Original Article

Assessment of Anaemia and Other Haematological Profiles of Pregnant Women Attending Antenatal Care in Tertiary Care Hospital of Eastern India

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ABSTRACT

Introduction: One of the most significant haematological transitions in pregnant women is physiological anaemia due to independent and heterogeneous fluctuations in plasma and red blood cell volumes. The phenomenon of haemodilution further add to lower haematocrit and haemoglobin rates, leading to pseudo anaemia. Various studies have been conducted to determine the hematologic profile of pregnant women in developed countries, but little is known in developing countries like India, particularly in the eastern India.

Aims/ objective: To determine the prevalence of anaemia and other haematological profiles and associated factors among pregnant women attending antenatal care clinic in tertiary care centre of eastern India.

Materials and Method: Approximately 5 ml of venous blood was aseptically collected using EDTA tubes from each of the study participants. Blood samples were taken from each study participant. Evaluation of haematological parameters was done using an automated haematology analyser. Haematological parameters between 2nd and 3rd trimester of pregnancy were compared using unpaired t-test. P-values of less than 0.05 were taken as to be indicator of statistically significant difference.

Results: Mean white blood cell count has been shown to rise with gestational age. Mean values of MCV and MCH have been shown to rise with advancing gestational age. Accordingly, in the present study, 12 (5%) of study participants were anaemic (Haemoglobin <11g/dl). Prevalence of anaemia was more common in pregnant women of age less than 20, women of rural area and illiterate females. Out of 240 pregnant women, 34 were thrombocytopenic (Platelet count < 150 × 109/L) with a prevalence of 14.17%.

Conclusion: Prevalence of anaemia in pregnant women visiting for ante-natal check-up was lower than community-based survey where awareness of ante-natal check-up is low. A complete blood count should be performed to diagnose and prevent anaemia, thrombocytopenia, and other possible hematologic abnormalities in pregnant mothers during prenatal care.

Keywords: Anaemia, Pregnancy, Haematological Profile, Iron Supplements.

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INTRODUCTION

The values of the complete blood count (CBC) parameters can have variations depending on numerous demographic, pathological, and physiological factors such as age, sex, body mass index, environment, race, nutritional status, ethnic origin, lifestyle pattern, biological rhythms, consumption of tobacco, alcohol or medicine and also the pregnancy.[1] This last factor is associated with profound changes anatomical, physiological, biochemical and endocrine parameters that have significant impact on multiple organs and systems. These variations are important in helping woman to adapt to the state of pregnancy and to help in growth of foetus and its survival. The hematologic system has to adapt itself in a number of ways, such as utilization of vitamins and minerals (iron, vitamin B12, folic acid) for foetal haematopoiesis which can lead to maternal anaemia. There should be sufficient stores to compensate for bleeding at the time of delivery which requires enhancement in haemostatic function. [2]

One of the most important hematologic changes for pregnant women is physiological anaemia due to independent and heterogeneous fluctuations in plasma volume (+40%) and red blood cell volume (+15%).[3] The phenomenon of haemodilution leads to decrease in haematocrit and haemoglobin (HGB) leading to pseudo anaemia. For pregnant women, these changes are physiological and support different thresholds for the definition of gestational anaemia. Regarding haemoglobin, according to the US Centres for Disease Control and Prevention (CDC), for pregnant women to be called anaemic, haemoglobin should be less than 11.0 g/dL in the first and third trimesters and less than 10.5 g/dL in the second trimester.[4] According to WHO, the threshold for anaemia during pregnancy is a total HGB concentration in

the blood of less than 11 g/dl. or haematocrit <33% at any time during pregnancy.[5]

Also, regarding white blood cells (WBC), pregnancy is associated with leucocytosis, which is primarily associated with elevated circulating neutrophils. Neutrophil counts begin to rise in the second month of pregnancy and reach a plateau at two or three months of gestation. At this point, the total white blood cell count is between 9,000 and 15,000 cells/microliter.[6] Gestational thrombocytopenia occurs in 7-8%. of all pregnancies. Breakdown of platelet is accelerated during pregnancy, resulting in slightly lower platelet counts, resulting in younger, larger platelets. Most thrombocytopenia during pregnancy is due to elevated breakdown.[7]

Considering all these changes in CBC testing that characterize pregnancy, it is of great importance to track the physiological variation of haematological parameters in pregnant women and to determine target group-specific reference values during normal pregnancy. The idea is to stop wrong diagnoses, unhelpful complementary tests, and unsubstantiated treatment suggestions for pregnant women.

