Original Research Article

Variation in Some Haematological Parameters in Patients with Plasmodiasis attending Antenatal Clinic in Primary Health Care Centre, Ozuoba, Port Harcourt

ABSTRACT

INTRODCTION: Haematological parameters are useful in making diagnosis of diseases and also help in the antenatal assessment of women during pregnancy. The physiological changes of pregnancy, due to the influence of hormones such as oestrogen, progesterone also affect haematological indices when compared with the non-pregnant state These parameters are also influenced by race, geographical location, age, environmental factors and the prevalence of infectious diseases such as malaria. The maternal and fetal effects of malaria are enormous in the tropics, these include miscarriages, stillbirths, preterm labour and deliveries, anaemia and severe malaria among others.

AIM: The study investigated haematological indices in pregnant women with plasmodiasis attending antenatal clinics in Primary health care centreOzuoba, Port Harcourt.

METHODOLOGY: This was a cross sectional study, which recruited a total of one hundred (100) subjects, of which (40) were non parasitized pregnant women who served as control, while (60) were parasitized pregnant women who served as test. The samples were analyzed for haematological parameters using (Sysmex XP-300), while microscopy was used to investigated for the presence of malaria parasite.

RESULT: Comparing the hematological parameters of the study population at different level of plasmodiasis, showed that WBC, and Neutrophil were significant with p-Value of 0.001 and 0.0089 respectively at $P<0.05$.

The other haematological parameters such as, RBC, HB, HCT, MCV, MCH, MCHC, PLT, PCT, Neutrophils, lymphocyte, monocyte, eosinophil and basophil showed no statistical significant difference at $p<0.05$. while comparison of the haematological parameters of the study group according to parity showed that WBC count had statistical significance with a p-Value of 0.0035 at $p<0.05$.

CONCLUSION: Findings from this study has shown that there was statistical significant difference in the white blood cell count of malaria-parasitized pregnant subject. It was further revealed that there was no statistical significant difference in the other haematological parameters. The reason for the pattern of result obtained is that some of the pregnant women may have been receiving prophylactic antimalarial drugs before their recruitment, thus causing a reduced effect of malaria parasitemia on other haematological parameters.

Keywords: Variation, Hamatological Parameters, Plasmodiasis, Pregnancy

Introduction

Hematological parameters are useful in making diagnosis of diseases and also help in the antenatal assessment of women in pregnancy. The physiological changes of pregnancy, due to

the influence of hormones such as oestrogen, progesterone also affect haematological indices when compared with the non-pregnant state[11].The haematological parameters is further influenced by race, geographical location, age, environmental factors and the prevalence of infectious diseases such as malaria[2]. On average, one in four pregnant women in areas of stable transmission in Africa has evidence of malaria infection at the time of delivery based on the estimated prevalence of 26% of placental malaria[4].

In Sub-Saharan Africa, Plasmodium falciparum infection of the placenta remains a major challenge among pregnant women[14] and its prevalence is influenced by maternal age, gravidity, use of malarial prophylaxis, nutrition, host genetics, level of host's immunity, parasite genetics and transmission rates[12]. Maternal anaemia is the commonest consequence of Plasmodium falciparum malarial infection[14]. In Sub-Saharan Africa, it is estimated that between 200,000 and 500,000 pregnant women develop severe anaemia as a result of malaria[13]. Anaemia is usually multifactorial in origin and although, malaria is an important contributor; nutritional deficiencies, hookworm, HIV infections and genetic red blood cell disorders (Sickle cell and thalassemias) are other important contributing factors[10]. The hypersplenism in malaria infection is associated with a reduction in all three blood series that is, causing not only anaemia, but also thrombocytopaenia and leucopaenia [6].

The severity and type of anaemia can be determined by the levels of haematological indices such as haemoglobin concentration, Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Haemoglobin (MCH)[3]. Although, many studies have reported on anaemia as a complication of malarial infection in pregnancy, the pattern of these blood indices has not been documented. There is also dearth of information on the effect of pregnancy on other blood cells in the presence of plasmodium falciparum in Rivers State.

