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PREVALENCE OF ANAEMIA AND ITS ASSOCIATED FACTORS AMONG PREGNANT WOMEN IN THE RURAL AREAS OF PURBA MEDINIPUR DISTRICT OF WEST BENGAL, INDIA

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Abstract: Anaemia in pregnancy exists worldwide. Anaemia in pregnancy is a public health problem in developing countries like India. This cross-sectional study was conducted in the rural areas of Purba Medinipur district, West Bengal, India from July 2020 to June 2022. A total of 358 pregnant women were included in this case study. We used the Odds Ratio (OR) with 95% Confidence Interval (CI) to examine the strength of the association between anaemia and exposure variables and the association between maternal anaemia and adverse pregnancy outcomes. The study found 68.16% of pregnant women to be anaemic in the district under study whereas the percentage of anaemic pregnant women in West Bengal is 62.3%. The study found that 63.93%, 31.15% and 4.92% of pregnant women suffer from mild, moderate and severe anaemia respectively in Purba Medinipur district. The logistic regression analysis revealed that maternal age, educational status, occupation, monthly family income, socio-economic status, gravida, interpregnancy interval, pica habits, antenatal care visits, meals frequency/ day during pregnancy, and history of food insecurity within past 12 months were significantly associated with anaemia among the pregnant women at p value ≤ 0.05. Maternal anaemia is significantly associated with poor pregnancy outcomes like preterm and LBW. It is highly recommended that awareness and education programs regarding the regular intake of iron-folate supplements, nutritious diet and iron-rich foods, regular antenatal care visits, hygienic practices and birth spacing in pregnancy should be started at grass-root levels to prevent anaemia in pregnant women.

Index Terms **- Prevalence, Anaemia, Pregnant, gravida, pica habits, ANC, LBW, Preterm**

I. INTRODUCTION

Anaemia is one of the commonest etiology related to pregnancy in the developing World. Anaemia in pregnant women is a global health problem. Global data shows that 56% of pregnant women have anaemia in low and middle-income countries (Black et al., 2013). Anaemia is one of the most common blood disorders during pregnancy and it affects approximately 51% of pregnant women in India (Dutta, 2021) and 38% of pregnant women globally (Stevens et al., 2013). Anaemia is a condition in which a low red blood cell (RBC) count or insufficient RBC's oxygen carrying capacity to meet physiologic needs or a haematocrit value (the proportion of blood volume that is RBCs), or a low haemoglobin concentration (the oxygen-carrying protein of RBCs) are generally found (Beutler and Waalen, 2006). For pregnant women, a haemoglobin concentration of less than 11.0g/dl (Hematocrit;{Hct}<33%) in the first trimester of pregnancy and a haemoglobin concentration of less than 10.5 0r 11.0g/dl (Hematocrit;{Hct}<32% or 33%) in the second or third trimester of pregnancy (depending on the guideline used) is considered anaemia (Pavord et al., 2020; CDC, 1998; WHO, 2011; ACOG, 2021; Milman et al., 2000).according to WHO anaemia in postpartum females is defined as haemoglobin concentration remains less than 10.0g/dl (WHO, 2011). The causes of anaemia in pregnancy in developing countries are multifactorial. These include the acute or chronic loss of RBCs, increased destruction of RBCs, decreased production of RBCs, increased fetal requirement, micronutrient deficiencies of iron, folic acid, and vitamins A and B_{12}, or a combination of all these factors (James, 2021). Increased demand and diminished intake of food, excess demand of multigravida women, intake of poor nutritious food and altered metabolism along with the background characteristics like low socioeconomic status, illiteracy, maternity in early age and a minimum interval of less than 2 years in between two pregnancies may be the underlying factors associated with prevalence of anaemia during pregnancy (Sinha et al., 2021). Dilutional anaemia is considered part of normal physiology in pregnancy (Al-Khaffaf et al., 2020). Few studies reported that anaemia in pregnancy has negative health effects on the mother as well as on the child. The maternal negative health effects include fatigue, impaired immune function, poor work capacity, increased risk of cardiac diseases, and mortality (Black et al., 2013; Mbule et al., 2013; Stevens et al., 2013). The negative health effects for the child include adverse outcomes of fetal, neonatal and childhood such as perinatal mortality, preterm birth, low birth weight (LBW) babies, stillbirth, early neonatal death and small for gestational age newborns (Jessani et al., 2021; Black et al., 2013; Mbule et al., 2013; Stevens et al., 2013). Maternal anaemia is also associated with behavioural abnormalities and neurodevelopmental disorders in the child (Wiegersma et al., 2019). Various studies also showed an association between anaemia and maternal mortality (Black et al., 2013; Shi et al., 2022; Daru et al., 2018). Apart from maternal mortality, anaemia in pregnancy may result in fetal growth retardation, low birth weight (LBW), stillbirth, and neonatal death (Shi et al., 2022; Nair et al., 2016; Figueiredo et al., 2018; Finkelstein et al., 2020). The reasons include maternity at low age, lack of education, low monthly family income, low socio-economic status, inadequate antenatal care visits, lack in dietary intake of iron and folic acid, history of food insecurity, lack of adequate meals/ day, short spacing of multiple pregnancies, excessive bleeding during labour, etc. (Sinha et al., 2021; Tolentino and Friedman, 2007; Azhar et al., 2021; Gebre and Mulugeta, 2015).