The common causes of anaemia are pregnancy, malnutrition, infections with hook worm or malaria, haemoglobinopathies, HIV, and obstetrical complications leading to abnormal blood loss.[8, 9] Socioeconomic status of the family, traditional eating habits in different region, irregular eating habits, and fear of weight gain are common behavioural risk factors for the development of anaemia in adolescent.[10]

Moreover, family illiteracy and duodenal ulcer bleeding are also predisposing risk factors of anaemia during pregnancy.[11] In addition, low family income, big family size, living in rural area, parasitic infection of intestine, walking bare foot, and history of abnormal and heavy menstrual cycle (> 5 days of menses) are shown to be the predictors of anaemia among pregnant women in developing countries like India.[12, 13] Despite there is decline in its prevalence through time, anaemia is still the common health problem in women of reproductive age.[14]

Various studies have been conducted to determine the hematologic profile of pregnant women in developed countries, but little is known in developing countries like India, particularly in the eastern India. Thus, purpose of this study was to determine the prevalence of anaemia and other haematological profiles and associated factors among pregnant women attending antenatal care clinic in tertiary care centre of eastern India.

MATERIALS AND METHODS

This was a cross-sectional study conducted in tertiary care centre of eastern India from August 2020 to July 2021 after approval of Institutional Ethic Committee. The study was conducted under the principle of ICH-GCP guidelines. Participant information sheet was given to all the study participants and then written and audio-visual informed consent was taken from them.

Inclusion Criteria: All pregnant women visiting out-patient department of obstetrics and gynaecology for ante-natal check-up were screened for eligibility.

Exclusion Criteria: Pregnant women who were sick at the time of data collection, women with history of bleeding in the pregnancy, women who have recently given blood transfusion, women having known chronic diseases like diabetes and hypertension or women with diagnosis of haemoglobinopathies were excluded.

Sample Size: With anticipated 10,000 women visiting out-patient department of obstetrics and gynaecology for ante-natal check-up, assuming 5% margin of error and 95% confidence interval and using the previous prevalence of 20%, minimum number of study participant was found to be 240. Based on the previous 1 year record, the target pregnant mothers were selected by systematic sampling technique at a sampling interval of three. The first interviewed participant was randomly selected by a lottery system.

Data on socio-demographic variables and other clinical characteristics were recorded by trained nurses with the help of structured interviewer administered questionnaire. Approximately 5 ml of venous blood was aseptically collected using EDTA tubes from each of the study participants. Blood samples were taken from each study subject Haematologic parameters were evaluated using an automated haematology analyser according to the Standard Operational Procedures (SOP) of the institute and manufacturers instruction.

Statistical Analysis: Data were presented in tabular form using Microsoft Excel 365. Descriptive analysis was done to calculate frequency and percentage. Haematological parameters between 2nd and 3rd trimester of pregnancy were compared using unpaired t test. Chi-square test was used to evaluate the statistical significance of categorical data. P-values of less than 0.05 were taken as to be indicator of statistically significant difference.

OBSERVATION AND RESULTS

Table 1: Baseline Demographic and Clinical Characteristics (n = 240)

Variables	Values
Age in years in Mean ± SD	29.65 ± 6.54
Body Mass Index in Mean ± SD	25.65 ± 3.62
Taking Iron and Folic Acid Supplementation, n (%)	
Yes	206
No	34
Gestational Age, n (%)	
1st Trimester	41
2nd Trimester	86
3rd Trimester	113

Most of study participants were of age group of 25-35 years. Nearly all the pregnant women were not taking Iron and Folic Acid Supplementation in 1st trimester. Most of the study participants were in 3rd trimester of pregnancy.