Materials and Methods

Study Design

This research work is a cross sectional study carried out among pregnant women who attended Ozuoba antenatal clinic. Questionnaires were administered to all the study subjects to determine their parities, social, occupational and marital status, including personal details. Blood samples were collected from study subjects who consented to participate in the study. Individuals who did not grant consent to participate in the study were excluded.

Study Population

A total of fifty (100) were recruited for this study. Non parasitized pregnant women were used as control (40) while 60 parasitized pregnant women were used as test.

Study Area

This study was conducted in Ozuoba Primary HealthCare Center, Port-Harcourt, Rivers State.

Eligibility of Participants

Inclusion Criteria

Only antenatal patients having signs and symptoms of malaria visiting the above listed hospital were included in the research.Apparently healthy antenatal patients without signs and symptoms of malaria were used for the control.

Exclusion Criteria

Antenatal patients who are under drug were not involve in the research. Smokers and alcohol consumers were also excluded from the research.

Samples Collection

Sample collection was done aseptically using the S-Monovette vacutainer blood collection system. After the tourniquet was applied 3-4 inches above the selected puncture site for not more

than 1 minute, the selected puncture site was palpated with the gloved index finger and wiped with a wet swab. The vacutainer needle screwed into the holder was inserted into the lumen of the vein at 15-30 degree angle with the skin. The vacutainer anticoagulated tube (sodium citrate) was inserted into the holder and was filled by the blood up to 5ml. The tourniquet was removed first followed by the filled tube which was then mixed gently.

Methodology

Full Blood Count (FBC): Measurement of haemoglobin, red blood, cells, white blood cells and platelets count were done by automation using Haematology CBC auto analyzer SYSMEX KX-21N (Sysmex Corporation Japan, S/No B4 577), made by Beckman Coulter.

Identification of Malaria Parasite by Giemsa Staining Technique: On a well labeled clean grease-free-glass slide, a Pasteur pipette was used to pipette a certain quantity of the well-mixed sample. Then a drop of the sample was placed on the slide. A thick film was made by smearing the blood on the slide. Thereafter, the film was allowed to air dry. The slide was then flooded with a 1in 30 dilution of Giemsa stain for 30 minutes. After staining, the slide was rinsed in water and blotted dry with cotton wool. The slide was allowed to air dry. After drying, a drop of immersion oil was placed on the stained portion of the slide and viewed under the light microscope using 40x and 100x objective lenses to focus and view respectively with the iris diaphragm opened and condenser rack up.

Interpretation of Results

1-10/10HPF = +++

10-20/10HPF = ++++

1-10/100HPF = +

11-20/100HPF =++

Data Analysis

The data generated were analyzed using GraphPad Prism (version 8.02) Comparison of some haematological indices between antenatal patients with signs and symptoms of malaria and statistical tools such as student's t-test and one way ANOVA were used. Results were presented as mean ± SD with statistical significance set at $p< 0.05$.

Ethical Approval: Ethical consent was sort and gotten for this research.

Results

Table 1 shows the Demographic Characteristics of Malaria Parasitized Subjects. Age groups of the population ranged from 19-25, 26-32, 33-40 with the frequency distribution of the 0.17, 0.63 and 0.20 and percentage of 17%, 63% and 20% respectively.

The educational status of the study population showed that SSCE, Tertiary and post graduate had frequency distribution of 0.55, 0.35 and 0.10 and percentage of 55%, 35% and 10% respectively.

The parity of the study population ranged from 0-1, 2-3, and 4-5 with the frequency distribution of 0.57, 0.37 and 0.06 respectively and the percentage of 57%, 37% and 6% respectively.

The occupation of participants in this study included business, teaching and student with the frequency distribution of 0.55, 0.40 and 0.05 and percentage of 55%, 40% and 5% respectively.

