



Changes in hematological parameters during different trimesters of pregnancy

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ABSTRACT

Pregnancy is a physiological condition in which several physiological changes occur. Although, pregnancy is normal phenomena but abnormal hematological parameters can affect and complicate the pregnancy. Additionally, anemia is considered the most common problem of pregnancy, may lead to high mortality especially in under developed countries. To evaluate changes in hematological parameters in pregnant females and compare hematological parameters within trimesters. A cross sectional study was conducted on 158 pregnant female in district hospital, Nowshera. Whole blood samples were collected in appropriate tube. Complete blood count was analyzed by using automatic hematological analyzer (KX-21, Sysmex, Japan). Data was analyzed through SPSS version 22. ANOVA test was used for comparisons of three trimesters data. Out of 158, 65.8% female was found in second trimester followed by third (20.3%) and first trimester (13.9%). Majority, anemia was found in pregnant female worked as labour and shopkeepers. Anemia was found in 56.3% pregnant female. Hematocrit, Mean cell volume, mean cell hemoglobin and mean cell hemoglobin concentration were low in majority pregnant female. Statistically significance in hematocrit, lymphocytes, monocytes, eosinophils and platelets were observed within trimesters, which showed decrease various parameters in third trimester than second and in second from first trimester, whereas, hemoglobin were decrease non-significantly. Present study revealed that anemia is common in pregnant female. Several hematological parameters were noted decrease in third trimester as compared to first and second trimester. Therefore, balanced and healthy diets are highly recommended for growth and health of baby especially in last (third) trimester.

Key words: hematological parameters, trimesters, pregnancy

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INTRODUCTION

Pregnancy or gestation is a physiological process in which fertilized egg is carried in uterus for the period of 38 to 42 weeks until the birth of offspring [1]. During this process many biochemical, hematological, hormonal and anatomical and physiological changes occur in body [2], which are necessary for normal development of fetus and for adapting the pregnancy [3]. The hematological parameter indicates the immunological, nutritive and hemostatic condition of a pregnant woman and is considered as major factors affecting the pregnancy [4, 5]. These hematological parameters for a pregnant woman include hematocrit (Hct), total red blood cell count (T-RBC), Total leukocytes count (TLC), total leucocyte count (TLC), mean cell volume (MCV), mean cell hemoglobin (MCH), mean cell hemoglobin concentration (MCHC), differential leucocytes count (DLC) and platelet count [6].

Hematocrit level falls down during pregnancy as compared to non-pregnant control and there is no significant difference in the value of Hct in all three trimesters [7, 8]. But according to Geetanjali Purohit et al. study reveals that there is variation in value of Hct in all three trimester of pregnancy. This decrease is not linear as Hct percentage in first and third trimester is lower but in second trimester, it is very significant [9].

In a normal non-pregnant female the total RBC count ranges from 4.4 to 5.4 million/ μ l of blood(8). Total RBC count fall down during pregnancy significantly compared to non-pregnant women(10).RBC count decreases linearly, as gestational age increases(11).

According to James TR et al. MCV increased significantly from first to third trimester during pregnancy(12). But another study conducted by Akinbami AA et al. MCV falls from first to third trimester due to anemia in patients(13).

Most of studies showed that the Hb content of pregnant women is low as compared to non-pregnant women(10).There is a significant decrease is seen in Hb from first to third trimester compared to non-pregnant women(9).

No significant changes in MCH during pregnancy and remains constant throughout the three trimester(10).But other studies shows that the values of MCH decreased significantly in the second and third trimester(9).

MCHC is found to be lower in pregnant women compared to non-pregnant women due to poor iron intake(9).In pregnant women with anemia MCHC is decreased significantly as compared to non-anemic pregnant women(14).Study conducted by SaidulAbrar et al. showed that the MCHC is constant during pregnancy and there is no change through the pregnancy(15).

The elevation of TLC is very significant in second and third trimester and there is no significant change between first trimester of pregnant and non-pregnant women(16)(17). In first trimester of pregnancy TLC count is raised in non-anemic women as compared to anemic women while in second and third trimester TLC count is higher in anemic women as compared to non-anemic women(1).

According to study, there is no significant variation in platelet count during pregnancy and its count is constant through pregnancy(1). However, according to Kaur, S. et al. platelet count fall down due to hemodilution during pregnancy as plasma volume increase(18). There is no significant variation in platelet count in three trimesters of pregnancy although, lower than non-pregnant healthy women(19).

During pregnancy, the neutrophil count double as compared to non-pregnant women. Rise in monocyte count is also seen, but lymphocyte; eosinophil and basophil count lower down in this state(20). According to D. C. Okpokam et al. Lymphocyte count rise during pregnancy and there is no change in eosinophil and basophil count in pregnant and non-pregnant women(21).

Several studies have been conducted on hematological parameters in pregnant female; however, few are available on different trimesters with different results. Therefore, this study was conducted to find the anemia along with comparison of hematological parameters in pregnant female within different trimesters.

