ORIGINAL ARTICLE

Prevalence and Causes of Anemia Among Pregnant Women Admitted in a Tertiary Care Hospital in North India

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Abstract

Background: Anemia is a condition in which the hemoglobin concentration of a women during pregnancy is <11g/dL. More than 50% of pregnant women suffer from anemia and it is the second leading cause(20%) of total maternal deaths. **Aim of the study** :was to estimate the prevalence and causes of anemia among pregnant women admitted in a tertiary care hospital in North India, and to determine its association with maternal and fetal outcomes. **Study design:** Cross-sectional study which included 200 consecutive participants fulfilling the inclusion criteria. **Results:** 200 females were evaluated out of which 171(85.5%) were anemic. 47% had mild, 37% patients had moderate and 1.5% had severe anemia. There was statistically significant association between anemia and age($p<0.001$), parity($p<0.001$), low birth weight(LBW)($p=0.05$), presence of pallor($p<0.001$), lethargy($p<0.001$), palpitations($p=0.001$), breathlessness($p=0.007$) and lack of IFA intake($p<0.001$). Anemic participants had significantly higher proportion of microcytic hypochromic presentation($p=0.011$), lower serum iron concentration($p<0.001$), higher Total Iron Binding Concentration(TIBC)($p<0.001$), lower serum ferritin($p<0.001$), lower serum folate($p<0.001$), lower serum B12($p<0.001$) as compared to non anemic participants. No statistically significant association was observed between anemia and BMI, educational level, socioeconomic status, residence(urban/ rural), trimester, gap between child birth. **Conclusion:** Iron deficiency anemia amongst pregnant females is highly prevalent; and to improve maternal and fetal outcomes; prevention, early diagnosis and treatment of anemia in pregnancy is to be given priority.

Keywords

Anemia, Pregnancy, Iron Folic Acid, Pallor

Introduction

WHO defines anemia in pregnancy as a hemoglobin concentration of <11g/dL or hematocrit of < 33%. It has been classified as mild (9-10.9), moderate (7-8.9) and severe (<7 g/dL).[1] The global prevalence of anemia in pregnancy is 36.8% [2], with prevalence in India being 52.2%. [3]

Anemia in pregnancy can be physiological and pathological . During pregnancy there is an increase in red blood cell mass by 30% and plasma volume by 40-50%, which results in erythrocyte dilution by 5-15% and decrease in hemoglobin concentration by approximately 2g/dL leading to "Physiologic Anemia of Pregnancy". In addition, there is increased demand due to the physiological increase in maternal red blood cell mass, and the needs of the growing foetus and placenta. Iron demand in pregnancy is about 900 mg, of which about 500-600 mg is accounted by the uterus, 150-200 mg is lost in the blood loss at delivery and 150-200 mg is utilised in lactation. Pathological causes include iron deficiency anemia,

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thalassemia, hemolytic anemia, anemia of chronic diseases, aplastic anemia, Vitamin B12 and folic acid deficiency.

Among the various pathological causes of anemia in pregnancy, Iron deficiency anemia(IDA) is the most common cause, globally affecting about 32 million women[4] with nutritional anemia being the most common cause of IDA. In developing countries, poor diet, frequent pregnancies and parasitic infections are responsible for high incidence of anemia in pregnant women. [5]

Recommendations for screening of anemia during pregnancy include first screening in the first trimester followed by 24-28 weeks and at 36 weeks of gestation.[6]

Anemia especially, IDA in pregnancy is associated with increased risk of preterm delivery, LBW, stillbirth, PPH, pulmonary edema, preeclampsia, eclampsia and maternal mortality. [7-9]

Anemia is a serious public health problem and means for prevention and treatment of IDA in pregnant women include iron supplementation, fortification of staple foods with iron, increasing health and nutritional awareness, combating parasitic infections, and improvement in sanitation and family planning advice. [10]

This study was done to help find out the common causes & risk factors of anemia amongst pregnant women in northern India and making pregnant women aware of its ill effects on their health and help in further prevention and control of anemia.

Materials and Methods

The study was done with the aim to estimate the prevalence and causes of anemia among pregnant women; and to determine its association with maternal and fetal outcomes.

It was a cross-sectional study undertaken in the Department of Obstetrics and Gynecology in a tertiary care hospital in North India between 1st November 2020 to 31st October 2021, after proper institutional ethical approval (IEC/GMC/2022/783). 200 women were included in the study after obtaining informed written consents.

All consecutive pregnant females, irrespective of age, period of gestation and gravida were considered for inclusion. Women with recent blood-transfusion and antepartum hemorrhage were excluded from the study.

