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Hematological Parameters in Pregnant Women with Special Reference to Iron

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Several biological factors, particularly haematological, are physiologically altered during normal pregnancy. Biologists and doctors who are aware of these changes in the maternal body can screen for potential abnormalities. The aim of this research is to find healthy pregnant women's reference values. This was a cross-sectional research of pregnant women who attended an antenatal clinic at Sree Balaji Medical College, with anaemic and non-anemic pregnant women. Pregnant women were categorized into three groups -Group I - First Trimester (50 cases); Group II - Second Trimester (50 cases) and Group III - Third Trimester (72 cases) while non- pregnant women formed the fourth group (30 cases). A statistically significant difference between the pregnant women and control group was noted ($p < 0.05$) for all the hematological parameters: red blood cells, hematocrit, hemoglobin, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, leukocytes, neutrophils, basophils, eosinophils, lymphocytes, monocytes, platelets and mean platelet volume. The present study provides additional baseline data for basic hematological parameters in healthy pregnant women and concluded that pregnancy in women has the tendency to alter some hematological indices.

Keywords: Haematological; pregnant women; anemic.

1. INTRODUCTION

Pregnancy represents a period of stress with excessive demands of nutrients not only for the mother but also for the offspring which reflects in the hematological parameters.

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Pregnancy causes a state of hydraemic plethora [1]. There is uneven increase of plasma volume during pregnancy leading to apparent reduction of erythrocyte, hemoglobin and hematocrit value. This unequal expansion of plasma volume and red cell mass resulting in hemodilution has been, perhaps wrongly termed as physiological anemia in pregnancy [2].

There is an inadequate data to give physiological limits for the expected dilution. Most iron transfer to the fetus occurs after thirty weeks of gestation and transmits to the increased maternal absorption which is regulated by the placenta. Thus the pregnancy induced hemodynamic change alters the physiologic state suitably to remove the general rules [3].

The normal hemoglobin levels in healthy pregnant women fetus between 11 and 12 g/dl. World Health Organization (WHO) defines anemia in pregnancy as hemoglobin less than 11.0 g/dl and graded the degree of anemia is to mild (9.0 -11.0 g/dl), moderate (7.0 - 9.0 g/dl) and severe (< 7.0 g/dl) [3,4,5,6].

2. MATERIALS AND METHODS

A total number of 202 cases attending the Sree Balaji Medical College and Hospital, during the period of July 2009 to August 2011 were included in the present study. Pregnant women were randomly selected and grouped accordingly into three groups -1 Trimester (50 cases), II Trimester (50 cases) and III Trimester (72 cases). Blood samples from 30 normal healthy (no pregnant and non-lactating) women were also included

All samples were analyzed for hematological parameters (Erythrocyte Count, Hemoglobin, Hematocrit, Mean Corpuscular Volume, and Mean Corpuscular Hemoglobin, Mean Corpuscular Hemoglobin concentration, Red Cell Distribution Width, Leukocyte count and Platelet count). Among the above-mentioned cases, randomly selected 22 women in third trimester were analyzed for iron profile studies (Serum Iron, Total Iron Binding Capacity,% Saturation and Serum Ferritin).

The clinical history with special reference to anemia, use of drugs, iron intake and investigation reports were tabulated as per the proforma. [6].

2.1 Anemia - Criteria for Diagnosis

Anemia was defined using the WHO criteria for anemia m pregnancy as well for non-pregnant women [5]. With these criteria the hemoglobin cutoff used to define anemia during pregnancy was l lg/dl and for non-pregnant women was 12 g/dl. The corresponding cutoff for hematocrit was 33% and 36% for pregnant and non-pregnant women respectively [5,6,7].

2.2 Sample Collection for Hematological Parameters

Blood was withdrawn from an ante cubital vein by means of dry sterile 5 ml, disposable plastic syringe with a needle of 20 gauge after preparing the cubital fossa with a sterile swab. Two ml of blood was withdrawn slowly. Immediately blood is transferred to sterile glass bottle with di-potassium EDTA as anticoagulant and was analyzed in an automated cell counter.

2.3 Sample Collection for Iron Profile Studies

Blood was withdrawn in a sterile condition as mentioned above, immediately blood is transferred to two sterile glass bottles, one with di-potassium EDTA as anticoagulant and another bottle without anticoagulant. Blood in the anticoagulant bottle was taken for the automated cell counter analysis. The blood in the bottle without anticoagulant was allowed to clot without disturbances for 30 - 60 mints at room temperature. Once the stable clot was formed, the serum separates out. The serum was taken through long Pasteur pipette and centrifuged at 3000 RPM for 10 mints and the supernatant was taken into a sterile plastic radioimmunoassay tube and stored at - 20 degree.

Hematological investigations were performed immediately on Automated hematology analyzer with standard calibration used. Following parameters were obtained by automated hematology analyzer.

1. Hemoglobin
2. CBC (TLC, DLC, RBC & Platelets)
3. RBC indices (MCV, MCH, MCHC & HCT)

2.4 Statistical Analysis

All the data of the case details, investigation parameters entered routinely on the Microsoft Office - Excel 2003 edition for data management.

