

An Observational Study on the Prevalence of Anemia in Pregnant Women and Its Association with Perinatal Outcomes

Sangita Kumari¹, Priyanshu Bharti²

¹Associate professor, Department of Obstetrics and Gynaecology, Nalanda Medical College and Hospital, Patna, Bihar, India

²Senior Resident, Department of Obstetrics and Gynaecology, Nalanda Medical College and Hospital, Patna, Bihar, India

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Corresponding Author: Dr. Priyanshu Bharti

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Abstract:

Background: The phenomenon of anaemia in pregnancy is among the primary issues of the population health that requires monitoring in low-resource environments because of the high susceptibility of mothers and fetuses to the disease and the high nutritional requirements.

Aim: To estimate the prevalence rates of anemia among pregnant women and assess the relationship between anemia and maternal and infant outcomes.

Methodology: A prospective observational research design was used on 100 expectant women who visited the Department of Obstetrics and Gynaecology at Nalanda Medical College and Hospital, Patna. Participants who had valid CBC reports were classified according to the WHO hemoglobin criteria. A structured questionnaire was used in obtaining sociodemographic, obstetric, dietary, and clinical data. The Chi-square test was used to make associations between anemia and other factors, such as unfavorable perinatal outcomes.

Findings: Younger maternal age, rural life, low level of education, low income, vegetarian diet, low frequency of consuming fruit and vegetables, and consumption of tea/coffee after meals were strongly related to anemia. Deficiency in iron supplements, past anemia and low birth intervals were also contributing factors. There were increased rates of pre-term labor, postpartum bleeding, ICU stay, low birth weight, pre-term birth and fetal distress ($p < 0.05$) among women who were anemic.

Conclusion: Anemia in pregnancy is multi-factorial and has a significant impact on adverse perinatal outcomes. It is crucial to reinforce nutritional education, iron supplementation and specific antenatal care.

Keywords: Anemia, pregnancy, prevalence, perinatal outcome, iron deficiency, maternal complications.

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Introduction

Anemia is one of the most widespread nutritional deficiencies on the planet and it is still a significant source of concern to the mass media especially in low- and middle-income nations like India where the socioeconomic disparities and nutritional challenges are widespread [1]. Due to a decrease in oxygen carrying capacity of blood, hemoglobinemia arises when the body is not able to develop adequate number of functional erythrocytes to satisfy physiological requirements. As explained, whenever the capacity of the erythrocytes to carry oxygen is impaired, the body cannot generate sufficient ones to satisfy the minimum needs. This is referred to as anaemia disease [2]. The condition has particularly serious consequences when pregnant, during which an increased metabolic load and greater susceptibility of both the mother and the growing fetus are also present.

The rates of anemia in pregnant women are still remarkably high in spite of tremendous improvement in the practice of maternal healthcare. In India, the prevalence rate is almost twice (49.7%) among pregnant women, which is close to the global rate of 41.8% as indicated in the 2008 WHO estimates. Among the Asians, anemia has become the second leading cause of maternal death with nearly 12.8 percent of maternal deaths occurring without postpartum bleeding. It is worth noting that India, on its part, has an estimated 80 percent contribution to maternal mortality due to anemia, in South Asia, which underscores the disproportionately high disease burden in the country and the necessity of developing specific interventions in this respect [3]. Considering these statistics, anemia during pregnancy is considered to be a significant social health issue universally and must be addressed and acted upon with force and tact [4].

The World Health Organization defines anemia in pregnancy as a hemoglobin of 11 g/100 ml and below clinically [5]. The condition is further classified as mild anemia (Hb 10.011 g /dl), moderate anemia (Hb 709.9 g /dl), and severe anemia (Hb under 7.0 g /dl). These groups are rather clinically important because the intensity of anemia is directly related to numerous obstetric conditions, maternal morbidity, and negative perinatal outcomes. Despite the multifactorial nature of etiology of anemia, iron deficiency is the most prevalent and dominant underlying cause, especially in resource-limited locales [6].