Table 1 Demographic Characteristics of Malaria Parasitized Subjects

Subjects	No. of Participants	Frequency	Percentage
Age Groups			
19-25	10	0.17	17%
26-32	38	0.63	63%
33-40	11	0.20	20%
Education Status			
SSCE	33	0.55	55%
Tertiary	21	0.35	25%
PostGrad.	6	0.10	10%
Parity			
0-1	34	0.57	57%
2-3	22	0.37	37%
4-5	4	0.06	6%
Occupation			
Business	33	0.55	55%
Teaching	24	0.40	40%
Students	3	0.05	5%
Level of Malaria			
+	43	0.72	72%
++	17	0.28	28%

Table 2 shows the Hematological Parameters of Malaria Parasitized Subjects and Non-Parasitized Subjects. Comparing the hematological parameters of the study group. It was seen that WBC had a Mean ± SD of 8.73±2.27 and 6.89±1.51 for the test and control respectively. There was a statistical significant difference with P- Value of 0.0036 at $P<0.05$. Further comparison of the test and the control subjects showed no statistical significant difference at $p<0.05$ for RBC, HB, HCT, MCV MCH, MCHC, PLT, PCT, Neutrophil, lymphocyte,monocyte, eosinophil and basophil.

Table 2: Comparative Analysis of Haematological Parameters of Malaria Parasitized

Subjects Against Non-Parasitized Subjects

Parameters	Malaria Parasitized Subjects (Test)	Non- Parasitized Subjects (Control)	pvalue	fvalue	Remark
WBC($x10^9$/L)	8.73±2.27	6.89±1.51	0.0036	3.015	S
RBC ($x10^9$/L)	3.88±0.52	3.78±0.36	0.4878	0.697	NS
HB (g/dl)	10.85±1.06	11.06±0.94	0.4788	0.712	NS
HCT (%)	32.02±3.62	32.69±3.17	0.5058	0.664	NS
MCV (FL)	82.98±6.86	86.51±5.59	0.0654	1.874	NS
MCH(pg)	28.17±2.77	29.30±2.23	0.1405	1.491	NS
MCHC(g/dl)	262.9±139.7	267.9±141.0	0.9007	0.125	NS
PLT ($x10^9$/L)	197.2±60.23	176.4±44.67	0.2046	1.281	NS
RDW-SD (%)	44.55±5.28	42.82±10.99	0.3872	0.870	NS
RDW-CV (fl)	14.27±2.23	13.76±1.22	0.3849	0.874	NS
PDW	14.92±2.31	15.06±2.21	0.2156	0.829	NS
MPV (%)	10.58±1.07	10.73±0.77	0.6020	0.524	NS
P-LCR	55.37±23.53	49.13±18.93	0.3371	0.966	NS
PCT (mL/L)	1.67±1.00	1.425±0.84	0.3681	0.904	NS
NEUT($x10^9$/L)	52.64±28.45	51.22±27.87	0.8606	0.176	NS
LYM($x10^9$/L)	18.49±11.19	20.22±11.76	0.5944	0.176	NS
Mono($x10^9$/L)	3.69±2.11	4.18±2.52	0.4387	0.779	NS
Eosin($x10^9$/L)	1.10±1.25	1.22±1.26	0.7380	0.335	NS
Baso ($x10^9$/L)	0.03±0.06	0.04±0.07	0.9273	0.091	NS

. keys: S=Significant, NS=Not Significant.

Table 3 shows the Hematological Parameters of Malaria Non-Parasitized Subjects and Malaria Parasitized Subjects at Different Level of Plasmodiasis Quantification. Comparing the hematological parameters at different level of plasmodiasis, it was seen that WBC, and Neutrophil were significance with p-Value of 0.001 and 0.0089 respectively at P<0.05. Comparison of other parameters such as RBC, HB, HCT, MCV MCH, MCHC, RDW-SD, RDW-CV, PDW, MPV, P-LCR, PCT, lymphocyte, monocyte, eosinophil and basophil showed no statistical significance difference at P<0.05.