The WHO criteria of anemia in pregnancy i.e., mild (9-10.9), moderate (7-8.9) and severe (<7 g/dL) was used to diagnose women with anemia.

The patients eligible, were studied for demographic features like maternal age, parity, socio- economic status, educational status, place of residence (rural/urban), past history of chronic illnesses or surgical history. Relevant history with the help of a questionnaire was taken to rule out nutritional deficiency, preconceptional heavy menstrual bleed, gastrointestinal blood loss, frequent pregnancy and childbirths, systemic diseases, eating disorders, malabsorption syndromes and medication history. Obstetrical history including history of vaginal bleeding in early months and history of APH was taken. Past obstetrical history including previous child births, history of LBW, PPH, puerperal sepsis, deep vein thrombosis, lactation failure, etc were taken.

Clinical examination including general physical, systemic and obstetrical examination was done. Patients were investigated thoroughly with complete blood count(CBC) including PBF, iron profile, Vitamin B12 and Folic acid levels, Hb electrophoresis, reticulocyte count, serum LDH to find out the cause of anemia.

Statistical Analysis

Data was collected and Statistical analysis was performed using software package of social sciences (SPSS for Windows, version 26, Armonk, NY: IBM Corp). Descriptive statistics were calculated as mean and standard deviation for continuous data and as number and percentage for categorical data. Comparison of qualitative study parameters was done using Chi-square test. The level of significance for the present study was set at a P value of less than 0.05.

Results:

There were a total of 200 participants in the study, out of which 171 (85.5%) were anemic and 29 (14.5%) were non-anemic. Majority of the patients (47%) had mild anemia, 37% patients had moderate anemia, 1.5% had severe anemia and 14.5% were non-anemic (*Fig 1*).

Patient characteristics and demographics: A statistically significant association was observed between age and anemia (Chi-square =23.089, P<0.001) with there being significantly higher proportion of anemic participants in 21-25 years age group while participants in the age group

Fig 1 : Severity of anemia in study participants.

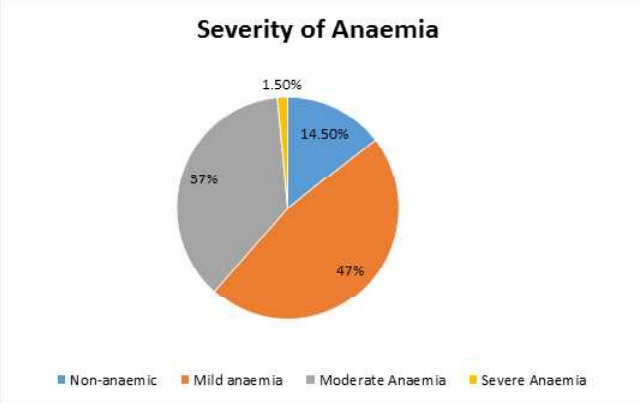

Table 1 : Patient characteristics and demographics and their association with anemia.

		Anemic(n=171; 85.5%)	Non anemic(n=29; 14.5%)	p - value
Age(years)	<20	3(1.8%)	4(13.8%)	**<0.001**
	21-25	82(48%)	5(17.2%)	
	26-30	69(40.4%)	20(69%)	
	31-35	12(7%)	0(0)	
	>35	5(2.9%)	0(0)	
BMI(kg/m2)		27.42(±3.02)	27.83(±2.44)	0.49
Education	Illiterate	21(12.3%)	7(24.1%)	0.060
	Primary school	39(22.8%)	5(17.2%)	
	High school	86(50.3%)	17(58.6%)	
	Graduate	25(14.6%)	0(0)	
Socioeconomic status	Lower	136(79.5%)	24(82.8%)	0.818
	Middle	25(14.6%)	3(10.3%)	
	Upper	10(5.8%)	2(6.9%)	
Residence	Rural	64(37.4%)	10(34.5%)	0.761
	Urban	107(62.6%)	19(65.6%)	

against anemia. 73.7% anemic participants had inadequate IFA intake compared to 17.2% non-anemic participants (p<0.001). History of low birth weight was also found to be significantly associated with anemia (Chi-square=3.851, P=0.04) with 22.8% anemics having a history of low birth weight as compared to non-anemic participants (6.9%).