The physiological needs of iron rise significantly during the period of pregnancy. Theoretically, one and a half pound more of iron is needed to sustain the growing maternal blood, the growing fetus, and the placenta. Out of this demand, approximately 300 mg is used to support the growth of the fetus and placenta, 500mg to enhance the mass of maternal hemoglobin and about 200mg to counteract the losses at the base [7]. The problem of iron deficiency in pregnant women is among the highest in India, despite many years of the supplementation programs on national levels. Iron deficiency anemia is a significant risk of both negative health outcomes in the mother and child when it is left untreated, which is why it is highly important to learn and manage this condition as soon as it occurs [8].

The effects of anemia in pregnancy go beyond just mere hemoglobin loss, given that it has a severe bearing on the morbidity and mortality of the pregnant mother. The untreated anemic mothers might have reduced overall health, greater susceptibility to infection, prolonged postpartum recovery, extended stay in hospital, preterm birth, eclampsia, amniotic fluid embolism, postpartum hemorrhage (PPH), deep vein thrombosis (DVT), heart failure, or even death. The fetus is also affected and there is an increased risk of intrauterine growth retardation, preterm delivery, low birth weight, developmental retardation and high neonatal mortality [9]. These implications demonstrate how significant the effect of maternal anemia on perinatal outcomes and life-long health trajectory of a child may be.

Owing to the seriousness of the issue, India became the first developing country to initiate the National Nutritional Anaemia Control Programme to curb the trend of maternal anemia. The government also advises prophylactic elemental iron and folic acid to a minimum of 100 days starting in the second trimester of pregnancy as follows: 100 mg elemental iron and 500 0g folic acid daily. In women with anemia, the treatment dose is increased to 200mg elemental iron and 1000 µg folic acid [10]. Regardless of these efforts that have already been in place, anemia is still very rampant with 65-75 percent of pregnant women oppressed by the condition throughout the country. This chronic load presupposes rather alarming deficiencies in the program execution,

healthcare access, nutrition awareness, and adherence to the treatment.

Considering the scale of the issue and the gravitational consequences of anemia in maternal and perinatal care, it is necessary to investigate the patterns, the intensity, and outcomes of anemia in pregnant women within particular healthcare facilities. This research is crucial in local trends and risk factors as well as enhancing targeted interventions. Thus, the purpose of the current prospective observational research is to determine the occurrence of anemia in pregnant women and examine its relation to perinatal outcomes with a particular focus on the level of anemia and the clinical consequences of anemia to a mother and fetus.

Methodology

Study Design: This research design utilized a prospective observational study design that sought to determine the prevalence of anemia in pregnant women and also determine how it was correlated to perinatal outcomes.

Study Area: The study was conducted in the Department of Obstetrics and Gynaecology, Nalanda Medical College and Hospital (NMCH), Patna, Bihar, India.

Study Duration: The study was carried out over a period of one year.

Sample Size: A total of 100 pregnant women attending the antenatal clinic of the Department of Obstetrics and Gynaecology were included in the study.

Study Population: The study population consisted of pregnant women attending the antenatal care (ANC) outpatient department during the study period and fulfilling the inclusion criteria.

Sampling Technique: A convenience sampling technique was adopted. Pregnant women visiting the ANC clinic and having Complete Blood Count (CBC) reports available at the time of visit were approached and recruited after informed consent.

Inclusion Criteria

- Pregnant women willing to participate in the study.
- Pregnant women attending the antenatal care clinic with a valid Complete Blood Count (CBC) report.
- Women who provided written informed consent.

Exclusion Criteria

- Pregnant women diagnosed with cardiac, renal, or hepatic diseases, diabetes mellitus, or hypertension.
- Pregnant women unwilling to participate in the study.

- Those not possessing a valid CBC report at the time of data collection.