Women in the reproductive age group are more vulnerable to anaemia particularly in developing countries (Zerfu and Ayele, 2013). Hence, the aim of this study was for determining the prevalence, risk factors, and adverse perinatal outcomes of anaemia among pregnant women in the Purba Medinipur district of West Bengal. Another aims to find out the association of anaemia among pregnant women with different socio-demographic factors.

II. METHODS AND MATERIALS

2.1 STUDY DESIGN

This cross-sectional study was conducted in the rural areas of Purba Medinipur district, West Bengal, India from July 2020 to June 2022. This study enrolled pregnant women and followed them during the entire pregnancy and 7 days after delivery. The patients were selected randomly and a consent form was filled by each participant before enrolment in the study.

2.2 INCLUSION AND EXCLUSION CRITERIA

This study population included all pregnant women attending routine care at the health care centre and clinics in Purba Medinipur district between July 2020 and June 2022 and having their haemoglobin (Hb) report and filling out the consent form. A total of 379 pregnant women were enrolled in this study.

This study excluded all pregnant women who reported their shifting of residence before delivery and who did not have haemoglobin (Hb) report with them. Unwilling pregnant women who did not consent were excluded from the study.

2.3 STUDY PROCEDURES

Pregnant women were informed about the aims of the study and follow-up schedule and those pregnant women agreeing to participate gave a signed consent. The study was conducted through face-to-face interviews using a questionnaire method by trained student assistants. The medium of language for interviews was Bengali. The collected information included socio-demographic characteristics, occupation and economic status, reproductive health history, history of food insecurity, iron supplementation, number of pregnancies, pregnancy interval, pica habits, number of meals/ day and frequency of antenatal care visits etc. After the completion of individual interviews, copies of clinical examination reports were collected. A total of 379 pregnant women were enrolled in this study, but the analysis was possible on 358 women finally who had complete information.

2.4 CATEGORIZATION OF VARIABLES

A pregnant woman was considered anaemic if her haemoglobin was <11 g/dl (WHO, 2011). WHO classified the severity of anaemia in adult females at sea levels that is non-anaemia as haemoglobin concentration 11 g/dl or higher in pregnant women, and mild anaemia as haemoglobin concentration 10-10.9 g/dl in pregnant women, and moderate anaemia as haemoglobin concentration 7-9.9 g/dl in pregnant women, and severe anaemia as haemoglobin concentration lower than 7 g/dl in pregnant women (WHO, 2011). The age of participants which was collected as a numerical variable was categorized (as 15-24, 25-34, and 35-49), as well as income per month ≤9307 INR, 9308-27882 INR, 27883-46474INR, 46475-69534INR, 69535-92950INR, 92951-185894INR, and ≥185,895INR) (Sood and Bindra, 2022), being gravida (first, second, third, or more percentages), frequency of antenatal care visits (1, 2-3, and 4+), pregnancy interval (≤24months and >24 months), gestational age at delivery (<37 and ≥37), and the number of meals/ day (2 or less, and 3 or more meals/ day). Preterm delivery was categorized as <37 weeks of gestation age, low birth weight categorized as <2500 grams and early neonatal death is the death during the first 7 days of life (UNICEF, WHO, The World Bank, 2014; Stephen et al., 2018).

2.5 DATA PROCESSING AND STATISTICAL ANALYSIS

In this study, SPSS version 20 was used to analyse the data. Descriptive statistics were used to summarize and present the data. Mean with respective measures of dispersion was used for numerical variables. We used the Odds Ratio (OR) with 95% Confidence Interval (CI) to examine the strength of the association between anaemia and exposure variables (socio-demographic, economic, nutrition, and reproductive health characteristics) and the association between maternal anaemia and adverse pregnancy outcomes (LBW, preterm, stillbirth and early neonatal death). The chi-square test was used to show any association between categorical variables and the severity of anaemia. A p-value of less than 0.05 was typically considered a statistically significant result.

III. RESULTS

Table 1: Logistic regression analysis of factors influencing anaemia in pregnancy (N=358)

	Variable name	Number (%)	Anaemia (Hb<11g/dl) No. (%)	Chi square	OR (95% CI)	*P* value
Age (years)	<25 years	156 (43.6%)	125 (80.13%)	18.840 (0.000)	2.81 (1.73-4.55)	0.000
	≥25 years	202 (56.4%)	119 (58.91%)		1	
Level of education	Secondary	74 (20.7%)	58 (78.38%)	6.690 (0.035)	2.12 (1.14-3.93)	0.018
	Higher Secondary	75 (20.9%)	54 (72.00%)		1.5 (0.84-2.67)	0.169
	Graduate/ Master	209 (58.4%)	132 (63.16%)		1	
Occupation	Homemaker	259 (72.3%)	193 (74.52%)	16.834 (.000)	1	