Table 2: Overall haematological profile of all pregnant women and comparison and 2nd and 3rd trimester pregnant women

Complete blood count results	Overall	Trimesters		
		2nd (n = 86)	3rd (n = 113)	P-Value (Unpaired t-test)
RBCs, × 10^6/mm^3	3.92 ± 0.84	3.95 ± 0.93	3.88 ± 0.82	0.57
Haemoglobin (g/dL)	11.78 ± 2.56	11.57 ± 2.67	11.88 ± 2.69	0.42
PCV (%)	34.39 ± 6.48	33.97 ± 6.35	34.57 ± 7.12	0.54
MCV (fL)	94.18 ± 6.88	93.57 ± 6.64	95.34 ± 7.65	0.09
MCH (pg)	33.19 ± 2.59	32.41 ± 1.55	33.66 ± 2.52	<0.0001
MCHC (g/dL)	35.21 ± 1.20	35.23 ± 1.06	35.20 ± 1.14	0.85
RDW (%)	10.82 ± 2.06	10.67 ± 1.31	10.92 ± 1.90	0.30
WBCs, × 10^3/ mm^3	9.13 ± 2.65	9.21 ± 2.62	9.24 ± 2.56	0.94
Neutrophils, × 10^3/ mm^3	6.21 ± 2.30	6.34 ± 2.37	6.37 ± 2.19	0.93
Lymphocytes, × 10^3/ mm^3	2.13 ± 0.52	2.10 ± 0.49	2.07 ± 0.48	0.67
Platelet count 10^3/ mm^3	231.74 ± 72.79	242.08 ± 85.03	214.22 ± 56.42	0.37

Based on WHO criteria, haemoglobin value of less than 11.0 g/dL is considered as indicative of anaemia for pregnant women. Accordingly, in the present study, 12 (5%) of study participants were Anaemic. Out of 240 pregnant women, 34 were thrombocytopenic (Platelet count < 150 × 109/L) with a prevalence of 14.17%.

Table 3: Distribution of Anaemia and Thrombocytopenia according to their severity

Severity	Anaemia number (%)	Thrombocytopenia number (%)
Mild	7	24
Moderate	3	8
Severe	2	2

Mean white blood cell count has been shown to rise with gestational age. Mean values of MCV and MCH have been shown to rise with advancing gestational age. Moreover, there was also statistically significant differences in MCH between second and third trimesters of pregnancy (P <0.0001)).

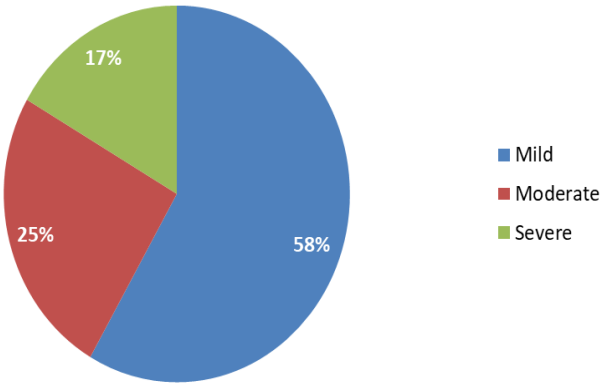

Figure 1: Distribution of Anaemia according to severity

Table 4: Distribution of anaemic patients according demographic variables

Variables	Anaemic status		P-Value (Chi-square)
	Anaemic (%)	Non Anaemic (%)	
Age			
< 20	7 (18.4)	31 (81.6)	0.0002
20–25	3 (3.3)	87 (96.7)	
≥ 26	2 (1.8)	110 (98.2)	
BMI			
< 19.8	4 (19.0)	17 (81.0)	0.0629
≥ 19.8	8 (6.7)	111 (93.3)	
Residence			
Urban	7 (3.6)	189 (96.4)	0.0321
Rural	5 (11.4)	39 (88.6)	