Study Procedure: The research process started by the recruitment of eligible women under pregnancy that are visiting the antenatal clinic of the Department of Obstetrics and Gynaecology within Nalanda Medical College and Hospital. Informed consent was written, and each participant signed the informed consent after a discussion of the objective of the study. All enrolled women had their Complete Blood Count (CBC) report examined since hemoglobin concentration was the main diagnostic factor of anemia. Upon the availability of peripheral blood smear (PBS) results, the same was also observed as being helpful in the identification of the morphological type and potential etiology of anemia. According to the classification delivered by the WHO, the participants were divided into anemic and non-anemic groups, and anemia was divided into mild, moderate, and severe depending on hemoglobin levels. Clinical, obstetric, dietary and lab data were captured in a tabular manner and a participant followed during her antenatal check-ups to write down any maternal and perinatal complications related to anemia.

Data Collection: A structured and pre-validated questionnaire was used in data collection and was given to every participant after the consent was obtained. The questionnaire was created in such a way that it is used to collect detailed data about sociodemographic factors, medical history, obstetrics, nutrition, and behavioral patterns that might contribute to the occurrence of anemia in pregnancy. It also contained questions about medical history, iron supplements intake, and the events of anemia or blood transfusion in the past. Data on the laboratory level, especially hemoglobin concentration based on the CBC report, were correlated with the data collected during the questionnaire. Hospital records were used to record maternal outcomes, including preeclampsia, preterm labor, postpartum bleeding, and ICU admission, and perinatal outcomes, including birth weight, gestational age at delivery, fetal distress, and neonatal condition at birth. Any data gathered were tabulated and a tabular analysis done with all the data collected in tabular format.

Statistical Analysis: All the data obtained in the questionnaires and the laboratory reports were initially tabulated on Microsoft Excel just to be accurate and complete. The SPSS version 27 was used to analyze the statistical data. To summarize the baseline characteristics of the study population, descriptive statistics (in terms of means, frequencies, and percentages) were calculated. The Chi-square test was used to determine the association between anemia and other sociodemographic, clinical, and perinatal outcome variables. P-value of 0.05 was deemed as statistically significant in determining associations. Using statistical analysis, it was also possible to identify the prevalence of anemia in the study population and how it is related to adverse maternal and fetal outcomes.”

Result

According to table 1, there is a significant relationship between a number of sociodemographic variables and anemia in pregnant women. The proportion of the anemic women was also greater in the younger age groups especially 20-25 years (32.1) and 26-30 years (35.7), age was also significantly associated (3). The place of residence also had its impact, with anemia being more common among the rural women (67.8%) than urban women (32.1) and this is statistically significant ($\chi^2 = 5.21$). The level of education was closely associated with anemia, and the primary (30.3) and secondary (51.7) education levels had a higher level of anemia than graduates or postgraduates ($\chi^2 = 9.47$, $p = 0.02$). Occupational status found a significant association between anemia and housewives (80.3) compared to employed women (19.6), and there was a significant relationship ($\chi^2 = 7.32$, $p = 0.03$). There was also a strong gradient in terms of income level with 51.7% anemic women living in household with incomes less than 5000 as compared to 12.5% in the 10000 and above category ($\chi^2 = 8.15$, $p = 0.01$). Religion also had an important linkage, and anemia is more prevalent among Hindu women (60.7 v/s 32.1 and 56.0 v/s 45.0) than among the Muslims and others ($\chi^2 = 12.03$, $p = 0.001$). Generally, Table 1 indicates that anemia in pregnancy is considerably correlated with younger maternal age, rural living, low level of education, joblessness, lower income and religion.