MATERIAL AND METHODS

This cross sectional study was conducted in six months duration (July-December 2018) in the institute of paramedical sciences (IPMS), Khyber Medical University (KMU), Khyber Pakhtunkhwa (KP) province Pakistan with collaboration of the department of obstetrics & gynecology, district headquarter hospital Nowshera.All pregnant female were included in current study within age of 17-34 years with 8th to 40th week's gestational period. Pregnant female with coagulation disorder, respiratory tract infection, hemolytic disorder were excluded from the study.

Random venous blood sample of 2.5 ml was collected from each pregnant female under aseptic condition in K3EDTA vacutainer tube (purple top). Complete blood count was analyzed using automatic hematological analyzer (KX-21- Sysmex, Japan).

All the collected data was first compile in excel sheet Microsoft word 2016, then further analyzed in statistical package for social sciences software version 22.

RESULTS AND DISCUSSION

A total of 158 pregnant females were studied during the study duration in which 13.9% (n=22), 65.8% (n=104) and 20.3% (n=32) were in first, second and third trimester respectively as shown in table no.1. The mean age of all pregnant females was 24.4 ± 3.6 with a minimum age was 17 year, whereas maximum was 34 years. A minimum gestational day was 36 while maximum were 270 days. Mean age of pregnant female was 24.4 ± 3.6 years in current study, similar to Anjum et al. study (26.07 ± 5.04 years) (22).

Mean hemoglobin (g/dl) was 10.1 ± 1.4 with minimum 6.1 and maximum was 13.5. Low hemoglobin were reported in present study, which could be due to increase concentration of plasma (23).

The minimum and maximum values of hematocrit (%), red blood cell (million/cmm), mean cell volume (fl), mean cell hemoglobin (pg), mean cell hemoglobin concentration (%), leucocytes (/cmm), neutrophils (%), lymphocytes (%), monocytes (%), eosinophils (%) and platelets (/cmm) are shown in table no. 2.

The majority pregnant female was labour (39.9%) and shopkeeper (22.8%) as shown in table no. 3. Low-income female (labour and shopkeeper) were found more anemic in current study as compared to other. These findings are supported by Ullah et al. from Karak, Pakistan (24).

Table No. 1: Distribution of pregnant female, according to the trimester

Trimester	Number of patients	Percentage
First	22	13.9
Second	104	65.8
Third	32	20.3
Total	158	100

Table No. 2: Minimum and maximum value of age, gestational age and various hematological parameters

Parameters	N	Minimum	Maximum	Mean±SD
Age	158	17.00	34.00	24.4±3.6
Gestational age in days	158	36.00	270.00	140.1±47.9
HGB(g/dl)	158	06.10	13.50	10.1±1.4
PCV(%)	158	18.30	40.50	30.4±4.1
TRBC(million/cmm)	158	02.04	05.17	04.0±0.5
MCV(fl)	158	51.40	114.60	77.7±9.3
MCH(pg)	158	15.10	36.80	25.5±3.4
MCHC (%)	158	26.90	40.50	32.8±2.2
TLC($\times 10^3$ /ul)	158	5.500	20.70	10.73±3.28
Neutrophils(%)	158	43.00	91.00	71.1±8.9
Lymphocytes (%)	158	06.00	49.00	21.9±8.0
Monocytes(%)	158	01.00	05.00	03.1±0.9
Eosinophils(%)	158	01.00	06.00	03.9±1.1
Platelets(/cmm)	158	22000.00	495000.00	255322.8±63375.0

Table No. 3: Distribution of pregnant female, according to the occupation

Occupation	Number of Pregnant Female % (n)
Labour	39.9 (63)
Shop keeper	22.8 (36)
Teacher	5.1 (08)
Farmer	5.1 (08)
Police/Army	3.8 (06)
Engineer	1.9 (03)
Business	1.3 (02)
Other Govt Job	19.6 (31)
Total	100.0 (158)

In present study, anemia was found in 56.3%(n=89) pregnant female. Anemia reported from Bangladesh 49%(25) and Nepal 58.6% prevalence (26). The prevalence of anemia in pregnant female was 67.5% in district Karak, Pakistan (24). Some studies reported high percentage of anemia (90.5%) from urban regions of Pakistan (27).

Hematocrit was below normal in 86.7% female whereas the TRBC, MCV, MCH and MCHC were found low in 29.1%, 60.1%, 59.5% and 59.5% hemoglobin level were found in 56.3% (n=89) in pregnant female respectively. The hematocrit level was found low in 86.7% pregnant female while normal in 13.3%. TRBC was reported normal in majority female whereas low in 29.1%. The MCV, MCH and MCHC were low in 60.1%, 59.5% and 59.5% respectively, in pregnant female while high in few. TLC was normal in 60.8% while high in 39.2% female with pregnancy. Neutrophils, lymphocytes, monocytes, eosinophils and platelets level were normal majority pregnant female with 67.1, 93.0%, 98.7%, 74.7% and 95.6% respectively as shown in table no. 4.