Table 3: One-WAY ANOVA of Haematological Parameters of Malaria Non-Parasitized Subjects (control) against Malaria Parasitized Subjects (Test) at Different Level of Plasmodiasis Quantification

parameters	Control	Malaria (+)	Malaria (++)	pvalue	fvalue	Remark
WBC($x10^9$/L)	6.897±1.519[a]	8.138±1.922	10.56±2.390[b]	<0.001	13.17	S
RBC ($x10^9$/L)	3.787±0.3686	3.914±0.5633	3.798±0.4107	0.6054	0.5058	NS
HB (g/dl)	11.06±0.9473	10.86±1.150	10.79±0.7740	0.7626	0.2722	NS
HCT (%)	32.69±3.176	32.17±3.931	31.58±2.537	0.7054	0.3509	NS
MCV (FL)	86.51±5.594	82.74±6.695	83.73±7.594	0.1664	1.843	NS
MCH(pg)	29.30±2.233	28.00±2.753	28.69±2.878	0.2444	1.439	NS
MCHC(g/dl)	267.9±141.0	259.0±141.7	275.0±138.3	0.9321	0.070	NS
PLT ($x10^9$/L)	176.4±44.67	201.3±63.51	184.8±48.91	0.3010	1.223	NS
RDW-SD (%)	42.82±10.99	45.23±5.611	42.48±3.560	0.3226	1.151	NS
RDW-CV (fl)	13.76±1.229	14.52±2.460	13.48±1.020	0.1947	1.677	NS
PDW	15.06±2.214	14.78±2.346	15.34±2.257	0.7357	0.3083	NS
MPV (%)	10.73±0.7795	10.51±1.072	10.79±1.109	0.5987s	0.5170	NS
P-LCR	49.13±18.93	55.00±23.77	56.48±23.72	0.6202	0.4812	NS
PCT (mL/L)	1.425±0.8475	6.478±30.01	1.660±0.9782	0.6808	0.3867	NS
NEUT($x10^9$/L)	64.32±6.704[a]	69.84±4.986[b]	68.99±7.366	0.0089	5.082	S
LYM($x10^9$/L)	26.14±8.186	24.06±4.613	24.93±6.703	0.5022	0.6960	NS
Mono($x10^9$/L)	4.183±2.525	4.840±1.106	4.308±1.274	0.2918	1.255	NS
Eosin($x10^9$/L)	1.229±1.267	1.245±1.168	1.769±1.246	0.3678	1.015	NS
Baso($x10^9$/L)	0.03±0.02	0.01±0.005	0.03077±0.07	0.2477	1.426	NS

Post-Hoc Analysis: WBC & NEUT: Values in the same row with different superscripts (a, b) differ from each other at p<0.05. Keys: S=Significant, NS=Not Significant.

Discussion

This research work is a cross sectional study carried out among pregnant women who attended Primary Health Care Centre, Ozuoba antenatal clinic, Port Harcourt Rivers State

Assessing the demographic distribution of the study population, it was shown that the age groups of the population ranged from 19-25, 26-32, 33-40 with the frequency distribution of the 0.17, 0.63 and 0.20 representing 17%, 63% and 20% respectively. This is in contrast to a study by [9], in their study they observed that younger women in the age group 21-25 years constituted a significant number of the subjects(36.7%) used in their study.

Majority of the malaria parasitized subjects had only Secondary education(55%), this was followed by those who attained tertiary level of education (35%) then followed by women with post graduate education(10%).This finding is in agreement with previous report by Hamidu [5] in Maiduguri, Nigeria. This is suggestive that the level of education can play a role in preventing malaria infection. High standard of education usually affect health awareness and therefore has a positive impact on health.

Comparing the hematological parameters of the study group. It was seen that WBC had a statistical significant difference with a p-Value of 0.0036 at $p<0.05$. The other hematological parameters such as RBC, HB, HCT, MCV MCH, MCHC, PLT, PCT, Neutrophil, lymphocyte,monocyte, eosinophil and basophil showed no statistically significant difference at $P<0.05$.

This is in agreement with a study by Osonuga *et al*.[8] who reported that WBC was elevated in malaria-parasitized pregnant women. This may be due to the fact that white blood cells are responsible for the body defense during pregnancy. However, the findings in this study is in contrast with a report by Abdullah [1] who reported that malaria parasitemia have no effect on all the hematological parameters when 500 pregnant women in Kano were assessed based on parity. This disparity in the findings may arise as a result of some pregnant women in their study, probably being on prophylactic antimalarial drugs before their recruitment, thus causing a reduced effect of malaria parasitemia on other haematological parameters.