Sociodemographic Factors	Anemic (%)	Non-anemic (%)	Total (%)	Chi-square (χ^2) value	P value
Age of mother (years)					
<20	3 (5.3%)	2 (4.5%)	5 (5%)	10.84	0.02
20-25	18 (32.1%)	9 (20.4%)	27 (27%)		
26-30	20 (35.7%)	19 (43.1%)	39 (39%)		
31-35	10 (17.8%)	8 (18.1%)	18 (18%)		
>35	5 (8.9%)	6 (13.6%)	11 (11%)		
Residence					

Rural	38 (67.8%)	20 (45.4%)	58 (58%)	5.21	0.02
Urban	18 (32.1%)	24 (54.5%)	42 (42%)		
Educational status					
Primary school	17 (30.3%)	8 (18.1%)	25 (25%)	9.47	0.02
Secondary school	29 (51.7%)	20 (45.4%)	49 (49%)		
Graduate	7 (12.5%)	10 (22.7%)	17 (17%)		
Masters	3 (5.3%)	6 (13.6%)	9 (9%)		
Occupation					
Housewife	45 (80.3%)	26 (59%)	71 (71%)	7.32	0.03
Employed	11 (19.6%)	18 (40.9%)	29 (29%)		
Income status (₹)					
<5000	29 (51.7%)	14 (31.8%)	43 (43%)	8.15	0.01
5000–10000	20 (35.7%)	18 (40.9%)	38 (38%)		
>10000	7 (12.5%)	12 (27.2%)	19 (19%)		
Religion					
Hindu	34 (60.7%)	17 (38.6%)	51 (51%)	12.03	0.001
Muslim	18 (32.1%)	24 (54.5%)	42 (42%)		
Christian/Others	4 (7.1%)	3 (6.8%)	7 (7%)		

Table 2 demonstrates important associations between obstetric/clinical factors and anemia. Although gravida status showed no significant association ($p = 0.19$), the trimester of pregnancy was significantly related to anemia, with more anemic women in the second trimester (55.3%) and fewer in the third trimester (19.6%) ($\chi^2 = 9.64$, $p = 0.008$). Iron supplementation showed a strong protective effect, as only 17.8% of anemic women reported taking supplements compared to 50% of non-anemic women, yielding a highly significant association ($\chi^2 = 14.24$, $p = 0.0002$). A history of anemia in

previous pregnancy was also significantly linked with current anemia, reported by 32.1% of anemic women versus 11.3% of non-anemic women ($\chi^2 = 7.52$, $p = 0.006$). Short birth intervals further increased anemia risk, with 33.9% of anemic women having intervals <1 year compared to 18.1% among non-anemic women, reflected in a significant chi-square value of 11.2 ($p = 0.003$). Overall, Table 2 highlights that trimester, iron supplementation, prior anemia, and short birth intervals are significant contributors to anemia during pregnancy.

Table 2: Association of Obstetric and Clinical Factors with Anemia, and Calculation of P-value Using Chi-Square Test					
Obstetric and Clinical Factors	Anemic (%)	Non-anemic (%)	Total (%)	Chi-square (χ^2) value	P value
Gravida					
Primigravida	22 (39.2%)	14 (31.8%)	36 (36%)	3.25	0.19
Second gravida	20 (35.7%)	17 (38.6%)	37 (37%)		
Multigravida	14 (25%)	13 (29.5%)	27 (27%)		
Trimester of current pregnancy					
1st trimester	14 (25%)	10 (22.7%)	24 (24%)	9.64	0.008
2nd trimester	31 (55.3%)	19 (43.1%)	50 (50%)		
3rd trimester	11 (19.6%)	15 (34.1%)	26 (26%)		
Iron supplementation (current pregnancy)					
Yes	10 (17.8%)	22 (50%)	32 (32%)	14.24	0.0002
No	46 (82.1%)	22 (50%)	68 (68%)		
History of anemia in previous pregnancy					
Yes	18 (32.1%)	5 (11.3%)	23 (23%)	7.52	0.006
No	38 (67.8%)	39 (88.6%)	77 (77%)		
Birth interval					
<1 year	19 (33.9%)	8 (18.1%)	27 (27%)	11.2	0.003
1–2 years	13 (23.2%)	14 (31.8%)	27 (27%)		
≥3 years	11 (19.6%)	10 (22.7%)	21 (21%)		
None	13 (23.2%)	12 (27.2%)	25 (25%)		