	Employed/Business	99 (27.7%)	51 (51.52%)		0.36 (0.22-0.59)	0.000
Monthly income	<Rs. 20000.00	61 (17.0%)	52 (85.25%)	15.844 (0.000)	3.91 (1.81-8.43)	0.001
	Rs. 20000.00-50000.00	121 (33.8%)	87 (71.90%)		1.73 (1.05-2.85)	0.031
	> Rs. 50000.00	176 (49.2%)	105 (59.66%)		1	
Socio-economic status	Upper lower (IV)	147 (41.1%)	112 (76.19%)	14.848 (0.001)	2.88 (1.66-5.01)	0.000
	Lower middle (III)	116 (32.4%)	82 (70.69%)		2.17 (1.23-3.83)	0.007
	Upper middle (II)	95 (26.5%)	50 (52.63%)		1	
Gravida	First pregnancy	164 (45.8%)	125 (76.22%)	17.004 (0.000)	1	
	Second pregnancy	177 (49.4%)	114 (64.41%)		0.56 (0.35-0.91)	0.018
	Third pregnancy/above	17 (4.7%)	5 (29.41%)		0.13 (0.04-0.39)	0.000
Interpregnancy interval	<24 months	85 (42.7%)	64 (75.29%)	13.426 (.000)	3.05 (1.65-5.63)	0.000
	≥24 months	114 (57.3%)	57 (50.00%)		1	
Antenatal care visit current	1 visit	40 (11.17%)	38 (95.00%)	19.598 (.000)	10.17 (2.4-43.1)	0.002
	2-3 visits	37 (10.34%)	23 (62.16%)		0.88 (0.43-1.79)	0.723
	≥4 visits	281 (78.49%)	183 (65.12%)		1	
Pica habits	No	295 (82.4%)	187 (63.39%)	20.824 (0.000)	1	
	Yes	63 (17.6%)	57 (90.48%)		5.49 (2.29-13.15)	0.000
Number of meals taken per day	≤2 meals/ day	53 (14.8%)	49 (92.45%)	16.921 (0.000)	6.91 (2.43-19.66)	0.000
	≥3 meals/ day	305 (85.2%)	195 (63.93%)		1	
History of Food Insecurity within past 12 months	No	281 (78.5%)	183 (65.12%)	5.864 (0.015)	1	
	Yes	77 (21.5%)	61 (79.22%)		2.04 (1.12-3.73)	0.020

In this study, 358 pregnant women were included. The socio-demographic and reproductive health characteristics of the pregnant women were shown in Table 1. The age of the participants ranged from 15 to 49 years with mean age of 24.38 (SD 4.63) years. The majority of the study participants belonged to the 25–34 years age group (53.63%), followed by those in the age range of 15-24 years (43.58%) and those in the age range of 35-49 years (2.79%). The majority of the participants were of upper-lower (IV) socio-economic status (41.1%), followed by those of lower-middle (III) socio-economic status (32.4%) and those of upper-middle (II) socio-economic status (26.5%). In this study 72.3% of participants were homemakers, 22.4% were employed and 5.3% were business women. In the present study, 17.0% of participants had an income per month less than 20000 Indian Rupee (INR) while 33.8% of participants had an income per month of 20000.00-50000.00 Indian Rupee (INR) and 49.2% of participants had an income per month more than 50000.00 Indian Rupee (INR). In this study, 54.2% of participants were multigravida while 45.8% were primigravida. The majority (78.49%) of the pregnant women had four or more times antenatal care visits, 10.34% of pregnant women had 2-3 times antenatal care visits and 11.17% of pregnant women had single-time antenatal care visits. In this study, 100% of participants reported they have received iron

supplementation during the current pregnancy but the frequency was not regular (data not shown). Most of the women (57.3%) reported an interpregnancy interval of ≥24 months while 42.7% of women were of <24 months interpregnancy interval.

Table 1 shows the association between anaemia and several predictor variables. In this study, the logistic regression analysis revealed that maternal age, educational status, occupation, monthly family income, socio-economic status, gravida, interpregnancy interval, pica habits, antenatal care visits, meals frequency/ day during pregnancy, and history of food insecurity within past 12 months were significantly associated with anaemia among the pregnant women. Women <25 years of age had 2.81 times higher prevalence of anaemia than those ≥25 years of age, and the difference was statistically significant. Women with secondary education or below secondary education had 2.12 times higher prevalence of anaemia during pregnancy than that of women with graduation or master's degrees and the difference was statistically significant. Liability of anaemia among employed and business women was lower than among homemaker women which were statistically significant. Women belonging to the low-income families (<Rs. 20000.00) had 3.91 times higher tendency of anaemia during pregnancy than those women belonging to high-income families (> Rs. 50000.00). Women with upper-lower and lower-middle Socio-economic status had a higher prevalence of anaemia than women with upper-middle socioeconomic status and the difference was statistically significant. A significant association of anaemia with gravida was found to be 76.22%, 64.41% and 29.41% for the first pregnancy, second pregnancy, and third pregnancy or further. It was statistically significant. Women who reported their interpregnancy interval having <24 months had 3.05 times higher prevalence of anaemia than those who have ≥24 months, and the difference was statistically significant. Women who attended ANC visits 4 or more times had lower prevalence of anaemia than those who attended 2-3 visits and single visit, and the difference was statistically significant. The tendency of anaemia among women who have pica habits had 5.49 times higher. All pregnant women reported having received iron supplementation in current pregnancy from Primary Health Centers in rural areas for National Nutritional Anaemia Prophylaxis Program (NNAPP) in India (data not shown). All pregnant women were tested for HIV status at their first antenatal care visit and all pregnant women were HIV-negative in this study (data not shown). In this study, no women were found who consume alcohol during pregnancy (data not shown).