There was no statistically significant association between gap between childbirth, duration of amenorrhea, trimester and presence of comorbidities and anemia (P=0.582, 0.497, 0.951 and 0.805 respectively).(*Table 2)*

Clinical features: A significantly higher proportion of anemic participants presented with pallor (75.4%) as compared to non-anemic participants (0%) (Chi-square=61.626, P<0.001). Lethargy, easy fatiguibility and palpitations were also more common in anemic participants as compared to non anmeic patients (60.2%, 63.2% and 34.5% vs 24.1%, 24.1% and 34.5%) (p=<0.001, 0.001 and 0.007 respectively). (*Table-3*)

Laboratory parameters: On evaluation of peripheral blood film (PBF), normocytic normochromic findings were seen in significantly higher proportion of non-anemic participants (75.9%) than anemic participants(46.8%). The anemic participants were more likely (45%) to have microcytic hypochromic presentation of PBF compared to non-anemic participants (24.1%)(Chi-square=9.062, P=0.011).

The mean serum iron concentration of non-anemic participants (75.9 mcg/dl (±5.71)) was significantly higher

26-30 had lower proportion of anemia as compared to other age groups.

No statistically significant association was seen between BMI, educational level, socioeconomic status, residence and anemia (p = 0.49, 0.060, 0.818, 0.761 respectively). (*Table 1*)

Patient parity and its association with anemia: A statistically significant association was found between parity and anemia (Chi-square=27.386, P<0.001). A significantly higher proportion of nulliparous participants were found to be non-anemic (89.7%) as compared to multiparous participants (10.3%) (p<0.001). Anemia was seen in 107 out of 110(97.3%) of multiparous participants in our study.

A statistically significant inverse association was found between IFA intake and anemia (Chi-square=34.956, P<0.001) and IFA intake was found to be protective

Table 2 : Past history and its association with anemia.

		Anemic(n=171; 85.5%)	Non anemic(n=29; 14.5%)	p – value
Amenorrhaea duration (in weeks)		22.84(±9.06)	21.34(±9.14)	0.497
Trimester	1st	33(19.3%)	6(20.7%)	
	2nd	86(50.3%)	15(51.7%)	0.951
	3rd	52(30.4%)	8(27.6%)	
Parity	0	64(37.4%)	26(89.7%)	
	1	77(45%)	2(6.9%)	
	2	25(14.6%)	1(3.4%)	**<0.001**
	3	4(2.3%)	0(0)	
	= 4	1(0.6%)	0(0)	
Comorbidities	Tuberculosis	26(15.2%)	2(6.9%)	
	Diabetes mellitus	11(6.4%)	2(6.9%)	
	Hypertension	8(4.7%)	1(3.4%)	
	Hypothyroidism	15(8.8%)	2(6.9%)	0.805
	Multiple comorbidities	2(1.2%)	0(0)	
IFA intake	Adequate	45(26.3%)	24(82.8%)	
	Inadequate	126(73.7%)	5(17.2%)	**<0.001**
History of Low birth weight	Yes	39(22.8%)	2(6.9%)	
	No	132(77.2%)	27(93.1%)	**0.040**
Gap between child birth	<2 Years	43(31.6%)	1(20%)	
	>2 Years	93(68.4%)	4(80%)	0.582

Table 3 : Clinical features and its association with anemia.

		Anemic(n=171; 85.5%)	Non anemic(n=29; 14.5%)	p – value
Pallor	Yes	129(75.4%)	0(0)	
	No	42(24.6%)	29(100%)	**<0.001**
Palpitation	Yes	98(57.3%)	7(24.1%)	
	No	73(42.7%)	22(75.9%)	**0.001**
Lethargy	Yes	103(60.2%)	7(24.1%)	
	No	68(39.8%)	22(75.9%)	**<0.001**
Breathlessness	Yes	108(63.2%)	10(34.5%)	
	No	63(36.8%)	19(65.5%)	**0.007**

Table 4: Laboratory parameters and their association with anemia.

		Anemic(n=171; 85.5%)	Non anemic(n=29; 14.5%)	p - value
Peripheral blood film	Normocytic Normochromic	80(46.8%)	22(75.9%)	
	Microcytic Hypochromic	77(45%)	7(24.1%)	**0.011**
	Macrocytic	1 4(8.2%)	0(0)	
Serum iron(mcg/dl)		62.53(±10.76)	75.9(±5.71)	**<0.001**
Serum TIBC (mcg/dl)		318.26(±35.94)	234.34(±22.68)	**<0.001**
Serum ferritin(mcg/l)		12.45(±4.20)	24.88(±2.58)	**<0.001**
Serum folate(nmol/l)		9.01(±2.89)	12.58(±2.18)	**<0.001**
Serum B12(pg/ml)		168.9(±21.24)	210.34(±9.09)	**<0.001**

than anemic participants (62.53 mcg/dl (±10.76)) (p=<0.001). The mean TIBC of anemic participants (318.26 mcg/dl (±35.94)) was significantly higher than non-anemic participants (234.34 mcg/dl(±22.68)) (p=<0.001).