Standard software (spss) has been used for the application of one-way analysis variant method to compare the four groups on the selected parameters. The results are Significant, Bonferroni multiple comparison test has been applied on which group statistical significance has occurred. Pearson correlation coefficient method has been applied to-find out the relationship between the selected parameters.

3. RESULTS

Hematological parameters in 172 pregnant and 30 non-pregnant women were evaluated in the present study. Pregnant women were categorized into three groups -Group I - First Trimester (50 cases); Group II - Second Trimester (50 cases) and Group III - Third Trimester (72 cases) while non- pregnant women formed the fourth group (30 cases).

In the present study, the age of the pregnant and non-pregna nt women varies from 20 to 27 years. The majority of the pregnant women (73.8%) and non-pregnant women (83.3%) were below 25 years.

In the present study, 77/172 cases (44.8%) were primigravida, among them 20 (40%), 23 (46%) and 34 (47.2%) women were in I II and III groups respectively. 95/172 cases (55.2%) were multigravida, among them 30 (60%), 27 (54%) and 38 (52.8%) women were in I, II and III groups respectively. [Ref Table: 3/ Chart: 3].

3.1 Red Blood Cell Count (RBC)

In the present study, 51/172 (29.7%) pregnant women had RBC count less than 3.6 millions per cu.mm, 66/172 (38.3%) pregnant women had RBC count within 3.6 to 4.2 millions per cu.mm and 55/172 (32%) pregnant women had more than 4.2 millions per cu.mm.

In non-pregnant women, 06 (20%) had RBC count less than 3.6 millions per cu.mm, 06 (20%) had RBC count within 3.6 to 4.2 millions per cu.mm and 18 (60%) had RBC count more than 4.2 millions per cu.mm.

Table 1. Experimental groups in the present study ()

Groups	Number of cases
Group 1: I Trimester (0-12 Weeks)	50
Group 2: II Trimester (13 - 28 Weeks)	50
Group 3: III Trimester (2'.:29 Weeks)	72
Group 4: Non – Pregnant	30

Table 2. Age incidence

Age Years	Group!	Group II	Group III	Group IV	Total
<25	40(80%)	40(80%)	47(65.3%)	25(83.3%)	152(75.3%)
2:25	10(20%)	10(20%)	25(34.7%)	05(16.7%)	50(24.7%)

Table 3. Gravida status in pregnant women

Gravida	Groupi	Group ii	Group iii	Total
PRIMIGRA VIDA	20 (40%)	23 (46%)	34(47.2%)	. 77(44.8%)
MULTIGRAVIDA	30 (60%)	27 (54%)	38(52.8%)	95(55.2%)

Table 4. RBC Count in the study groups

Rbccount (millions/cu.mm)	Group I	Group Ii	Group Iii	Group Iv	Total
<3.6	15 (30%)	07 (14%)	29 (40.3%)	06(20%3	57(28.3%)
3.6 -4.2	21 (42%)	22 (44%)	23(31.9%)	06(20%)	72 (35.6%)
4.2 - 4.5	14 (28%)	21 (42%)	20 (27.8%)	18(60%)	73(36.1%)

3.2 Hematocrit (HCT)

In the present study the hematocrit was less than 33% in majority of the pregnant women (119/172 cases - 69.2%).

In non-pregnant women majority of them had hematocrit more than 33% (63.3%) and 36.7% of them had hematocrit less than 33%.

3.3 Hemoglobin (HGB)

In the present study hemoglobin of the pregnant women was < 11.0 g/dl in 139/172 cases (80.8%) and it was above 11.0 g/dl in 33/172 cases (19.2%). All the non-pregnant women had hemoglobin more than 12.0 g/dl.

Among the pregnant women mild degree of anemia (9.0 to 11.0 g/dl) seen in 47.1% of cases , moderate degree of anemia (7.0 to 9.0 g/dl) seen in 26.7% of cases and 7% of cases were severely anemic (:S 7.0

(Individual values in all groups Ref Graph: 3).

3.4 Mean Copuscular Volume (MCV)

In the present study, among pregnant women 99/172 (57.6%) had MCV below 80 fl, 68/172 (39.5%) had MCV within the normal range (80 - 100 fl) and 5/172 (2.9%) had MCV more than 100 fl. In non-pregnant women, 20 (66.8%) had MCV below 80 fl and 10 (33.3%) had MCV within normal range. [Ref Table: 7/ Chart: 7]

(Individual values in all groups Ref Graph: 4)

3.5 Mean Copuscular Hemoglobin (MCH)

In the present study, 80/172 (46.5%) pregnant women had MCH below 25.9 ng, 91/172 (52.9%) had MCH within the normal range (26.0 -34.9 ng) and 01/172 (0.6%) had MCH more than 35.0 ng. In non-pregnant women, 10 (33.3%) had MCH less than 25.9 ng, 12 (40%) had MCH within normal range and 08 (26.7%) had MCH more than 35.0 ng.