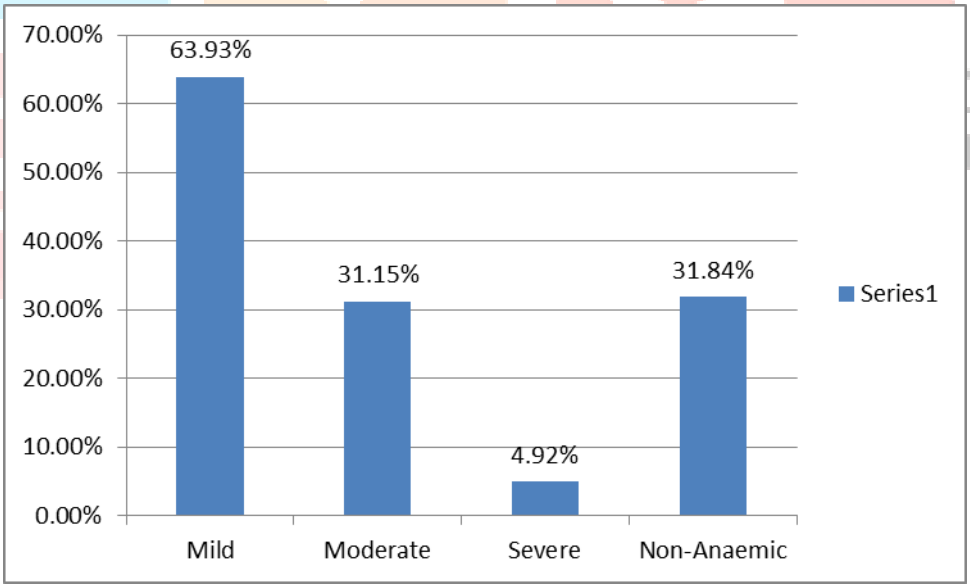

Figure 1: Severity of anaemia in pregnancy in Purba Medinipur district

In this study, it was found that among the 358 pregnant women, 68.16% (244) suffered from anaemia. Among 244 anaemic pregnant women 63.93 (156) had mild anaemia, 31.15% (76) had moderate anaemia and 4.92 (12) had severe anaemia while the rest had no anaemia (Figure 1).

Table 2: Pregnancy outcomes by anaemia status (N=358).

Variables	Number (%)	Anaemia (Hb<11g/dl) n (%)	p value	OR (95th CI)	p
Preterm delivery					

No	312 (87.15%)	205 (84.78%)	6.723	1	
Yes	46 (12.85%)	39 (65.71%)		2.91 (1.26-6.72)	0.012
Low birth weight (LBW) (<2500gms)					
No	291 (81.28%)	191 (79.1%)	4.552 (0.05)	1	
Yes	67 (18.72%)	53 (65.64%)		1.98 (1.05-3.75)	0.035
Stillbirth					
No	355 (99.16%)	242 (68.45%)	1.377 (NS)	1	
Yes	3 (0.84%)	3 (100%)		3.23 (0.17-63.14)	0.439
Early neonatal death					
No	357 (99.72%)	243 (68.07%)	0.469 (NS)	1	
Yes	1 (0.28%)	1 (100%)		1.41 (0.06-34.9)	0.833

At delivery, there were 46 preterm birth (12.85%), 67 low birth weight newborns (18.72%), and 3 (0.84%) stillbirth cases. Only one infant died within the first 7 days (0.28%). A significant association was found between maternal anaemia and preterm birth and LBW in Purba Medinipur district (Table 2). No association was found between anaemia and stillbirth and early neonatal death in Purba Medinipur district (Table 2).

IV. Discussion

Anaemia is a major health issue during pregnancy in India. National Family Health Survey-5 found the prevalence of anaemia in pregnant women of the age group between 15–49 years to be 62.3% in West Bengal (NFHS-5, 2021). This result is nearly identical to our study, where we found it to be 68.16%; which is less than another study (90%) done in West Bengal by Sinha et al., (2021). The prevalence of anaemia obtained in this study is higher compared to 51% as reported in a review of recent studies conducted in India (Dutta, 2021) while it is lower compared to 87% as reported in 2009 (Kalaivani, 2009). Sinha et al. (2021) showed the prevalence of anaemia in pregnancy was high because their participants were mainly poor from tribal populations with very low socio-economic status. Several studies have been conducted in different low- and middle-income countries of the world to determine the prevalence of anaemia among pregnant women. In the African continent, a few recent studies found that the prevalence of anaemia in pregnant women was as low as 25.8% to 37.6% (Mahamoud et al., 2020; Omete et al., 2020). A study conducted in Bangladesh reported a prevalence of 57.9% among pregnant women (Rahman et al., 2018), whereas another study done in Nigeria showed a prevalence of 49.9% among pregnant women (Adegoke et al., 2020). This variation may be due to various socio-demographic, nutritional and comorbid conditions and geographical variations.