Table 3 shows a significant association between dietary factors and anemia, with higher anemia

prevalence observed among vegetarians (53.5%) compared to non-vegetarians (26.7%) and those

with mixed dietary patterns (19.6%), as confirmed by the chi-square value of 10.14 ($p = 0.006$). Poor intake of fruits and vegetables was also linked to anemia, with 53.5% of anemic individuals consuming them only weekly, whereas daily consumers had a lower anemia rate of 26.7%, yielding a chi-square value of 9.86 ($p = 0.01$). Additionally, consuming tea or coffee after meals showed a strong association

with anemia, with 50% of anemic participants reporting this habit compared to only 22.7% among non-anemic individuals ($\chi^2 = 12.44$, $p = 0.0004$). Overall, Table 3 highlights that dietary pattern, inadequate fruit and vegetable intake, and post-meal tea/coffee consumption significantly influence anemia risk.

Dietary Factors	Anemic (%)	Non-anemic (%)	Total (%)	Chi-square (χ^2) value	P value
Dietary pattern					
Vegetarian	30 (53.5%)	14 (31.8%)	44 (44%)	10.14	0.006
Non-vegetarian	15 (26.7%)	18 (40.9%)	33 (33%)		
Mixed	11 (19.6%)	12 (27.2%)	23 (23%)		
Intake of fruits and vegetables					
Daily	15 (26.7%)	19 (43.1%)	34 (34%)	9.86	0.01
Alternate days	11 (19.6%)	13 (29.5%)	24 (24%)		
Weekly	30 (53.5%)	12 (27.2%)	42 (42%)		
Tea/Coffee after meals					
Yes	28 (50%)	10 (22.7%)	38 (38%)	12.44	0.0004
No	28 (50%)	34 (77.2%)	62 (62%)		

Table 4 demonstrates a clear association between maternal anemia and increased feto-maternal complications, with chi-square analysis confirming statistically significant differences. Anemic mothers experienced higher rates of preterm labor (21.4% vs. 11.3%), severe postpartum hemorrhage, preeclampsia, and ICU admissions compared to non-anemic mothers, and the overall association for maternal complications was significant ($\chi^2 = 10.88$, $p = 0.01$).

Similarly, neonatal adverse outcomes were more frequent among anemic mothers, including low birth weight (17.8% vs. 11.3%), preterm birth, and fetal distress, with the relationship showing strong statistical significance ($\chi^2 = 15.21$, $p = 0.0004$). Overall, the data indicate that anemia substantially elevates the risk of both maternal and neonatal complications.

Maternal-Fetal Complications	Anemic (%)	Non-anemic (%)	Total (%)	Chi-square (χ^2) value	P value
Maternal complications during labor					
Preterm labor	12 (21.4%)	5 (11.3%)	17 (17%)	10.88	0.01
Severe postpartum hemorrhage	4 (7.1%)	1 (2.2%)	5 (5%)		
Preeclampsia	3 (5.3%)	1 (2.2%)	4 (4%)		
Placental abruption	0	0	0		
Hysterectomy	0	0	0		
Increased ICU admission	5 (8.9%)	2 (4.5%)	7 (7%)		
None	32 (57.1%)	35 (79.5%)	67 (67%)		
Neonatal adverse outcomes					
Low birth weight	10 (17.8%)	5 (11.3%)	15 (15%)	15.21	0.0004
Preterm birth	9 (16%)	4 (9%)	13 (13%)		
Fetal distress	3 (5.3%)	1 (2.2%)	4 (4%)		
Other	0	0	0		
None	34 (60.7%)	34 (77.2%)	68 (68%)		