Educational status			
Illiterate	3 (12.0)	22 (88.0)	0.0151
Primary	5 (10.9)	41 (89.1)	
Secondary and above	4 (2.4)	165 (97.6)	
Gestational age			
1st trimester	1 (2.4)	40 (97.6)	0.2396
2nd trimester	7 (8.1)	79 (91.9)	
3rd trimester	4 (3.5)	109 (96.5)	
Parity			
Para 0	8 (6.0)	126 (94.0)	0.4381
Para 1+	4 (3.8)	102 (96.2)	
Age of last child			
≤ 2	2 (10.0)	18 (90.0)	0.1047
> 2	2 (2.3)	84 (97.7)	
Number of ANC visit			
1	5 (5.4)	88 (94.6)	0.5027
2	5 (6.8)	68 (93.2)	
3+	2 (2.7)	72 (97.3)	

Prevalence of anaemia was more common in pregnant women of age less than 20, women of rural area and illiterate females.

DISCUSSION

Monitoring haematological profiles is important for the diagnosis or monitoring of illness in pregnant woman. Prevalence of anaemia in our study was found to be very low as compared with the findings of other studies that have been done in developing countries. [12, 13, 15-24] This difference can be because of variations in socioeconomic status and literacy, eating habits, practice of visit for ante-natal check-up, prevalence of malaria and parasitic intestinal infection in some of the study area, access to health care centres, access to iron and folic acid supplementation, and techniques used to determine haematological parameters where there may be to bias or random errors as compared with automated haematology analysers that were used in the current study.

Furthermore, the low prevalence of anaemia detected in this study may also be due to the low prevalence of malaria in the study area at the time of the study.[25] Participants were local residents and wore shoes that prevented them from being infected with parasites that could affect their red blood cell levels.

Although the overall prevalence of anaemia in this study was low, the magnitude of severe anaemia was higher compared with earlier studies. [13, 15, 18, 20, 24] The explanation for the differences might be associated with variation in socioeconomic status and awareness of pregnant women to the sign and symptoms of anaemia and its affect on maternal and foetal health between the different regions and countries where studies were conducted.

According to the current study, pregnant woman with age less than 20 years old were more likely to develop anaemia than the pregnant women with age greater than 26 years old. This result was similar to a study in a developing country where lower age was more associated with anaemia; but different with another study where pregnant women of higher age [39–45 years] had more association with anaemia.[15, 18] These differences between the results of previous studies and the current study might be because of variations in season in which study was conducted, diet pattern, lifestyle and access to health care services among pregnant women. Although other parameters had no significant association with anaemia, in the current study, low body mass index, women in second trimester of pregnancy, and low number of ANC visits were the factors that were associated with higher prevalence of develop anaemia. Whereas living in urban areas, having educational level of secondary or higher, first pregnancy, pregnant women on iron plus folic acid supplementation were the factors associated with low prevalence of anaemia.

The prevalence of thrombocytopenia was higher in the third trimester of pregnancy. This result is relatively unvarying with other studies in India. [26, 27] In this study, platelet counts were much decreased in the third trimester than in the first and second trimesters, as seen in studies in other developing countries. The decrease in platelet count that accompanies with increase in gestational age may be due to haemodilution due to increased plasma volume during pregnancy. The trend toward lower platelet counts with increasing gestational age puts pregnant women at risk of bleeding. [27] Therefore, platelet counts should be routinely done during prenatal testing to allow timely

diagnosis and favorable foeto-maternal outcome in all types of thrombocytopenia during pregnancy.

Mean total white blood cell count increased gradually from the first to the third trimester of pregnancy. This may be due to the physiological stress caused by pregnancy and the needs of the developing foetus. An increase in white blood cell counts with gestational age was consistent with results from previous studies.29 However, the current results are not consistent with previous studies in which white blood cell counts varied significantly between trimesters. [28,29] Lifestyle and population variation between study groups could be the reason for these differences.

Red blood cell counts were significantly higher in the first trimester than in the third trimester, but changes in haemoglobin and haematocrit were not significant at all trimesters. This finding was inconsistent with previous studies in which haematocrit levels decreased significantly with increasing gestational age. [30, 31] A study done in a developing country found that most RBC indices were significantly different in different trimesters.[15] Moreover, another study found that RBCs count significantly were significantly different between first–second and second–third trimesters.[29] These differences might be because of geographical, educational, socio-economic, access to health care services and behavioural variations among different study areas.

