and 7.75% had mild, moderate, and severe anemia, respectively. Educational level ($\chi^2 = 21.90$, $df = 299$, $p = 0.01$) and family income level ($\chi^2 = 12.46$, $df = 299$, $p = 0.006$) were associated with anemia among antenatal women. Parity ($\chi^2 = 15.58$, $df = 299$, $p = 0.01$), gestational age ($\chi^2 = 14.95$, $df = 299$, $p = 0.02$), and consumption of iron and folic acid tablets ($t_{299} = 60.56$, $p < 0.001$) were pregnancy-related factors significantly associated with anemia. **Conclusions:** According to this study, anemia in pregnant women is highly prevalent in north-western India and has a number of modifiable contributing factors. These factors should be considered for the prevention and control of anemia in pregnant women during antenatal care and visits.

Keywords: Anemia, pregnancy, pregnant women, public health

Introduction

Anemia is a serious global public health problem that affects approximately 40% of pregnant women worldwide, especially in low- and middle-income countries.^[1-3] The International Federation of Gynecology and Obstetricians acknowledges iron deficiency anemia as a common yet overlooked health problem among women and pregnant mothers. India has the greatest number of pregnant women with anemia in the world, contributing to about 80% of maternal deaths caused by anemia in South East Asia.^[3]

According to the World Health Organization's (WHO) Global Health Observatory data, the prevalence of anemia among pregnant women in India is 50%, which is higher when compared to the neighboring countries such as Bangladesh (42%) and Pakistan (44%). On the contrary, the prevalence of anemia in pregnancy is comparatively lower in other parts of the world; it is reported to be 19%

in China, 17% in Germany, and 16% in Australia.^[4] According to recent estimates, 51% of pregnant women in developing nations and 14% of pregnant women in developed nations have anemia.^[5] Anemia in pregnancy is linked to high maternal and fetal morbidity and mortality, including intrauterine growth retardation, preterm birth, neonatal death, perinatal death, infant mortality, longer duration of hospital stay, frequent antenatal admissions, postpartum hemorrhage, and reduced cognitive and motor development outcomes in children.^[1,6,7] Individual, economic, interpersonal, and organizational factors have a role in the high prevalence of anemia among pregnant mothers in India. Comprehensive approaches have been adopted at multiple levels, and several health schemes have been implemented to address this problem. The Indian government has implemented various projects, one of which is the Anemia Mukht Bharat, which has several targeted interventions for anemia during pregnancy.^[8]

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Although there are various causes of anemia in women, iron deficiency is the most common cause, primarily due to recurrent menstrual loss and poor supply of iron in the diet. During pregnancy, anemia is caused by the increased demand for iron for the growing fetus and placenta and increased red blood cell mass, which is further aggravated by other factors, such as childbearing at an early age, repeated pregnancies, short interval between pregnancies, and poor access to antenatal care and supplementation.^[9-11] Anemia during pregnancy is largely preventable. The WHO has urged all nations to take measures to control anemia among reproductive-age women, including pregnant women, using appropriate screening iron supplementation to improve their educational and financial capacity.^[3]

Despite ongoing efforts by the Government of India and various stakeholders, anemia remains a significant public health concern among pregnant women in India,^[12] and there is a substantial difference in the prevalence of anemia within India. It has been reported to vary widely among pregnant women in various regions of India. This could be due to various local, socioeconomic, cultural, and regional factors.^[8] The massive problem regarding the causes and prevalence of anemia in the north-western region of India has been highlighted by a recent study conducted in the area.^[4] Hence, it is imperative to monitor the prevalence of anemia during pregnancy and its associated factors within the country at the regional level to effectively address this problem. The regional prevalence and factors associated with anemia in pregnant women are unknown. Understanding the regional prevalence can help devise locally viable plans to address risk factors. Therefore, this study was undertaken to assess the prevalence of anemia and its associated factors among pregnant women attending antenatal clinics at selected hospitals in Punjab, a north-western state of India.

Materials and Methods

This quantitative, cross-sectional survey was conducted at the antenatal clinics of two major government hospitals in the state of Punjab, in the north-western region of India, from July 2022 to December 2022. The antenatal clinics for the study were selected from the cities of Mohali and Chandigarh (both from the Punjab state) based on convenience. Pregnant women, aged 18–45 years, and willing to provide informed consent were included in the study. Women with a known diagnosis of anemia before pregnancy, those taking invasive treatment for anemia, and those who were seriously ill were excluded from the study.

The sample size was computed using the Kish-Leslie formula ($n = [Z\alpha/2] 2[1 - p]/d2$) by considering 84.56% prevalence of anemia among pregnant women, 5% margin of error, and 95% confidence interval.^[13] Substituting into the formula, the sample size was calculated to be 207. Data were collected from 300 pregnant women to improve the generalizability of the results. A convenient sampling technique was used to recruit participants.