Anaemia is more prevalent among pregnant women in rural areas. A study conducted in rural India found that the prevalence of anaemia among pregnant women was 21.7% (Kalaivani et al. (2018), which is less than this study (68.16%) done in West Bengal. Another study done in rural Bangladesh reported that the prevalence of anaemia among pregnant women was 23.6% (Ahmed et al. (2021). This study found that 63.93% had mild anaemia, 31.15% had moderate anaemia and 4.92% had severe anaemia in the study area which was unlike Sinha et al. (2021) who found 29.0% mild anaemia, 60.5% had moderate anaemia and lower severe anaemia. Few studies done in Aurangabad city and New Delhi in India found that the prevalence of anaemia increases with lower per capita income, which is consistent with our study (Lokare et al., 2012; Toteja et al., 2006). A study done in Ethiopia showed that pregnant women with low income were more anaemic than pregnant women with higher income (Bekele et al., 2016; Gedefaw et al., 2015). This result is consistent with the present study. Lower family income leads to limited access to essential nutrients and is associated with poor dietary habits that might lead to anaemia during pregnancy. Though the present study showed that all the participants under the study took their iron and folic acid tablets, the majority of the participants did not take iron and folic acid tablets regularly. The reason for this might be the participants who take their iron-folate tablets regularly which can help them to increase their haemoglobin level and prevent anaemia during pregnancy period. This result was consistent with other studies

(Gebremedhin et al., 2014; Alene and Dohe, 2014; Bisoi et al., 2011; Demmouche et al., 2011). In this study pregnant women with graduation or master's degrees were less likely to be anaemic compares to their counterparts. A study done in Ethiopia reported prevalence of anaemia was found high among pregnant women who had no education (Gebre and Mulugeta, 2015). Level of education plays an important role in reducing the severity of anaemia in several studies (Jufar and Zewde, 2014; Bisoi et al., 2011). Women who have higher education can be aware of anaemia during pregnancy and take some preventive measures like eating high-iron foods and taking adequate iron and folic acid supplements (Gebre and Mulugeta, 2015). Women have some level of education and attend antenatal care visits for 4 or more recommended visits during pregnancy. Antenatal care visit in current pregnancy plays an important role in reducing maternal anaemia. Antenatal care visits with a prescription for proper diet, and regular intake of iron and folic acid supplements have reduced the severity of anaemia remarkably in the present study which is consistent with another study (Mangla et al. 2016). In this study, the prevalence of anaemia was 6.91 times higher among the study participants having a meal frequency of less than or equal to 2 times per day as compared to that of participants who had a meal frequency of more than or equals to 3 times per day. The pregnant women having a meal frequency of less than or equal to 2 times per day were at 6.91 times higher risk of developing anaemia as compared to pregnant women who had a meal frequency of more than or equals to 3 times per day. This result is consistent with other studies (Abriha et al., 2014; Obse et al., 2013). This might be the reason that pregnant women need more energy and nutrients which should be fulfilled by increasing the frequency of meals per day. A high prevalence of anaemia in pregnancy may be due to heavy menstrual bleeding, multiple pregnancies, or multiple abortions. Thus, this study had shown a significant association of gravida with the severity of anaemia. In view of the low dietary deficiency of iron and folic acid, and the high prevalence of anaemia among pregnant women, India started the National Nutritional Anaemia Prophylaxis Program (NNAPP) to prevent anaemia among pregnant women (Lokare et al., 2012). Through this program, 100 mg of ferrous iron and 500 mcg of folic acid tablets were distributed to pregnant women through Primary Health Centers in rural areas. Despite these preventive measures, the prevalence of anaemia in pregnant women is still high in India (Dutta, 2021) and 68.16% in Purba Medinipur District. In this study, we found that the majority of pregnant women cannot consume iron and folic acid tablets regularly. National iron supplementation programs have failed to provide regular iron and folic acid supplementation to pregnant women due to a lack of compliance or low efficacy of government policies. The high prevalence of anaemia can be caused by a lack of motivation and education toward the utility of iron and folic acid supplementation.

In this study, the occurrence of negative birth outcomes was LBW (18.72%), preterm delivery (12.85%), stillbirth (0.84%), and early neonatal death (0.28%). A survey conducted by National Family Health Survey (NFHS-5, 2019-21) found that the prevalence of LBW in India was 17.06% (Singh et al., 2023) which is nearly identical to the result of the present study (18.72%). Anaemia is one of the major variables which were identified as a modifiable factor to reduce the risk of LBW (Singh et al., 2023). The preterm birth (12.85%) is found to be higher than in other studies reported from Tamil Nadu (5.6%), Maharashtra (6.1%), and Gujarat (9.0%), (Ahankari et al., 2017; Soundarajan et al., 2016; Carcavalli et al., 2020). A survey conducted by National Family Health Survey found the prevalence of neonatal death in India was 2.75% (NFHS-5, 2019-21), however, it was higher than reported in this study (0.28%). The prevalence of stillbirth in India was 0.9% during 2019-21 (Kuppusamy et al., 2023) which is nearly identical to the result of the present study (0.84%). The prevalence of stillbirth was higher among women in rural and women with no education (Kuppusamy et al., 2023). In a recent study, it was found that severe anaemia was the major cause of stillbirth in the Indian population (McClure et al., 2022).