Levels of MCV and MCH increased significantly from the first to the third trimester of pregnancy, whereas MCHC remained relatively constant in this study. This is relatively consistent with earlier studies.[29] However, in studies conducted in developing countries, MCV decreased during early to mid-pregnancy, MCH was relatively stable during all pregnancies, and MCHC remained stable during early and mid-pregnancy but was found to decrease in the second trimester.[31] This may reflect the differential presence of iron deficiency among study participants in the countries studied.

CONCLUSION

Prevalence of anaemia in pregnant women visiting for ante-natal check-up was lower than community based survey where awareness of ante-natal check-up is low. Prevalence anaemia and thrombocytopenia was more in 3rd trimester of pregnancy. There are variations in the RBC count, MCV, MCH and platelets count between different trimesters of pregnancy. Therefore, A complete blood count should be performed to diagnose and prevent anaemia, thrombocytopenia, and other possible hematologic abnormalities in pregnant mothers during prenatal care.

REFERENCES

1. Bros B, Leblanc T, Barbier-Bouvet B, Beytout J, Casassus P, Danjou G, et al. Lecture critique de Lhémogramme: valeurs seuils à reconnaître comme probablement pathologiques et principales variations non pathologiques. National Agency of Accreditation and Evaluation of Health (ANAES). Referral medical service; September 1997; Accessed on February 2016. [Google Scholar]
2. Mohamed AO, Hamza KM, Babker AMA. Physiological changes in some hematological and coagulation profile among Sudanese healthy pregnant women. Int J Med Sci Public Health. 2016;5(3):525–528. [Google Scholar]
3. Cotes PM, Canning CE. Changes in serum immunoreactive erythropoietin during the menstrual cycle and normal pregnancy. Br J Obst Gynecol. 1983;90(4):304–311. [PubMed] [Google Scholar]
4. Sarah K, Harm, Mark H, Yazer, Jonathan H, Waters Changes in hematologic indices in Caucasian and non-caucasian pregnant women in the United States. Korean J Hematol. 2012;47(2):136–141. [PMC free article] [PubMed] [Google Scholar]
5. World Health Organization, Department of Nutrition for Health and Development . Iron Deficiency Anaemia Assessment, Prevention and Control. A guide for programme managers. Geneva: World Health Organization.WHO/NHD/01.3;2001:114; Accessed on February 2016. [Google Scholar]
6. Chandra S, Tripathi AK, Mishra S, Amzarul M, Vaish AK. Physiological changes in hematological parameters during pregnancy. Indian J Hematol Blood Transfus. 2012;28(3):144–6. [PMC free article] [PubMed] [Google Scholar]
7. Eledo BO, Buseri FI, Akhogba AO. Evaluation of Some Haematological Parameters among Pregnant Ijaw Women: an Indigenous West African Tribe. Journal of Health, Medicine and Nursing. 2015;13(2015):10–17. [Google Scholar]
8. Cheesbrough M. District laboratory practice in tropical countries. Part 2. 2nd ed. Cambridge: Cambridge University Press; 2006.
9. Perkins S. Diagnosis of anemia: practical diagnosis of hematologic disorders. Chicago: ASCP Press; 2006. p. 3–16.
10. Balcı YI, Karabulut A, Gürses D, Çövüt İE. Prevalence and risk factors of anemia among adolescents in Denizli, Turkey. Iran J Pediatr. 2012;22(1):77.
11. Argaw B, Argaw-Denboba A, Taye B, Worku A, Worku A. Major risk factors predicting anemia development during pregnancy: unmatched-case control study. J Community Med Health Educ. 2015;5:353.
12. Melku M, Addis Z, Alem M, Enawgaw B. Prevalence and predictors of maternal anemia during pregnancy in Gondar, Northwest Ethiopia an institutional based cross-sectional study. Cairo: Hindawi Publishing Corporation; 2014.
13. Getachew M, Yewhalaw D, Tafess K, Getachew Y, Zeynudin A. Anemia and associated risk factors among pregnant women in Gilgel Gibe dam area, Southwest Ethiopia. Parasit Vectors. 2012;5(1):1–8.
14. Stevens GA, Finucane MM, De-Regil LM, Paciorek CJ, Flaxman SR, Branca F, Peña-Rosas JP, Bhutta ZA, Ezzati M, Nutrition Impact Model Study Group. 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. Lancet Glob Health. 2013;1(1):e16–25.
15. Jufar AH, Zewde T. Prevalence of anemia among pregnant women attending antenatal care at tikur anbessa specialized

hospital, Addis Ababa Ethiopia. J Hematol Thromboembol Dis. 2014;2:125.