The data collection instrument was developed after an extensive review of the literature and consultation with subject experts. Section 1 of the structured questionnaire collected information regarding the sociodemographic characteristics of the study participants, including age, education, and occupation. Section 2 collected information regarding the current hemoglobin concentration from medical records. Hemoglobin levels were measured at the hospital using the automated cell counter method. The hemoglobin concentration was interpreted as no anemia (11.0 g/dL), mild anemia (9–10.9 g/dL), moderate anemia (7–8.9 g/dL), and severe anemia (<7 g/dL) based on the classification given by WHO.^[14] Section 3 collected information regarding factors associated with anemia, including obstetric factors, consumption of iron and folic acid (IFA) prophylaxis, health conditions during current pregnancy, and cultural and lifestyle habits. Standard measuring utensils were used to ensure clarity regarding the portions of food consumed. The nutrient composition of the edible portions of the food was calculated from the standard diet and charts for common Indian food.^[15]

The data collection instrument was prepared in English. It was then translated into the native language (Punjabi) and back-translated to ensure that the meaning was retained. The instrument was pilot tested among 20 pregnant women to ensure the clarity and appropriateness of the items and to check the feasibility of the administration of the tool. Five experts from obstetrics, nursing, and midwifery evaluated the study instrument for relevance, appropriateness, and clarity. The content validity index was 0.91. A test-retest method was used to ensure the reliability of the tool. This was performed in 20 pregnant women attending the antenatal clinic. The Cronbach's alpha value for the reliability test was 0.9.

The data were coded and entered in Microsoft Excel, cleaned, and exported to SPSS version 20 (IBM Corp., Armonk, NY, USA) for analysis. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were used to describe the variables of interest. An independent sample *t*-test was used to identify the factors associated with anemia. The predictors of anemia were determined using multinomial logistic regression analysis. Statistical significance was set at $p < 0.05$.

Ethical considerations

Ethical clearance was obtained from the Research and Ethics Committee of the Institute (REC-2021/22 3905) in June 2022. Permission was obtained from the hospital administrators before data collection. The investigator obtained written informed consent from all participants after providing information regarding the nature and purpose of the study. Anonymity and confidentiality were also ensured. Data were collected in a counseling room at the antenatal clinic by using a structured questionnaire.

Results

The characteristics of the pregnant women who participated in the

study are presented in Table 1. Half of the pregnant mothers were in the age group of 24–29 years. The majority of them (88.33%) were not working and were living in a nuclear family (64.34%). Most of them belonged to an urban domicile (75.32%) and had a family income of <10,000 INR (55.71%).

As shown in Figure 1, the overall prevalence of anemia among pregnant women was found to be 70.7%. While 35.71% of the pregnant women had mild anemia, moderate and severe anemia were found in 27.33 and 7.75%, respectively.

Table 1: Characteristics of study participants (n=300)

Variables	Frequency (%)
Age (in years)	
<23	90 (30.00)
24–29	151 (50.33)
30–35	51 (17.00)
>35	8 (2.66)
Education status of women	
No formal education or degree	38 (12.66)
Primary education	32 (10.66)
Secondary education	104 (34.66)
Senior secondary	53 (17.66)
Graduate and above	73 (24.33)
Education status of husband	
No formal education	29 (9.66)
Primary education	44 (14.66)
Secondary education	94 (31.33)
Senior secondary education	63 (21.00)
Graduate and above	70 (23.33)
Occupation of woman	
Not employed	265 (88.33)
Employed in a firm	20 (6.66)
Laborer/daily wage employee	3 (1.00)
Self-employed	12 (4.00)
Family monthly income (INR)	
<10,000	167 (55.66)
10,001–20,000	83 (27.66)
20,001–30,000	22 (7.33)
30,001–40,000	11 (3.68)
>40,001	17 (5.66)
Religion	
Hindu	216 (72.00)
Sikh	67 (22.33)
Muslim	13 (4.33)
Christian	4 (1.33)
Type of family	
Nuclear	193 (64.33)
Joint	107 (35.66)
Type of family	
Urban	226 (75.33)
Rural	74 (24.66)
Dietary habits	
Vegetarian	117 (39.00)
Non-vegetarian	148 (49.33)
Ovo-vegetarian	35 (11.66)

The association between the demographic variables of the participants and anemia is shown in Table 2. The educational level ($\chi^2 = 21.90$, $df = 299$, $p = 0.01$) and family income ($\chi^2 = 12.46$, $df = 299$, $p = 0.006$) of antenatal women were significantly associated with anemia.

