ORIGINAL ARTICLE

Haematological Values in Pregnant Women in Port Harcourt, Nigeria

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ABSTRACT

***Background**: Conflicting results have been documented regarding the statistical significance of variations in some haematological parameters at different trimesters of pregnancy. Environmental factors, ethnic and tribal peculiarities have variously been implicated. The values of eight important haematological parameters: Haematocrit (Hct), Haemoglobin concentration (Hbc), Red Blood Cell (RBC) count, White Blood Cell (WBC) count, Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Erythrocyte Sedimentation Rate (ESR) were therefore determined in healthy pregnant subjects receiving antenatal care at the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria.*

***Method**: Cross-sectional prospective study involving 130 pregnant subjects aged between 18 and 43 years. The subjects were divided into three groups consisting of 46 subjects in the first trimester, 36 subjects in the second trimester and 48 subjects in the third trimester of pregnancy. The height, weight and body mass index of all subjects were also determined.*

***Results**: Results obtained for the haematological parameters indicate that only Haematocrit (Hct) showed significant differences amongst the three groups; highest amongst subjects in the third trimester and lowest amongst subjects in the second trimester ($p<0.05$). Haemoglobin concentration (Hbc), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), and Erythrocyte Sedimentation Rate (ESR) were found to be highest amongst subjects in the second trimester; Red Blood Cell (RBC) count and White Blood Cell (WBC) count were highest amongst subjects in the first trimester of pregnancy. These differences were however, not statistically significant ($p>0.05$). Among the anthropometric parameters studied, only weight showed significant differences in the three groups of pregnant subjects ($p<0.05$); being highest amongst subjects in the third trimester and lowest in subjects in the first trimester.*

***Conclusion**: The present study provides additional baseline data for basic haematological parameters in healthy pregnant Nigerian women. This would be of immense benefit especially in the antenatal assessment of pregnant Nigerian women.*

KEYWORDS: Hematological values; Pregnancy; Port Harcourt.

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INTRODUCTION

Physiological variations are known to occur in a wide range of haemorheological and other blood parameters in apparently healthy individuals[1, 2]. These variations depend on several factors amongst which include the parameter assessed, the individual tested, the analytical method used, and the precision of the instruments[1]. It is only on the basis of knowledge of these analytical and biological variations that is it possible to calculate the critical difference between results; that is the change that must occur before significance can be claimed in a particular circumstance[3]. The importance and significance of gender, race, age and other population specific reference values for various physiological parameters cannot therefore be overemphasized[4]. Studies providing reference haematological and other blood parameters in apparently healthy individuals in various physiologic states and in several different ambient circumstances will certainly continue to be relevant[4-7].

In Nigeria, recent reports have presented values of some haematological parameters in apparently healthy adult pregnant women[8, 9]. However, dispute persists regarding the statistical significance, if any, of the reported variations in some of these haematological parameters. Reporting from different centers, two recent studies present conflicting results regarding the statistical significance of some haematologic parameters especially haematocrit, leukocyte count and platelet count in the trimesters of pregnancy and in non pregnant Nigerian women. This suggests that more studies are clearly needed from other centers in Nigeria to help elucidate the pattern of variation of these haematological parameters in healthy adult pregnant women. Such studies would provide additional data and help in the determination of reference ranges for various haematological parameters in pregnant Nigerian women[10].

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The aim of the present study therefore is to report values of some important haematological parameters in apparently healthy pregnant women in Port Harcourt, Nigeria and determine any possible significant differences in the trimesters of pregnancy. This would help in the determination of haematologic reference ranges during pregnancy and assist in the antenatal assessment of healthy adult Nigerian women.

MATERIALS AND METHODS

A total of 130 apparently healthy pregnant subjects aged between 18 and 43 years with mean ages of: 26.73±5.59 for the first trimester; 26.67±5.68 for the second trimester and; 32.91±6.10 for the third trimester were selected for the study. The subjects were all attending the antenatal clinics of the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria. The subjects were from different socio-economic classes and ethnic groups in south-eastern Nigeria. They were divided into three pregnancy groups, consisting of 46 subjects in the first trimester, 36 in the second trimester and 48 in the third trimester of pregnancy. Informed consent was sought and obtained from each subject before recruitment into the study. For the purpose of the present study the first trimester was considered to end at thirteenth week, the second to end at the twenty-sixth week and the third trimester to end at forty weeks.

Height and weight were determined using the seca scale. Body mass index was determined using the formula of Du Bouis and Du Bouis[11]: weight in kg divided by the square of the height in meters (kg/m^2). 5 ml of venous blood was subsequently collected from an ante cubital vein with the subject comfortably seated and with minimum stasis. The blood was immediately transferred into EDTA specimen bottles and carefully mixed. All blood samples were collected between 9am and 12noon each day and analyzed within two hours of collection.