V. CONCLUSION

The findings in this study demonstrate that there is a moderate prevalence of anaemia among pregnant women in Purba Medinipur district. Anaemia continues to be a serious public health issue in India. The etiology of maternal anaemia in this study is multifactorial and varies as per the age of the mother, socioeconomic status, parity, birth spacing <2 years, poor antenatal care visits, educational status, iron supplementation, meal frequency/ day, and rural residence in the study area. Anaemia in pregnancy has been considered harmful to the life of the mother along with the baby. The government of India has strengthened different strategies to reduce the prevalence of anaemia in pregnancy. The strategies in pregnancy include screening for anaemia during pregnancy and treatment and giving a combination of iron and folic acid (FeFo) supplements. Though the Government of India implemented many strategies, knowledge of the risk factors and compliance of pregnant women are very much essential to reduce anaemia in pregnancy and its consequences. It is recommended that campaigns are to be organized for the promotion of health and prevention of diseases at places of contact with pregnant women. It is highly recommended that awareness

and education programs regarding the regular intake of iron and folic acid supplements, nutritious diet, and iron-rich foods, regular antenatal care visits, hygienic practices, and awareness regarding the minimum gap in between two pregnancies should be generated at grass-root levels to prevent anaemia in the pregnant women. National health programs for mothers and children should be commenced not only by the Government of India but also by other community-level organizations including hospitals, NGOs, volunteers, etc. They have to work together to achieve this.

VI. Conflict of interest

The author declares that there are no conflicts of interest regarding the publication of this paper.

VII. Acknowledgement

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REFERENCES

[1] Abriha, A., Yesuf, M.E., and Wassie, M.M. 2014. Prevalence and associated factors of anemia among pregnant women of Mekelle town: a cross sectional study. BMC research notes, 7(1): 1-6.

[2] Addis Alene, K. and Mohamed Dohe, A. 2014. Prevalence of anemia and associated factors among pregnant women in an urban area of Eastern Ethiopia. Anemia, 2014.

[3] Adegoke, O.A., Adeyemi, A.B., Adegoke, O.A., Adeyemi, A.B., and Arowojolu, A.O. 2020. Prevalence and predictors of anaemia among pregnant women in Nigeria: a multi-site cross-sectional survey. BMC Pregnancy and Childbirth, 20(1): 206.

[4] Ahankari, A., Bapat, S., Myles, P., Fogarty, A. and Tata, L. 2017. Factors associated with preterm delivery and low birth weight: a study from rural Maharashtra, India. F1000Research, 6: 72.

[5] Ahmed, T., Rahman, M.M., Islam, M.M., Islam, M.R. and Al-Mamun, M.A. 2021. Prevalence and determinants of anemia among pregnant women attending antenatal care services in a rural area of Bangladesh. BMC Pregnancy and Childbirth, 21(1): 1-8.

[6] Al-Khaffaf, A., Frattini, F., Gaiardoni, R., Mimiola, E., Sissa, C. and Franchini, M. 2020. Diagnosis of anemia in pregnancy. Journal of Laboratory and Precision Medicine, 5(9): 1-5.

[7] American College of Obstetricians and Gynecologists. 2021. Anemia in pregnancy: ACOG practice bulletin, number 233. Obstetrics and gynecology, 138(2): e55-e64.

[8] Azhar, B.S., Islam, M.S. and Karim, M.R. 2021. Prevalence of anemia and associated risk factors among pregnant women attending antenatal care in Bangladesh: a cross-sectional study. Primary Health Care Research and Development, 22: e61.

[9] Bekele, A., Tilahun, M. and Mekuria, A. 2016. Research Article. Prevalence of Anemia and Its Associated Factors among Pregnant Women Attending Antenatal Care in Health Institutions of Arba Minch Town, Gamo Gofa Zone, Ethiopia: A Cross-Sectional Study. Anemia, 1-9.

[10] Beutler, E. and Waalen, J. 2006. The definition of anemia: what is the lower limit of normal of the blood hemoglobin concentration? Blood, 107(5): 1747-1750.

[11] Bisoi, S., Haldar, D., Majumdar, T.K., Bhattacharya, N., Sarkar, G.N. and Ray, S.K. 2011. Correlates of anemia among pregnant women in a rural area of West Bengal. The Journal of Family Welfare, 57(1): 72-78.

[12] Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., De Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R. and Uauy, R. 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. The lancet, 382(9890): 427-451.

[13] Carcavalli, L., Rocha, I.A., Valentim, A.F., Penido, M.G., Parlato, E.M., Pordeus, I.A. and Serra-Negra, J.M. 2020. Difference of socioeconomic factors among mothers of preterm and full-term infant. Pesquisa Brasileira em Odontopediatria e Clínica Integrada, 20.

[14] Centers for Disease Control and Prevention. 1998. Recommendations to prevent and control iron deficiency in the United States. Morbidity and Mortality Weekly Report, 47(RR-3): 1–29.

[15] Centers for Disease Control and Prevention. 1998. Recommendations to prevent and control iron deficiency in the United States. MMWR Recomm Rep. 47(RR-3): 1–29.

[16] Daru, J., Zamora, J., Fernández-Félix, B.M., Vogel, J., Oladapo, O.T., Morisaki, N., Tunçalp, Ö., Torloni, M.R., Mittal, S., Jayaratne, K. and Lumbiganon, P. 2018. Risk of maternal mortality in women with severe anaemia during pregnancy and post partum: a multilevel analysis. The Lancet Global Health, 6(5): e548-e554.