Comparing the hematological parameters of the study population at different level of plasmodiasis, it was seen that WBC, and Neutrophil were significant with p-Value of 0.001 and 0.0089 respectively at P<0.05. Comparison of other parameters such as RBC, HB, HCT, MCV MCH, MCHC, RDW-SD, RDW-CV, PDW, MPV, P-LCR, PCT, lymphocyte, monocyte, eosinophil and basophil showed no statistical significant difference at P<0.05. This is in agreement with a study by Muwong *et al*.[7]. In their study, it was seen that increase in plasmodiasis is directly proportional to WBC.

Conclusion

Findings from this study has shown that there was a significant difference in white blood cell count of malaria-parasitized pregnant subjects. It further revealed that there was no statistical significant difference in the other haematological parameters.

References

1. Abdalla SPG. Platelets and Blood Coagulation in Human Malaria. Imperial College Press, London, United Kingdom. 2004; 21-27.
2. Desai M, TerKuile FO, Nosten F, McGready R, Asamoa K, Brabin B. Newman RD. (2007).Epidemiology and burden of malaria in pregnancy. *The Lancet infectious diseases.* 2007; (2): 93-104.
3. Ekvall H. Malaria and anemia. *Currency Opinion Hematology*, 2003; 10: 108-14.
4. Guyatt HL, Snow RW. Impact of malaria during pregnancy on low birth weight in sub-Saharan Africa. *Clinical microbiology reviews*. 2004; 17(4): 760-69.
5. Hamidu JL, Salami HA, Ekanem AU. Hamman, L. Prevalence of protein-energy malnutrition in Maiduguri, Nigeria. *African journal of biomedical research*, 2003; 6(3): 1.
6. Markus MB. Malaria eradication and the hidden parasite reservoir. *Trends in parasitology*. 2017; 33(7): 492-95.
7. Muwonge H, Kikomeko S, Sembajjwe LF, Seguya A, Namugwanya C. How reliable are hematological parameters in predicting uncomplicated Plasmodium falciparum malaria in an endemic region?. *International Scholarly Research Notices*. 2013; 2(5): 36-55.
8. Osonuga IO, Osonuga OA, Onadeko AA, Osonuga, A, Osonuga AA. Hematological profile of pregnant women in southwest of Nigeria. *Asian Pacific Journal of Tropical Disease*. 2011; 1(3): 232-34.

9. Panti AA, Omokanye LO, Ekele BA, Jiya NMA, Isah AY, Nwobodo EI, Ahmed Y. The prevalence of asymptomatic malaria parasitaemia at delivery in usmanudanfodiyo university teaching Hospital Sokoto North western Nigeria. *Global Resource Journal*. 2012; 2(9): 48-53.

10. Sarkar PK, Ahluwalia G, Vijayan VK, Talwar A. Critical care aspects of malaria. *Journal of Intensive Care Medicine*. 2010; 25(2): 93-03.

11. Steketee, RW, Nahlen BL, Parise ME, Menendez C. (2001). The burden of malaria in pregnancy in malaria-endemic areas. *The American journal of tropical medicine and hygiene*. 2001; 64(4): 28-35.

12. Tako EA, Zhou A, Lohoue J, Leke R, Taylor DW, Leke RF. .Risk factors for placental malaria and its effect on pregnancy outcome in Yaounde, Cameroon. *The American journal of tropical medicine and hygiene*. 2005; 72(3): 236-242.

13. Tilley L, Dixon MW, Kirk K. The Plasmodium falciparum-infected red blood cell. *The international journal of biochemistry & cell biology*. 2001; 43(6): 839-842.

14. Uneke CJ. Impact of placental *Plasmodium falciparum* malaria on pregnancy and perinatal outcome in sub-Saharan Africa: Part III: Placental malaria, maternal health and public health. *Yale Journal of Biology and Medicine*. 2008; 81: 1-7..