Table 5. HCT values in the study groups

Hematocrit (%)	Group I	Group Ii	Group M	Group Iv	Total
<33.0	42 (84%)	39 (78%)	38(52.8%)	11(36.7 %)	130(64.4%)
33.0 - 36.0	08 (16%)	11(22%)	34 (47.2%)	19(63.3%)	72 (35.6%)

Table 6. HgB values in the study groups

Hemoglobin (g/dl)	Group I	Group II	Group III	Total
11.0	03(6%)	08 (16%)	22 (30.6%)	33 (19.2%)
9.0 -< 11.0 *(MILD)*	22 (44%)	29 (58%)	30(41.7%)	81 (47.1%)
7.0- <9.0 *(MODERATE)*	16 (32%)	13 (26%)	17(23.6%)	46 (26.7%)
7.*0 (SEVERE)*	09(18%)	-	03 (4.1%)	12 (7%)

Table 7. MCV values in the studygroups

MCV (fl)	Group I	Group II	Group iII	Group IV	Total
< 80.0	34 (68%)	37 (74%)	28 (38.8%)	20 (66.7%)	119(58.9%)
80.0 -100.0	16 (32%)	13 (26%)	39(54.2%)	10(33.3%)	78 (38.6%))
> 100.0	-	--	05 (7%)	-	05 (2.5%)

Table 8. MCH Values in the study groups

MCH (fig)	Group I	Group II	Group III	Group IV	Total
<25.9	27 (54%)	24 (48%)	29(40.3%)	10(33.3%)	90 (44.6%)
26.0-34.9	22 (44%)	26 (52%)	43 (59.7%)	12 (40%)	103 (51%)
>35.0	01 (2%)	~	~	08 (26.7%)	09(4:4%)

Table 9. Red Cell Distribution Width (RDW)

Mchc (g/dl)	Group i	Group ii	Group iii	Group iv	Total
30.9	19(38%)	12(24%)	53(73.6%)	--	84(41.6%)
31.0-36.0	30(60%)	38(76%)	16(22.2%)	18(60%)	102(50.5%)
2:36.1	01(2%)	-	03(4.2%)	12(40%)	16(7.9%)

Table 10. RDW values in the study groups

RDW (%)	Group i	Group ii	Group iii	Group iv	Total
10.0 -16.0	13(26%)	12(24%)	08(11.1%)	17(56.7 %)	50(24.8 %)
>16.0	37(74%)	38(76%)	64(88.9%)	13(43.3%)	152(75.2%)

3.6 Mean Copuscular Hemoglobin Concentration (MCHC)

In the present study, 84/172 (48.8%) pregnant women had MCHC below 30.9 g/dl, 84/172 (48.8%) had MCHC within the normal range (31.0 -36.0 g/dl) and 04/172 (2.4%) had MCHC more than 36.1 g/dl. In non-pregnant women, 18 (60%) had MCHC within normal range and 12 (40%) had MCHC more than 36.1 g/dl.

In the present study, 33/172 (19.2%) pregnant women had RDW within the normal range (10.0 -16.0 %), 139/172 (80.8%) had RDW more than 16.0%.

In non-pregnant women, 17 (56.7%) had RDW within normal range and 13 (43.3%) had RDW more than 16.0%. [Ref Table: 10/ Chart: 10].

4. DISCUSSION

The study revealed that there were significant decreased in RBCs count, hemoglobin (Hb) and packed cell volume (PCV) of pregnant women compared to non-pregnant women (P value <0.05) and significant decreased in mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) of pregnant women (P value <0.05). The authors found the most common type of anemia among Sudanese pregnant women is microcytic hypochromic type and likely to be of iron deficiency second class is normocytic normochromic type, and less of occurrence type is dimorphic picture types with increased reticulocyte production index results from prophylaxes iron response [3].

Study of hematological parameters in pregnancy was done by Sifakis S et al and Sarkar S et al. Osonuga et al studied hematological profile of pregnant women in southwest of Nigeria at different trimesters of pregnancy. The research involved 33 healthy pregnant women as the study group and 11 non-pregnant women as control. The age range of these women was 20-40 years. The blood was properly mixed and analyzed for packed cell volume (PCV), total white cell count, differential counts and erythrocyte sedimentation rate (ESR). Hematology was done according to standard methods.[8-10]

The result showed that study group exhibited statistically significant lower values of PCV, monocyte and lymphocyte while WBC, eosinophil and ESR were not significantly changed. There was no significant difference in all hematological parameters among the three trimesters. Healthy pregnancy may have effect on hematological parameters. Therefore, there is a need to monitor these parameters during pregnancy. We also find that stages of pregnancy have no influence on hematological parameters [4,5].

5. CONCLUSION

Microcytic hypochromic anemia was the predominant morphological type of anemia in all age ranges, all gravidae and all trimesters. There was statistically significant association between age and morphological type of anemia. As lower educational attainment was associated with high prevalence of anemia, educational status played important role in awareness about anemia and nutrition.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Author has declared that no competing interests exist.

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