ERYTHROCYTE CHANGES IN NORMAL PREGNANCY IN MAIDUGURI, NORTH EASTERN NIGERIA

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ABSTRACT

***Background**: There is paucity of data in respect of full blood count, which include the PCV, Hb, RBC in pregnant women in Maiduguri North- Eastern region of Nigeria.*

***Methodology**: A cross-sectional study was carried out at the Ante-natal Clinic of the University of Maiduguri Teaching Hospital. The control group was constituted by women from the family planning clinic who had weaned their babies. Blood samples were taken from 200 pregnant women and 150 non-pregnant controls.*

***Results:** Eight of the pregnant women were in 1st trimester, 119 in 2nd trimester and 73 in 3rd trimester. The mean ± SD of Hb, PCV, and RBC, were: Hb 8.5±2.2 g\dl, 7.9 ±1.7g\dl 8.2 ± 1.7 g\dl, PCV: 31.8 ± 5.8%, 28.6 ± 3.6%, 28.7 ± 4.9%, RBC: 4.1±1.1 x 10^{12}\L, 4.0 ±0.9 x 10^{12}\L, 3.9±1.9 x 10^{12}\L for 1st, 2nd, and 3rd trimesters, respectively. The non-pregnant women had Hb, PCV, and RBC, of: 11.0 ± 1.34 g\dl, 34.0 ± 3.63%, 4.2 ± 0.58 x10^{12} \L. There was a significant fall in Hb PCV and RBC count in pregnancy (P<0.05). The MCV in the 1st, 2nd and 3rd trimesters were 82.3 ± 18.8 fl, 75.6 ±18.2 fl, and 79.2 ±17.4 fl, respectively. The MCHC in the 1st, 2nd and 3rd trimesters were 26.2 ± 5.1 g\dl, 27.9 ± 5.5 g\dl and 28.2 ±5.6 g\dl, respectively. The MCH in the 1st, 2nd and 3rd trimesters were 22.0 ±7.4, 21.0 ±5.3 pg, and 22.0 ±6.2 pg, respectively. The corresponding values for the non-pregnant women were: MCV 81.4 ± 10.52 fl, MCHC 32.5 ± 2.4 g\dl and MCH 26.3 ± 2.87pg. The MCV, MCHC and MCH were found to be significantly lower in pregnant than in the non-pregnant women (p<0.05).*

***Conclusion**: Our finding showed that there is a significant fall in Hb, PCV, and RBC in pregnancy. Further studies are needed to determine the normal pregnancy values for our population.*

INTRODUCTION

The physiological changes of pregnancy result in profound changes in the maternal haematological system[1]. Haemo-dilution occurs in pregnancy as a result of increase in plasma volume, so does red cell mass[2]. Plasma volume and total red cell mass are under separate control and have no fixed relation to one another. Changes in pregnancy provide a dramatic illustration of this point[3].Maternal blood volume increases during pregnancy. The degree of expansion varies considerably, in some women there is only a modest increase, while in others the blood volume nearly doubles[4].

The measurement of circulating plasma volume is not practical clinically but a useful assessment can be made from coulter counter measurement[5].The haematocrit or packed cell volume (PCV) falls in parallel with the red cell count and haemoglobin concentration from an average of non-pregnant value of 0.40 - 0.42 to a minimum of 0.31 - 0.34. These values are derived from healthy pregnant women not receiving iron supplement, this reduction is modified in those taking supplementary iron[3].

There is a paucity of data in respect of Full blood count, which include the PCV, Haemoglobin (Hb), and Red blood cells (RBC) counts among pregnant women in Maiduguri, North- Eastern Nigeria.Therefore, the aim of the study is to determine the range of erythrocyte values in normal pregnancy in Maiduguri.

MATERIALS AND METHODS

A total of three hundred and fifty (350) subjects were investigated in this study comprising two hundred (200) healthy pregnant women booking for antenatal care. The control was one hundred and fifty (150) non-pregnant healthy women. The ages for both pregnant and non-pregnant women ranged from 18 to 45 years.Eight were in the first trimester of pregnancy, 119 were in the second trimester of pregnancy, and 73 were in the third trimester of pregnancy.

This was a cross sectional study in which pregnant women were recruited from the booking clinic of UMTH Maiduguri. The pregnant women were normal individuals without previous history of any disease especially hypertension, diabetes mellitus or sickle cell anaemia. The pregnancy was singleton confirmed by ultrasound scan (USS). The process of conception was normal, and not by in vitro fertilization. The women were from different ethnic, socio-economic, cultural and religious backgrounds.

Blood samples were drawn from each subject at different

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gestational ages. The controls were selected from normal, non-pregnant individuals attending family planning clinic. They had no history of hypertension, diabetes or sickle cell anaemia and had weaned their babies from breastfeeding. A questionnaire was administered to both pregnant and non-pregnant women. Women on hormonal contraception were also excluded from the study.Five milliliters of venous blood sample were aseptically obtained from each subject using plastic syringes and needles into plastic sequestrene bottles containing tri-potassium ethylene diamine tetracetic acid (K3-EDTA) anticoagulant. Care was taken to avoid undue stasis and frothing during withdrawal of the blood and subsequent mixing with anticoagulant [6].Specimens collected from the ante-natal clinic as well as other centres of collection were transported to Human Physiology Laboratory in the University of Maiduguri and Haematology laboratory in UMTH. Labile tests viz: PCV and RBC were carried out within three hours of collection. Haemoglobin estimation was performed using the cyamythaemoglobin method and packed cell volume by the microhaematocrit method. The RBC count was by haemocytometry (counting the RBCs on a haemocytometer). Manual methods were used for all the tests.