[17] Demmouche, A., Khelil, S. and Moulessehoul, S. 2011. Anemia among pregnant women in the Sidi Bel Abbes Region, West Algeria: An Epidemiologic Study. Journal of Blood Disorders and Transfusion, 2(3): 1-6.
[18] Dutta, A. 2021. A systematic review of the burden of anemia in pregnant women–Indian perspective. National Journal of Physiology, Pharmacy and Pharmacology, 11(11): 1207-1215.
[19] Figueiredo, A.C., Gomes-Filho, I.S., Silva, R.B., Pereira, P.P., Mata, F.A.D., Lyrio, A.O., Souza, E.S., Cruz, S.S. and Pereira, M.G. 2018. Maternal anemia and low birth weight: a systematic review and meta-analysis. Nutrients, 10(5): 601.
[20] Finkelstein, J.L., Kurpad, A.V., Bose, B., Thomas, T., Srinivasan, K. and Duggan, C. 2020. Anaemia and iron deficiency in pregnancy and adverse perinatal outcomes in Southern India. European journal of clinical nutrition, 74(1): 112-125.
[21] Gebre, A. and Mulugeta, A. 2015. Prevalence of anemia and associated factors among pregnant women in North Western zone of Tigray, Northern Ethiopia: a cross-sectional study. Journal of nutrition and metabolism, 2015: 1-7.
[22] Gebremedhin, S., Enquselassie, F. and Umeta, M. 2014. Prevalence and correlates of maternal anemia in rural Sidama, Southern Ethiopia. African journal of reproductive health, 18(1): 44-53.
[23] Gedefaw, L., Ayele, A., Asres, Y. and Mossie, A. 2015. Anaemia and associated factors among pregnant women attending antenatal care clinic in Walayita Sodo town, Southern Ethiopia. Ethiopian journal of health sciences, 25(2): 155-164.
[24] International Institute for Population Sciences (IIPS) and ICF. 2023. National Family Health Survey (NFHS-5), 2019-21: India, Volume 1. Vol. 21. Mumbai: IIPS; 2021. International Institute for Population Sciences - IIPS/India, Icf. India DHS, 2019-21 - Final Report (English). India: DHS, 2019-21.
[25] James, A.H. 2021. Iron Deficiency Anemia in Pregnancy. Obstetrics and Gynecology. 138: 4.
[26] Jessani, S., Saleem, S., Hoffman, M.K., Goudar, S.S., Derman, R.J., Moore, J.L., Garces, A., Figueroa, L., Krebs, N.F., Okitawutshu, J. and Tshefu, A. 2021. Association of haemoglobin levels in the first trimester and at 26–30 weeks with fetal and neonatal outcomes: a secondary analysis of the Global Network for Women's and Children's Health's ASPIRIN Trial. BJOG: An International Journal of Obstetrics and Gynaecology, 128(9): 1487-1496.
[27] Jufar H. and Zewde, T. 2014. "Prevalence of anemia among pregnant women attending antenatal care at Tikur Anbessa specialized Hospital, Addis Ababa Ethiopia," Journal of Hematology and Thromboembolic Diseases, 2.
[28] Kalaivani, K. 2009. Prevalence and consequences of anaemia in pregnancy. Indian Journal of Medical Research, 130(5): 627-633.
[29] Kalaivani, K., Karmarkar, M.G. and Thomas, T. 2018. Prevalence and consequences of anaemia in pregnancy. Indian Journal of Medical Research, 148(5): 441–448.
[30] Kuppusamy, P., Prusty, R.K., Chaaithanya, I.K., Gajbhiye, R.K. and Sachdeva, G. 2023. Pregnancy outcomes among Indian women: increased prevalence of miscarriage and stillbirth during 2015–2021. BMC Pregnancy and Childbirth, 23(1): 1-9.
[31] Lokare, P.O., Karanjekar, V.D., Gattani, P.L. and Kulkarni, A.P. 2012. A study of prevalence of anemia and sociodemographic factors associated with anemia among pregnant women in Aurangabad city, India. Annals of Nigerian Medicine, 6(1): 30-34.
[32] Mahamoud, N.K., Mwambi, B., Oyet, C., Segujja, F., Webbo, F., Okiria, J.C. and Taremwa, I.M. 2020. Prevalence of anemia and its associated socio-demographic factors among pregnant women attending an antenatal care clinic at Kisugu Health Center IV, Makindye Division, Kampala, Uganda. Journal of blood medicine, 11: 13-18.
[33] Mangla, M. and Singla, D. 2016. Prevalence of anaemia among pregnant women in rural India: A longitudinal observational study. Int J Reprod Contracept Obstet Gynecol, 5(10): 3500-5.
[34] Mbule, M.A., Byaruhanga, Y.B., Kabahenda, M. and Lubowa, A. 2013. Determinants of anaemia among pregnant women in rural Uganda. Rural and remote health, 13(2): 1-15.
[35] McClure, E.M., Saleem, S., Goudar, S.S., Tikmani, S.S., Dhaded, S.M., Hwang, K., Guruprasad, G., Shobha, D., Sarvamangala, B., Yogeshkumar, S. and Somannavar, M.S. 2022. The causes of stillbirths in south Asia: results from a prospective study in India and Pakistan (PURPOSe). The Lancet Global Health, 10(7): e970-e977.
[36] Milman, N., BYG, K.E. and Agger, A.O. 2000. Hemoglobin and erythrocyte indices during normal pregnancy and postpartum in 206 women with and without iron supplementation. Acta Obstetricia et Gynecologica Scandinavica: Original Article, 79(2): 89-98.