Table No. 4: Low, normal and high level of several hematological parameters.

Parameters	Low % (n)	Normal % (n)	High % (n)
HGB (g/dl)	56.3 (89)	43.7 (69)	00
PCV (%)	86.7 (137)	13.3 (21)	00
TRBC (million/cmm)	29.1 (46)	70.9 (112)	00
MCV (fl)	60.1 (95)	38.0 (60)	01.9 (03)
MCH (pg)	59.5 (94)	39.9 (63)	0.6 (01)
MCHC (%)	59.5 (94)	34.2 (54)	06.3 (10)
TLC ($\times 10^3$ /ul)	00	60.8 (96)	39.2 (62)
Neutrophils (%)	32.9 (52)	67.1 (106)	00
Lymphocytes (%)	02.5 (04)	93.0 (147)	04.4 (07)
Monocytes (%)	01.3 (02)	98.7 (156)	00
Eosinophils (%)	00	74.7 (118)	25.3 (40)
Platelets (/cmm)	02.5 (04)	95.6 (151)	01.9 (03)

The hemoglobin level were 10.5 ± 0.9 , 10.1 ± 1.0 and 10.0 ± 1.3 in first, second and third trimester respectively, with no significance in three trimesters. Anemia were found more severe in third trimester as compared to second and first trimester female, similar to the report of Ullah et al. from Karak, Pakistan (24). High anemia in third trimester could be due to increase requirement of fetus (10, 22, 24, 28, 29).

Other parameters such as hematocrit, lymphocytes, monocytes, eosinophils and platelets level were significantly decrease subsequently of first trimester than second and second from third trimester. On the other side, TRBC, MCV and MCH count was non-significantly increased continuously from first to second and second to third trimester while the TLC count significantly increased. The level of MCHC and neutrophils were irregular in all trimesters as shown in table no. 5. Present study also showed a rising level of total leucocytes count with increased in third trimester than second and first trimester ($p < 0.05$). This study also showed lower hemoglobin, hematocrit, lymphocytes, monocytes, eosinophils and platelets concentration with increasing gestational period. This is consistent with the study of Michael OA et al. (28). Similar finding were obtained by Sejeny et al. in their study that progressive fall in platelets counts during pregnancy (30). Low platelets level during pregnancy is a slow process, therefore, does not required any intervention. Although, no need of any intervention but may cause serious problem during delivery with severe bleeding (31).

Table No. 5: Comparison of hematological parameters among first, second and third trimester of pregnant female

Parameters (unit)	Trimester I 13.9 % (n=22)	Trimester II 65.8 % (n=104)	Trimester III 20.3 % (n=32)	ANOVA (p-value)
HGB (g/dl)	10.5 ± 0.9	10.1 ± 1.0	10.0 ± 1.3	0.171
PCV (%)	37.5 ± 2.6	32.9 ± 2	31.7 ± 2.3	0.008
TRBC (million/cmm)	4.0 ± 0.4	4.1 ± 0.2	4.2 ± 1.8	0.184
MCV (fl)	81.9 ± 7.4	82.9 ± 8.4	85.7 ± 13.9	0.656
MCH (pg)	26.2 ± 2.9	27.0 ± 3.3	27.3 ± 2.5	0.222
MCHC (%)	31.5 ± 2.9	33.0 ± 2.0	30.5 ± 6.6	0.805
TLC ($\times 10^3$ /ul)	07.8 ± 1.4	9.7 ± 2.4	10.2 ± 2.1	0.001
Neutrophils (%)	63.4 ± 9.1	73.8 ± 7.2	70.7 ± 9.1	0.001
Lymphocytes (%)	28.5 ± 8.5	19.9 ± 5.9	19.7 ± 6.8	0.001
Monocytes (%)	4.3 ± 0.6	3.5 ± 0.8	3.4 ± 0.7	0.001
Eosinophils (%)	3.8 ± 0.4	3.6 ± 1.3	3.6 ± 1.1	0.049
Platelets (/cmm)	3.3 ± 0.6	3.1 ± 4.0	2.5 ± 0.4	0.007

This study was carried out at single district with less sample size. We do not investigate coagulation profile and serum iron level.

It is necessary for developing countries to educate the illiterate female or unaware about pregnancy complications. Need especial health promotional seminars and programs inside backwards area of the Pakistan.

CONCLUSION

It is revealed by current study that pregnant female is more prone to anemia especially in the third trimester female. During pregnancy, nutrition plays a vital role. Therefore, it is highly recommended to

educate the female about healthy and balanced diet during pregnancy such as iron containing food (meat and spinach), proper treatment and adverse effect of black tea on iron absorption.

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CONFLICT OF INTEREST

There is no conflict of interest of any author.

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