The data was entered on excel spread sheet and imported onto SPSS version 13 package for analysis. The student t-test was used to compare some variables. Probability value of less than or equal to 0.05 is significant, while probability value of greater than 0.05 is not significant.

RESULTS

The mean, standard deviation (SD) and significant t-test for 150 non-pregnant women were compared with that of 200 pregnant women, 8 in the first trimester, 119 in the second trimester and 73 in the third trimester. The student t-test was used in analysing the results obtained from the different groups in the study to find whether there were any significant difference in the blood parameters between non-pregnant women and the women in the first, second and third trimesters of pregnancy.

In the first trimester, there was a significant fall in Hb, and PCV values ($P<0.05$). Although the Hb and PCV rose in the third trimester, it never reached the pre-pregnancy values. The RBC count declined progressively from the first trimester to the third trimester.

The calculation of the haematological indices showed that MCV was in-significantly higher ($P>0.05$) in the first trimester, declined in the second trimester and peaked up a little in the third trimester. The MCHC and the MCH were lower in pregnant than in non-pregnant ($P<0.05$).

DISCUSSION

Haematological values in pregnancy have been shown to vary from the non-pregnant values[2, 8], with a progressive decline in PCV, Hb, RBC, platelet; and a progressive increase in the WBC.Factors contributing to such variation, among other things include the effect of the placental hormones of pregnancy, increased erythropoietin and plasma volume expansion [2,4].

This study showed that there was a significant fall in PCV and Hb in pregnancy ($P<0.05$). The Hb and PCV declined more in the second trimester, but peaked up in the third trimester, while the RBC count declined progressively from the fist trimester to the third trimester. This fall occurred significantly because all the women were not on haematinics (folic acid or iron supplements) or anti-malarial prophylaxis as they were recruited from the booking clinic. Paitain[9], reported that fall in Hb and PCV is worst without iron therapy. In another report[7], iron therapy improved PCV in pregnant Nigerian women.

The result obtained in this study is in keeping with results of other workers[2, 5, 10, 11] and reflects the drop in haematocrit consequent upon the 50% increase in plasma volume that occurs in pregnancy[12]. This is the hall mark of "the physiological anaemia of pregnancy".The rise in the haematocrit observed in the third trimester was because of the continued expansion in the RBC volume ahead of the plasma volume.

The WHO[13] figure of 11g/dl as the minimum Hb will not apply in this environment as pregnancy outcome has been found to be normal in mothers with Hb 10g/dl[14, 15]. The relatively low Hb concentration may be attributed to malaria which is very common in this environment. Rougemont[16], observed

Table 1: *Erythrocyte changes in normal pregnancy compared with the non-pregnant control.*

Parameter	Non-pregnant Women (n=150)±SD	Pregnant women (n=200)±SD		
		1st T N=8	2nd T n=119	3rd T n=73
Hb(g/dl)	11.0 ± 1.34	34.0 ± 3.63	4.2 ± 0.58	81.4 ± 10.52
PCV (%)	32.5 ± 2.4	26.3 ± 2.87	8.5 ± 2.2	31.8 ± 5.8
RBC (x1012\L)	4.1 ± 1.1	82.3 ±18.8	26.2 ± 5.1	22.0 ± 7.4
MCV(fl)	7.9 ± 1.7	28.6 ± 3.8	4.0 ± 0.9	75.6 ± 18.2
MCHC (g/dl)	27.9 ± 5.5	21.0 ± 5.3	8.2 ± 1.7	28.7 ± 4.9
MCH (pg)	3.9 ± 1.0	79.2 ± 17.4	28.2 ± 5.6	22.0 ± 6.2

n=number, SD=standard deviation, T=trimester

Table 2: *Normal reference values in pregnancy*

Parameter	Average	Range
Hb (g/dl)	8.2	7.9-8.5
PCV (%)	29.7	28.6-31.8
RBC (x10)	4.0	3.9-4.1
MCV (fl)	19.0	75.6-82.3
MCHC (g/dl)	27.4	26.2-28.2
MCH (pg)	21.6	21.0-22.

that anaemia more often normochromic and regenerative usually appears during the second trimester of pregnancy in the Republic of Mali. Malnutrition, resulting from poverty and ignorance may also be partly responsible[14]. Our study supports this suggestion as the minimum Hb concentration observed was 7.9g/dl in the mid-trimester. It would however be necessary to prospectively follow the outcome of these pregnancies to make conclusions as to whether these values should be considered as normal in pregnancy in this environment.

From this study it can be inferred that most women in this part of the world go into pregnancy with anaemia. A minimum Hb of 8.7g\dl has been suggested by Lawson[14] which is in keeping with our findings (table 1).

The RBC count also followed a similar pattern with that of Hb and PCV, declining progressively with increasing gestational age. The results observed in this study are in agreement with other studies [10,17,18,19]. The mean RBC count for the pregnant women was 3.9x 10^{12}/L.The MCV, MCHC and MCH were lower in pregnant than in the non-pregnant control.

Conclusion and Recommendation: These results showed that there is a significant fall in Hb, PCV, and RBC in pregnancy. Further studies are needed to evaluate the pregnancy outcome in these women and probably come up with normal values for our population.

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