16. Wadgave HV. Burden of anemia among the pregnant women in rural Area. Health Line. 2011;2:76–7.
17. Ugwuja EI, Ogbonnaya LU, Obuna AJ, Awelegbe F, Uro-Chukwu H. Anemia in relation to body mass index (BMI) and socio-demographic characteristics in adult Nigerians in Ebonyi state. J Clin Diagn Res. 2015;9(1):4–7.
18. Siteti MC, Namasaka SD, Ariya OP, Injete SD, Wanyonyi WA. Anemia in pregnancy: prevalence and possible risk factors in Kakamega County, Kenya. Sci J Pub Health. 2014;2(3):216–22.
19. Shamah-levy T, Villalpando S, Rivera JA, Mejía-Rodríguez F, Camacho-Cisneros M, Monterrubio EA. Anemia in Mexican women: a public health problem. Salud Pública de México. 2003;45:499–507.
20. Kefiyalew F, Zemene E, Asres Y, Gedefaw L. Anemia among pregnant women in Southeast Ethiopia: prevalence, severity and associated risk factors. BMC Res Notes. 2014;7(1):771.
21. Obse N, Mossie A, Gobena T. Magnitude of anemia and associated risk factors among pregnant women attending antenatal care in Shalla Woreda, West Arsi Zone, Oromia Region, Ethiopia. Ethiop J Health Sci. 2013;23(2):165–73.
22. Gebremedhin S, Enquselassie F. Correlates of anemia among women of reproductive age in Ethiopia: evidence from Ethiopian DHS 2005. Ethiop J Health Dev. 2011;25(1):22–30.
23. Haidar J. Prevalence of anemia, deficiencies of iron and folic acid and their determinants in Ethiopian women. J Health Popul Nutr. 2010;28(4):359–68.
24. Melku M, Agmas A. Maternal anemia during pregnancy in Bahr Dar Town, Northwestern Ethiopia: a facility-based retrospective study. Appl Med Res. 2015;1:2–7.
25. Tadesse S, Ashenafi H, Aschalew Z. Seroprevalence study of newcastle disease in local chickens in central Ethiopia. Intern J Appl Res Vet Med. 2005;3(1):25–9.
26. Dwivedi P, Puri M, Nigam A, Agarwal K. Fetomaternal outcome in pregnancy with severe thrombocytopenia. Eur Rev Med Pharmacol Sci. 2012;16(11):1563–6.
27. Nisha S, Amita D, Uma S, Tripathi AK, Pushplata S. Prevalence and characterization of thrombocytopenia in pregnancy in Indian women. Indian J Hematol Blood Transf. 2012;28(2):77–81.
28. Ifeanyi OE, Ndubuisi OT, Leticia EOB, Uche EC. Haematological profile of pregnant women in Umuahia, Abia State, Nigeria. Int J Curr Microbiol App Sci. 2014;3(1):713–8.
29. James TR, Reid HL, Mullings AM. Are published standards for haematological indices in pregnancy applicable across populations: an evaluation in healthy pregnant Jamaican women. BMC Pregn Childbirth. 2008;8(1):8.
30. Queen E, Ifeanyi OE, Chinedum OK. Evaluation haematological parameters among pregnant women attending antenatal clinic in College of Health Demonstration Clinic, Port Harcourt. J Dental Med Sci. 2014;13(9):122–7.
31. Akinbami AA, Ajibola SO, Rabiu KA, Adewunmi AA, Dosunmu AO, Adediran A, Osunkalu VO, Osikomaiya BI, Ismail KA. Hematological profile of normal pregnant women in Lagos, Nigeria. Int J Women's Health. 2013;5:227–32.

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