Discussion

The reported prevalence rate of anaemia in the present study (58% among the pregnant women) was in line with other national and regional data. Similar

rates have been recorded in the National Family Health Survey (NFHS-4 and NFHS-5), which also recorded prevalence rates of 57% and 61% respectively, indicating the ongoing burden of maternal anemia in India (Rahman et al., 2021) [11] [12]. In

the same way, Biradar et al., (2023) [2] showed 57.6% prevalence whereas Noronha et al., (2012) [3] showed 56.7%. The fact that these studies have reached the same conclusion supports the long-standing difficulty in eliminating anemia despite the current efforts by the public health. Other localized studies in India and Africa have indicated relatively lower magnitudes, however, and this may indicate that regional socioeconomic disparities and access to health services are partially determining the epidemiology of anemia (Bansal et al., 2020) [10].”

One interesting observation during our research was that microcytic hypochromic anemia was the most prevalent (78.5) and the etiology was iron deficiency. It is consistent with the findings of Shradha Maka et al. (2017) [12] and Hansda et al. (2022) [13] as both researchers also reported iron-deficiency anemia as the prevalent peripheral smear pattern in antenatal women. This similarity supports the already identified knowledge which states that insufficient dietary intake, inadequate absorption, and augmented physiological needs of iron-deficit anemia during pregnancy play a significant role. The difference can be observed in the works of regions with superior food variety where the ratio of megaloblastic or normocytic anemia has been indicated to be higher as a result of improved iron consumption but poor folate or B12 supplementation.

Our results showing moderate anemia to be the most prevalent (61.4) then mild and severe are similar to those of Nigar and Ahmad (2020) [14] and Goyal and Pandey (2020) [15] who also found moderate anemia to be the most common among antenatal women. The trend is an indication of late antenatal care and low compliance with nutritional supplementation, which are prevalent in low-resource environments. Nevertheless, Sinha et al. (2021) [1] reported that mild anemia burden in a rural area with better resources was higher, which is why the access to early antenatal care could be important in anemia severity.

The present study had a serious role in sociodemographic factors in prevalence of anemia. The majority of anemic respondents were aged 2630 years as stated in the works by Bansal et al. (2020) [10] and Getahun et al. (2017) [16]. This trend is an indicator of high fertility rates, the reduction of birth intervals and the accumulating depletion of iron stores in women in their productive ages. Residence showed also a strong correlation, with 64.2 percent of cases among rural women, as reported by Hansda et al. (2022) [13] and Weldemariam (2018) [17] that considered higher anemia rates in the rural communities because of education, income, and access to nutrition and healthcare disparities. Although we have identified statistically significant correlations between anemia and demographic variables including education, socioeconomic status and occupation, opposite results were reported by Vindhya et al. (2019)

[4] and Biradar et al. (2023) [2], who reported no significant correlations between the variables. These differences could be due to the differences in the study populations, sample sizes, and the heterogeneity of rural-urban characteristics.

There were also strong links between obstetric factors. Most of the participants were at the second trimester as well as Bansal et al. (2020) [10] and Mulumbalah et al. (2014) [9], indicating the physiological theory of hemodilution and the high nutrient requirements in the mid-pregnancy. The fact that most of the anemic women were first-time mothers is in line with the findings of Khatana et al. (2020) [18] although some researchers have found higher anemia among multigravidas because of cumulative nutritional depletion. Birth interval of less than 1 year was strongly correlated with anemia as expected since this was also found in Cheema et al. (2016) [19], but Vindhya et al. (2019) [4] did not find any such correlation. The awareness of anemia and its ineffective compliance with Iron supplementation, as was the case among our respondents (67.1 and 78.5%), demonstrates the same patterns described by Pradhan et al. (2023) [20], which supports the influence of health education and counseling in preventing anemia.