The association between pregnancy-related factors and anemia is shown in Table 3. Parity ($\chi^2 = 15.58$, $df = 299$, $p = 0.01$), gestational age ($\chi^2 = 14.95$, $df = 299$, $p = 0.02$), and consumption of IFA tablets ($t_{299} = 60.56$, $p < 0.001$) were significantly associated with anemia among pregnant women.

Not on iron supplementation or not being regular in iron supplementation increases the chances of anemia of different severity. Multigravida and grand multigravida status were independent predictors of moderate and severe anemia, respectively ($R^2 = 0.43$, $p < 0.01$).

Discussion

Anemia is a pervasive concern globally, including India. Despite various interventions, more than a quarter of the world's women remain anemic, especially during pregnancy.^[3] It is contributing to 20%–40% of maternal deaths in India.^[16] In the current study, 70.3% of the study population was found to be anemic, which is higher than the global and national average.^[3,13] A similar prevalence of anemia among pregnant women was reported in studies conducted in Maharashtra (70.70%) and Punjab (84%).^[12,17] However, studies have reported varying prevalences of anemia across the country, ranging from 33% to 75%.^[12] This could be due to differences in sociodemographic patterns, health literacy, varying access to health care, sample size, and the method used to estimate anemia. Several reagent-based methods, such as the hemoglobin cyanide method, reagent-less methods, and non-invasive methods, exist for hemoglobin analysis, which can provide potentially different results based on standardization. A higher prevalence of anemia reported in this study compared to the national average indicates poor maternal care in this part of the country.^[18]

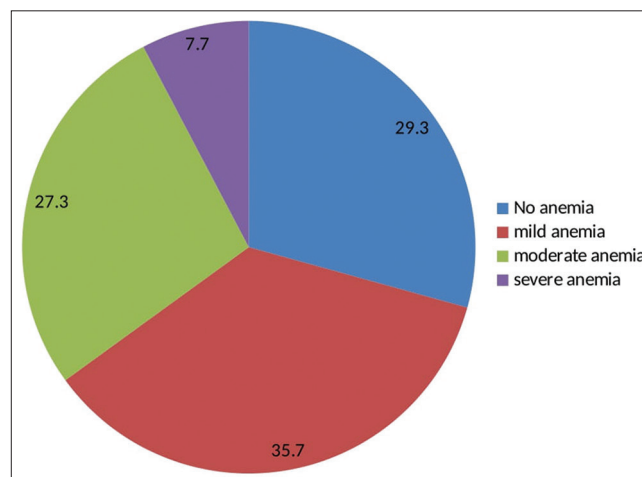


Figure 1: Prevalence of anemia of different severities among the antenatal mothers

Table 2: Association between anemia and demographic variables (n=300)

Variables	No Anemia	Anemia			χ^2	p
		Mild	Moderate	Severe		
Occupation status of pregnant women						
Homemaker	74	96	76	10	3.94	0.26
Employed	14	11	6	4		
Age						
<30	70	85	66	20	0.72	0.86
>30	18	22	16	3		
Education of pregnant woman						
No formal or primary education	9	26	28	7	21.90	0.01*
Secondary education	28	43	23	10		
Senior secondary or above	58	38	31	6		
Dietary habit						
Vegetarian	37	43	27	10	4.67	0.58
Non-vegetarian	42	53	41	12		
Eggetarian	9	11	14	1		
Family income (INR)						
<10,000	36	52	63	16	12.46	0.006*
>10,000	52	45	29	7		
Type of family						
Nuclear	57	70	55	11	3.06	0.38
Joint	31	37	21	12		
Domicile						
Urban	72	84	54	16	6.90	0.07
Rural	16	23	28	7		

*Significant at $p < 0.05$ level

The prevalence of mild, moderate, and severe anemia was found to be 35.71%, 27.33%, and 7.75%, respectively, in the study population. A large population survey conducted in India revealed a comparable prevalence of mild (25.2%), moderate (28.3%), and severe (2.6%) anemia among women of reproductive age.^[19]

Despite a considerable decline in moderate and severe anemia among pregnant women in India over the last 15 years, it continues to be a major public health concern with an overall prevalence of 50.4%.^[20] However, a meta-analysis by Karami *et al.* indicated that the overall global prevalence of anemia in pregnant women was 36.8%.^[21] This stark difference between the prevalence of anemia in India and other parts of the world can be explained by the several economic, social, and health issues that directly contribute to poor health promotion practices and nutrition among pregnant women.^[8] These variations in the severity of anemia across different geographic regions signify the need for designing and setting goals for anemia control and prevention at the local level.