[37] Nair, M., Choudhury, M.K., Choudhury, S.S., Kakoty, S.D., Sarma, U.C., Webster, P. and Knight, M. 2016. Association between maternal anaemia and pregnancy outcomes: a cohort study in Assam, India. BMJ Global Health, 1(1): e000026.

[38] Obse, N., Mossie, A. and Gobena, T. 2013. Magnitude of anemia and associated risk factors among pregnant women attending antenatal care in Shalla Woreda, West Arsi Zone, Oromia Region, Ethiopia. Ethiopian journal of health sciences, 23(2): 165-173.

[39] Omote, V., Ukwamedua, H.A., Bini, N., Kashibu, E., Ubandoma, J.R. and Ranyang, A. 2020. Prevalence, severity, and correlates of anaemia in pregnancy among antenatal attendees in Warri, South-Southern Nigeria: A cross-sectional and hospital-based study. Anemia, 2020.

[40] Pavord, S., Daru, J., Prasannan, N., Robinson, S., Stanworth, S., Girling, J. and BSH Committee. 2020. UK guidelines on the management of iron deficiency in pregnancy. British journal of haematology, 188(6): 819-830

[41] Rahman, M. M., Abe, S. K., Rahman, M. S., Kanda, M., Narita, S., Bilano, V., Ota, E., Gilmour, S. and Shibuya, K. 2018. Maternal anemia and risk of adverse birth and health outcomes in low-and middle-income countries: systematic review and meta-analysis. The American journal of clinical nutrition, 108(2): 400-411.

[42] Shi, H., Chen, L., Wang, Y., Sun, M., Guo, Y., Ma, S., Wang, X., Jiang, H., Wang, X., Lu, J. and Ge, L., Dong, S., Zhuang, Y., Zhao, Y., Wei, Y., Ma, X. and Qiao, J. 2022. Severity of Anemia During Pregnancy and Adverse Maternal and Fetal Outcomes. JAMA network open, 5(2): e2147046.

[43] Singh, D., Manna, S., Barik, M., Rehman, T., Kanungo, S. and Pati, S. 2023. Prevalence and correlates of low birth weight in India: findings from national family health survey 5. BMC Pregnancy and Childbirth, 23(1): 1-13.

[44] Sinha, A., Adhikary, M., Phukan, J.P., Kedia, S. and Sinha, T. 2021. A study on anemia and its risk factors among pregnant women attending antenatal clinic of a rural medical college of West Bengal. Journal of Family Medicine and Primary Care, 10(3): 1327-1331.

[45] Sood, P. and Bindra, S. 2022. Modified Kuppuswamy socioeconomic scale: 2022 update of India. International Journal of Community Medicine and Public Health, 9: 3841.

[46] Soundarajan, P., Muthuramu, P., Veerapandi, M. and Mariappan, R., 2016. Retrospective study factors related to preterm birth in Government Raja Mirasudar hospital and obstetric and perinatal outcome. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 5(9): 3006-3011.

[47] Stephen, G., Mgongo, M., Hussein Hashim, T., Katanga, J., Stray-Pedersen, B. and Msuya, S.E. 2018. Anaemia in pregnancy: prevalence, risk factors, and adverse perinatal outcomes in Northern Tanzania. Anemia, 2018: 1846280.

[48] Stevens, G.A., Finucane, M.M., De-Regil, L.M., Paciorek, C.J., Flaxman, S.R., Branca, F., Peña-Rosas, J.P., Bhutta, Z.A. and Ezzati, M. 2013. Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995–2011: a systematic analysis of population-representative data. The Lancet Global Health, 1(1): 16-e25.

[49] Tolentino, K. and Friedman, J.F. 2007. An update on anemia in less developed countries. The American journal of tropical medicine and hygiene, 77(1): 44-51.

[50] Toteja, G.S., Singh, P., Dhillon, B.S., Saxena, B.N., Ahmed, F.U., Singh, R.P., Prakash, B., Vijayaraghavan, K., Singh, Y., Rauf, A. and Sarma, U.C. 2006. Prevalence of anemia among pregnant women and adolescent girls in 16 districts of India. Food and Nutrition Bulletin, 27(4): 311-315.

[51] UNICEF, WHO, The World Bank, UN; New York, USA: 2014. Levels and trends in child mortality. Report.

[52] Wiegersma, A.M., Dalman, C., Lee, B.K., Karlsson, H. and Gardner, R.M. 2019. Association of prenatal maternal anemia with neurodevelopmental disorders. JAMA psychiatry, 76(12): 1294-1304.

[53] World Health Organization, 2011a. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity (No. WHO/NMH/NHD/MNM/11.1). World Health Organization.

[54] Zerfu T.A. and Ayele H.T. Micronutrients and pregnancy; effect of supplementation on pregnancy and pregnancy outcomes: a systematic review. Nutrition Journal, 12: 20.