The following haematological parameters were subsequently determined by the methods indicated: Haematocrit (Hct) using Hawksley micro-capillary tubes centrifuged at 3000 r.p.m for 10 minutes, the mean of two separate samples was taken as the haematocrit value; Haemoglobin concentration (Hbc) by the cyanmethaemoglobin method as described by Dacie and Lewis 1991[12]; Red Blood Cell (RBC) count and White Blood Cell (WBC) count manually using the improved Neubauer counting chamber as described by Dacie and Lewis 1991[12]; Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) were calculated from values of the appropriate haematological parameters determined[12]. Erythrocyte Sedimentation Rate (ESR) was determined by the method of Westergren as described by Dacie and Lewis 1991[12]. All haematological parameters were determined at room temperature (27°C±0.5).

The results obtained are as presented in Tables I and II. Statistical significance was determined using the analysis of variance.

RESULTS

Table I shows mean values, standard deviations and ranges for age, weight, height, and body mass index in all subjects at the different trimesters of pregnancy. Statistical analysis showed significant differences in only weight amongst the three different groups of pregnant subjects ($p<0.05$). Subjects in the third trimester of pregnancy had the highest mean value of weight: 71.27± 9.52kg, followed by subjects in the second trimester with a mean weight of 67.02± 7.37kg. Subjects in the first trimester had the least mean weight: 66.65± 8.33kg. Age, height and body mass index did not show significant differences amongst the three groups of pregnant subjects under study ($p>0.05$).

Table II shows the mean values, standard deviations and ranges for the eight haematological parameters studied in all subjects at the different trimesters of pregnancy. However, amongst the eight haematological parameters studied, only Haematocrit (Hct) showed significant differences ($p<0.05$) between the subjects in the three groups. The highest value of Haematocrit: 29.02±3.74% was recorded amongst subjects in the third trimester of pregnancy, while the lowest value of 26.64±4.18% was recorded amongst subjects in the second trimester of pregnancy; subjects in the first trimester had an intermediate value of 27.26±4.11%.

Haemoglobin concentration (Hbc), Red Blood Cell (RBC) count, White Blood Cell (WBC) count, Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Erythrocyte Sedimentation Rate (ESR) did not show significant differences amongst the subjects in the three different pregnancy groups. However, Haemoglobin concentration (Hbc), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC) and Erythrocyte Sedimentation Rate (ESR) were found to be consistently highest amongst subjects in the second trimester of pregnancy and generally lowest among subjects in the first trimester of pregnancy, except for Mean Corpuscular Haemoglobin Concentration (MCHC) which was lowest

amongst subjects in the third trimester.

Red Blood Cell (RBC) and White Blood Cell (WBC) counts were both found to be highest in subjects in the first trimester of pregnancy and to show a progressive decline amongst subjects in the second and third trimester of pregnancy.

Table I. Age, Weight, Height and Body Mass Index Values in the Trimesters of Pregnancy

	First Trimester (n=46)	Second Trimester (n=36)	Third Trimester (n=48)	Significant difference (ANOVA)
Age (years)	26.73 ±5.59 (18-43)	26.67 ±5.68 (18-43)	32.91 ±6.10 (18-43)	No (p>0.05)
Weight (kg)	66.65± 8.33 (49-90)	67.02± 7.32 (45-95)	71.27 ±9.52 (45-99)	Yes (p<0.05)
Height (cm)	158 ±1.07 (141-175)	158 ±1.10 (141-175)	158 ±1.40 (141-175)	No (p>0.05)
Body Mass Index (BMI) (kg/m^2)	26.84±4.45 (19.38-35.56)	27.99±7.29 (18.67-54.55)	27.82±6.65 (19.38-36.57)	No (p>0.05)

All values = mean ±standard deviations, ranges in parenthesis.