Being multigravida and not taking iron folic acid tablets as prescribed were found to be significant predictors of anemia in the study population. The factors associated with anemia were grand multigravidity, gestational age (third trimester), no intake of iron folic acid tablets, low education of the mother, and low family income (<10,000 INR/month). Studies have also reported that multigravidity, low socioeconomic status, educational level of women and husbands, and not taking iron

supplements are associated with anemia during pregnancy.^[22-25] The education level of mothers and low family income are directly linked to poor food quality and can predispose women to anemia.^[26] Grand multigravidity and gestational age also contribute to anemia, as pregnancy can deplete iron sources and increase the demand for blood for the mother and fetus.^[10]

This study highlights the importance of designing anemia control and prevention programs at multiple local levels based on the type of anemia (mild, moderate, or severe) and contributing factors, given the heterogeneity and variations in these factors, to curb the prevalence, especially in limited resource settings. As pointed out by several global associations of women's health and international midwifery associations, such as the International Confederation of Midwives, the International Federation of Gynecology and Obstetrics, and the Maternal Health Unit of the WHO, anemia in pregnancy has to be addressed from multiple perspectives with complementary efforts.

This study reports the prevalence of anemia and its predictors in pregnant women attending antenatal care in Punjab. Data were collected from two different settings in the region to improve generalizability. This study explored the association between several sociodemographic and pregnancy-related factors and anemia during pregnancy. Despite this, the study has some limitations. Although the factors associated with anemia were determined in this study, a causal relationship between anemia and the studied factors could not be established. The study included a few variables, and many other possible factors that

Table 3: Association between anemia and pregnancy-related factors (n=300)

Variables	No anemia	Anemia			Test value	p
		Mild	Moderate	Severe		
Parity						
Primigravida	48	41	30	10	15.58	0.01*
Multigravida	32	43	26	8		
Grand multigravida	8	23	26	5		
History of abortion					03.09	0.37
No	77	90	66	17		
Yes	11	17	16	6		
Still birth					01.53	0.67
No	87	103	80	22		
Yes	1	4	2	1		
Gestational age in weeks					14.95	0.02*
1–12	17	12	22	9		
13–26	27	35	26	8		
27–40	44	60	34	6		
Space between present pregnancy and last child					18.80	0.09
1 st pregnancy	48	42	31	11		
<1 year	4	8	10	4		
1 year	5	8	10	3		
2 years	5	13	12	2		
3 years or above	26	36	19	3		
Hyperemesis gravidrum					0.91	0.82
No	75	86	69	19		
Yes	13	21	13	4		
Taking iron folic acid tablets					60.56	0.00*
No	19	69	55	21		
Yes	69	38	27	2		
Current history of intestinal parasite infection					2.62	0.45
No	84	96	77	21		
Yes	4	11	5	2		
Complaints of minor ailments during current pregnancy					1.49	0.68
No	61	75	63	16		
Yes	27	32	19	7		
Intake of more than 1 cup of tea, cocoa, or coffee per day					2.23	0.52
No	31	30	23	5		
Yes	57	77	59	18		
Crave to eat any non-food substance					5.11	0.16
No	78	95	67	17		
Yes	10	12	15	06		

*Significant at $p < 0.05$ level

could affect hemoglobin concentration, including the presence of acquired or inherited disorders, were not accounted for in this study. There are other factors that could have significant associations with anemia in pregnancy, which have not been investigated in this study, including distance to health facility and family size. In addition, the use of self-reporting as a method of data collection increases the chance that women in the study might have overreported their information, mainly because of social desirability bias. However, the investigators attempted to overcome these biases by developing trust and offering support.

Investigators recommend conducting a longitudinal study in a wider geographical area, including pregnant women and non-pregnant women as controls.

Globally, the prevalence of anemia continues to be the highest in India.^[27] The findings of this study can be used to design appropriate and efficient anemia control programs to achieve India's Sustainable Development Goals. The high prevalence of anemia reported in the study population compared with the national average signifies the potential importance of adjusting and modifying anemia control and prevention interventions based on the prevalence of anemia and prevailing contributing factors.

Conclusion

This study concluded that there is a comparatively higher prevalence of anemia in the study population than the national average. Multigravidity, gestational age, not taking iron folic acid

tablets, and dietary consumption were found to be associated with anemia in the study population. Other social factors found to be significantly associated with anemia were low education among women and low-income families. Most of these factors are modifiable; hence, anemia can be reduced in this region of India by concerted efforts of several levels of healthcare. These findings highlight the need to enhance awareness and provide knowledge to pregnant women and prepare and strengthen the healthcare workers and healthcare system to effectively prevent and treat anemia during pregnancy.

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Conflicts of interest

Nothing to declare.

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