Food habits were also a cause of anemia. Half of the anemic women were vegetarians, which is also in line with the results of Bansal et al. (2020) [10], Cheema et al. (2016) [19], and Weldekidan et al. (2018) [17], highlighting the low bioavailability of non-heme iron in plant food. The beneficial impact of tannins on iron absorption is also confirmed by the high percentage of women drinking tea or coffee after meals (41.4), which also corresponds to the results reported by Weldekidan et al. (2018) [17]. The results are indication that dietary advice during antenatal programs is necessary, particularly when the population is composed mainly of vegetarians.

Adverse fetomaternal outcomes were also related to anemia. We observed higher preterm labor (12.8%), ICU admission (7.1%), postpartum bleeding (5.7%), low birth weight, and prematurity rates, which were similar to Hansda et al. (2022) [13], Suryanarayana et al. (2017) [21], and Youssry et al. (2018) [22] studies. These parallels strengthen anemia as an important and preventable factor of poor pregnancy outcome. In spite of the fact that part of the available literature demonstrated greater connections with severe rather than moderate anemia, our results reveal that even moderate anemia may harm maternal and neonatal health.

Conclusion

The research demonstrate that obstetric, perinatal, sociodemographic, and dietary factors of anemia in pregnancy are interrelated, and anemia in pregnancy is a multifactorial issue with considerable clinical consequences. The socioeconomic disadvantage

was found to affect the prevalence of anemia through lower maternal age, rural location, low education levels, low income, and housewife status. Women in the second trimester, those not taking iron supplementation, those with a previous history of anemia, and those with shorter birth intervals were more prone to anemia clinically, which is indicative of cumulative nutritional stress and poor preventative care. Eating habits were also vital as vegetarian diets, low intake of fruits and vegetables, and post meals tea or coffee consumption were all found to increase anemia rates, and the quality of dietary products and absorption practices are crucial. Notably, anemia was highly linked with unfavorable maternal and neonatal outcomes, such as increased rates of preterm birth, post-partum complications and low birth weights or other problems of the neonatal conditions. In general, the results highlight the importance of holistic antenatal interventions, including nutrition, supplementation, education, and socioeconomic susceptibility to promote maternal outcomes and pregnancy outcomes.