There was a statistically significant difference in mean serum ferritin, serum folate and serum B12 between anemic and non-anemic participants(P<0.001, <0.001, <0.001 respectively) (*Table 4)*.

Discussion

The present study was conducted in a tertiary care hospital in North India over a period of one year i.e., 1st

November 2020 to 31st October 2021, with the aim to study prevalence of anemia in pregnant women and to study causes of anemia in antenatal women admitted in SMGS Hospital.

There were a total of 200 participants in the study, out of which 171 (85.5%) were anemic and 29 (14.5%) were non-anemic.

Previous studies by Toteja *et al*, [11] Pushpa et al ., [12] and Bansal *et al*., [13] reported overall prevalence of anemia to be 84.9%, 87.21% and 81.8% in females in the Indian subcontinent which is similar to the prevalence of anemia in our study.

In a cross-sectional study conducted by Baig-Ansari *et al.*, (2008)[14] it was seen that 75% pregnant women had mild anemia, 14.8% pregnant women had moderate anemia and 0.7% pregnant women had severe anemia whereas in study by Ijaz-UL *et al.*, [15] it was found that 60.14% pregnant women had moderate anemia, 39.86% pregnant women had mild anemia and none of the pregnant women had severe anemia. Our study had higher prevalence of participants with moderate anemia as compared to study by Baig *et al* [14] while the results were similar to the study by Ijaz Ul *et al* [15].,

In this study statistically significant association was observed between age and anemia (Chi-square = 23.089, P<0.001). Significantly more anemic participants (48%) were in 21-25 years age group compared to non-anemic (17.2%) while significantly more non-anemic participants (69%) were in 26-30 years age group compared to anemic participants (40.4%) which was similar to the study by Pushpa *et al.*, .[12]

There was no association between education level and anemia (P=0.818) which was in contrast with the studies by Stephen *et al*., [16] and Pushpa *et al.*, [14] who found low education level of the participant to be associated with anemia.

Similarly, there was no correlation between socioeconomic status and anemia(p=0.818) which was found to be significant in studies by Bansal *et al.*, [13] who found low socioeconomic status to be associated with anemia.

History of low birth weight was found to be statistically significantly associated with anemia(p= 0.04) which was similar to studies by Levy *et al.*, [17]

No association was found between BMI, gap between child birth, presence of comorbidities, amenorrhea duration, trimester and anemia.

Anemic patients were found to have significantly higher rates of pallor, palpitations, lethargy and breathlessness as compared to non anemics(p=<0.001, 0.001, <0.001, 0.007 respectively).

A statistically significant association was found between parity and anemia (Chi-square=27.386, P<0.001) with higher proportion of nulliparous participants being non anemic while higher proportion of anemics were multiparous which was similar to the study by Thomson .[18]

IFA intake was found to be significantly associated with lower levels of anemia(Chi-square=34.956, P<0.001). A significantly higher proportion of anemic participants (73.7%) had inadequate IFA intake compared to non-anemic participants (17.2%). Participants with adequate IFA intake were more likely to be non-anemic. These findings were consistent with the findings of the study by Bansal *et al.*.[13]

We found higher proportion of normocytic normochromic findings in anemic participants (75.9%) than anemic participants (46.8%). Anemic participants were more likely (45%) to have microcytic hypochromic presentation of PBF compared to non-anemic participants (24.1%). The findings were consistent to the study conducted by Gautam *et al.*, [19]

Mean serum iron was significantly higher in non anemics than anemic participants (P<0.001). Gebreweld *et al.*, [20] and Gautam *et al.*, [19] had similar findings in their study on pregnant females. The mean total iron binding capacity (TIBC) of anemic participants was significantly higher than that of non-anemic participants (P<0.001) which was consistent with the study conducted by Ahenkorah *et al.*, .[21] Mean serum ferritin, folate and B12 were significantly higher in non anemics as compared to anemic participants (p< 0.001, < 0.001, < 0.001 respectively). This was consistent with findings by Ahmed *et al*.[22], and Chacko et al., [23] respectively.

The present cross-sectional study concludes that the overall prevalence of anemia was 85.5%. Majority of anemic pregnant females had iron deficiency anemia. The associated risk factors were age of the participants, history of low birth weight, lethargy, palpitation,

breathlessness, parity, IFA intake, pallor, PBF, serum iron, serum TIBC, serum ferritin, serum folate and serum B12 among the pregnant women with anemia.

IDA is a major health problem and needs to be tackled to reduce the morbidity and mortality amongst pregnant females. Patient education along with early detection and prompt treatment will help decrease the burden of anemia.

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Conflicts of Interest

There are no conflicts of interest.

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