Table II. Haematological Values in the Trimesters of Pregnancy

	First Trimester (n=46)	Second Trimester (n=36)	Third Trimester (n=48)	Significant differences
Haematocrit (%)	27.26±4.11 (20-32)	26.64±4.18 (21-32)	29.02±3.73 (21-35)	Yes (p<0.05)
Haemoglobin concentration (g/dl)	8.81±1.09 (7.2-10.5)	9.31±1.26 (7.0-11.3)	9.28±1.51 6.2-11.8	No (p>0.05)
RBC count (x 10^{12}/L)	5.69±2.23 (2.17-7.64)	4.58±1.63 (1.38-7.69)	4.82±1.50 (2.17-7.25)	No (p>0.05)
WBC count (x 10^9/L)	6.48±1.35 (4.0-9.4)	6.44±1.71 (4.0-9.6)	6.24±1.63 (4.0-9.6)	No (p>0.05)
Mean Corpuscular Volume (MCV) (fl)	63.94±2.72 (10.40-84.90)	67.79±3.25 (10.70-96.80)	67.27±2.59 (10.0-92.50)	No (p>0.05)
Mean Corpuscular Haemoglobin (MCH) (pg)	20.89±0.79 (10-39)	24.14±1.28 (10-73)	22.65±1.17 (9-72)	No (p>0.05)
Mean Corpuscular Haemoglobin Concentration (MCHC) (g/dl)	33.08±6.86 (26.9-46.2)	35.58±6.43 (24.1-53.3)	32.92±6.60 (19.4-46.2)	No (p>0.05)
Erythrocyte Sedimentation Rate (ESR) (mm/1hr)	38.07±22.8 (5.0-93)	45.61±25.86 (5.0-102)	44.06±25.31 (6.0-123)	No (p>0.05)

All values = mean ± standard deviation, range in parenthesis

DISCUSSIONS

Expectedly, statistically significant differences in weight were observed in the three different groups of pregnant subjects. This is consistent with established physiological weight changes in pregnancy; most gain occurs in the last two trimesters[13]. However, despite this difference in weight, significant differences in body mass index (BMI) were not observed among the three groups of pregnant subjects.

Amongst the eight haematological parameters studied, only haematocrit values showed significant differences in the three pregnancy groups. The value of haematocrit showed an initial reduction amongst subjects in the second trimester and later a rise amongst subjects in the third trimester of pregnancy. The initial reduction may be due to the effects of haemodilution resulting from the increase in blood volume usually occurring from the twentieth week of pregnancy[13]. The subsequent rise in haematocrit value seen amongst subjects in the third trimester can only be attributed to the effects of supplementary haematinics. This finding compares with the report of Owunkeme and Uguru 1980[9] and Obisesan *et al* 1998[8] both studies found no significant changes in mean haematocrit pregnancy. The mean value of haematocrit seen in our subjects in the present study were however and in addition, lower than reported by both studies.

The mean haemoglobin concentration seen in the subject population of the present study was apparently lower than the accepted normal for pregnant African patients[14]. This suggests a pre-existing anemia in our subjects. On account of the low corpuscular indices: mean corpuscular volume and mean corpuscular haemoglobin in our subjects, this anemia is most probably from iron deficiency[12, 14]. This is supported by the improvement in haemoglobin concentration, mean corpuscular volume and mean corpuscular haemoglobin in subjects in the second and third trimesters of pregnancy. The improvement is most probably attributable to haematinic supplementation. This in addition, is consistent with the findings that in Bantu women with a high iron intake, no fall in mean corpuscular haemoglobin occurs in pregnancy and corpuscular indices change little[14]. Surprisingly, in the subject population of the present study, mean corpuscular haemoglobin concentration was within normal ranges and showed no significant differences amongst the three groups of pregnant subjects.

Erythrocyte sedimentation rate values obtained in the present study were within normal limits in pregnancy[15], but are higher than values seen in non pregnant subjects[12]. High erythrocyte sedimentation rates, without any detectable abnormality, are not unusual in pregnancy[16] and arise from the high fibrinogen concentration[17] and anemia seen in pregnancy, especially in African women[14]. High fibrinogen concentration causes an increase in red cell aggregation and thus elevates erythrocyte sedimentation[14] while anemia by altering the ratio of red cell to plasma encourages rouleaux formation and thus elevates erythrocyte sedimentation[12]. These reasons accounts for the high erythrocyte sedimentation rate seen amongst subjects involved with the present study. In addition both red blood cell and white blood cell counts were found to be within limits of pregnancy[14]. The white blood cell count seen in the present study was found to be in the same range as the report of Obisesan *et al* 1998[8].

Aside from the significant differences in haematocrit values, the present study supports suggestions that no statistically significant differences exist in most haematologic parameters in the trimesters of pregnancy. Manual methods were used in the present study because automation was not readily available in our centre; nonetheless this does not detract from the

implications of our findings.

In conclusion, the present study reports values of eight important haematologic parameters in apparently healthy adult pregnant subjects in Port Harcourt, Nigeria. Results obtained indicate that except for haematocrit most haematologic parameters do not show significant differences in the three trimesters of pregnancy. Our study provides additional baseline haematologic data for apparently healthy pregnant Nigerian women.

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