References

1. Sinha A, Adhikary M, Phukan JP, Kedia S, Sinha T. A study on anemia and its risk factors among pregnant women attending antenatal clinic of a rural medical college of West Bengal. *J Family Med Prim Care*. 2021 Mar;10(3):1327-1331. doi: 10.4103/jfmpc.jfmpc_1588_20. Epub 2021 Apr 8. PMID: 34041173; PMCID: PMC8140236.
2. Biradar B, Arasu S, Ramesh N. Anemia burden in pregnancy and birth outcomes among women receiving antenatal care services from a secondary level hospital in South India: A record review. *J Family Med Prim Care* 2023;12:2352-8.
3. Noronha JA, Al Khasawneh E, Seshan V, Ramasubramanian S, Raman S. Anemia in Pregnancy—Consequences and Challenges: A Review of Literature. *J South Asian Feder Obst Gynae* 2012;4(1):64-70
4. Vindhya J, Nath A, Murthy GV, Metgud C, Sheeba B, Shubhashree V, Srinivas P. Prevalence and risk factors of anemia among pregnant women attending a public-sector hospital in Bangalore, South India. *Journal of family medicine and primary care*. 2019 Jan 1;8(1):37-43.
5. Dutta DC. Text book of obstetrics: including perinatology and contraception. New central book agency; 2004.
6. Kaushal S, Priya T, Thakur S, Marwaha P, Kaur H. The etiology of anemia among pregnant women in the hill state of Himachal Pradesh in North India: a cross-sectional study. *Cureus*. 2022 Jan 20;14(1).
7. Kozuma S. Approaches to anemia in pregnancy. *JMAJ*. 2009;52(4):214-8.
8. Tandon R, Jain A, Malhotra P. Management of iron deficiency anemia in pregnancy in India. *Indian Journal of Hematology and Blood Transfusion*. 2018 Apr;34(2):204-15.
9. Mulambalah Chrispinus Siteti, Siamba Donald Namasaka, Ogotu Philip Ariya, Siteti Darwin Injete, Wekesa Antony Wanyonyi. Anaemia in Pregnancy: Prevalence and Possible Risk Factors in Kakamega County, Kenya. *Science Journal of Public Health*. Vol. 2, No. 3, 2014, pp. 216-222. doi: 10.11648/j.sjph.20140203.23
10. Bansal R, Bedi M, Kaur J, Kaur K, Shergill HK, Khaira HK, et al. Prevalence and factors associated with anemia among pregnant women attending antenatal clinic. *Adesh Univ J Med Sci Res* 2020;2(1):42-8.
11. Rahman MA, Rahman MS, Aziz Rahman M, Szymlek-Gay EA, Uddin R, Islam SM. Prevalence of and factors associated with anaemia in women of reproductive age in Bangladesh, Maldives and Nepal: Evidence from nationally-representative survey data. *Plos one*. 2021 Jan 7;16(1):e0245335.
12. Maka SS, Tondare SB, Tondare MB. Study of impact of anemia on pregnancy. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 2017 Nov 1;6(11):4847-51.
13. Hansda R, Tirkey S, Trivedi K, Singh P, Prakash J. Study on types of anaemia and foetomaternal outcome in antenatal patients. *J Family Med Prim Care* 2022;11:3040-4.
14. Nigar A, Ahmad A. Prevalence of anemia in pregnancy at booking: A retrospective study at a tertiary care centre in Lucknow India. *Int J Reprod Contracept Obstet Gynecol* 2020;9:4585-9
15. Goyal N, Pandey H. Study on prevalence of anemia in pregnant women in labour. *Int J Reprod Contracept Obstet Gynecol* 2020;9:2725-8.
16. Getahun W, Belachew T, Wolide AD. Burden and associated factors of anaemia among pregnant women attending antenatal care in southern Ethiopia: Cross sectional study. *BMC Res Notes* 2017;10:276.
17. Weldemariam TB. Prevalence and factors associated with anemia among pregnant women attending antenatal care in Shallaworeda, Warsi zone, Oromia region. *Int J Green Pharm* 2018;12:253.
18. Khatana A, Verma S, Sehra RN, Yadav K. Moderate to severe maternal anaemia in pregnancy and its impact on perinatal outcome in tertiary care hospital. *Int J Reprod Contracept Obstet Gynecol* 2020;9:1487-92.
19. H.K. Cheema, Baljit Singh Bajwa, Kulbir Kaur, Harshdeep Joshi. Prevalence and possible risk factors of anaemia in different trimesters of pregnancy. *International Journal of Contemporary Medical Research* 2016;3(4):1194-1197.

20. Pradhan S, Karna T, Singha D, Bhatta P, Rath K, Behera A. Prevalence and risk factor of anemia among pregnant women admitted in antenatal ward in PBMH Bhubaneswar, Odisha. *J Family Med Prim Care*. 2023 Nov;12(11):2875-2879. doi: 10.4103/jfmpe.jfmpe_558_23. Epub 2023 Nov 21. PMID: 38186780; PMCID: PMC10771138
21. Suryanarayana R, Chandrappa M, Santhuram AN, Prathima S, Sheela SR. Prospective study on prevalence of anemia of pregnant women and its outcome: A community based study. *J Family Med Prim Care* 2017; 6:739-43.
22. Youssry, M., Radwan, A., Gebreel, M. and Patel, T. (2018) Prevalence of Maternal Anemia in Pregnancy: The Effect of Maternal Hemoglobin Level on Pregnancy and Neonatal Outcome. *Open Journal of Obstetrics and Gynecology*, 8, 676-687. doi: 10.4236/ojog.2018.87072.