

HAEMATOLOGICAL PROFILE OF PREGNANT WOMEN INFECTED WITH MALARIA PARASITES AT FEDERAL TEACHING HOSPITAL ABAKALIKI, EBONYI STATE

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ABSTRACT

Malaria in pregnancy is a major public health problem in endemic areas of sub-Saharan Africa and has important consequences on birth outcome. There are subtle and substantial changes in hematological parameters of malaria in pregnancy. This work is designed to ascertain the impact of malaria in pregnant women visiting Federal Teaching Hospital Abakaliki II. Out of the 100 pregnant women screened for malaria, 44 (44.0%) were positive for malaria parasite. Of the 44.0% pregnant women positive for malaria parasite, the age range of 26-30 years (31.8%) were more infected with malaria parasite, followed by 21-25 years (22.7), while 41-45 (4.5%) years were the least infected. Pregnant women with no formal education were most infected (36.4%), followed by primary education (27.3%), while secondary education showed the lowest rate of malaria in pregnancy (13.6%). Housewives reported the highest cases of malaria in pregnancy, while student reported the lowest (9.2%). Married women showed the highest cases of malaria in pregnancy (79.5%), while widow reported the lowest (2.3). Christian reported in the highest cases of pregnancy in malaria (46.0%) and Muslim the least (40.0%). The mean values of the haematological parameters of pregnant women with respect to parasitaemia were Hemoglobin (9.78 ± 37.45 g/dL), Packed cell volume ($31.56 \pm 2721.14\%$), White blood count ($8.58 \pm 50.06 \times 10^3/\text{mm}^3$), Neutrophils ($57.96 \pm 1004.97\%$), Lymphocyte ($28.24 \pm 1392.97\%$), Mesophils ($7.28 \pm 110.49\%$), Eosinophils ($3.62 \pm 1156.91\%$) and Platelets ($141.88 \pm 133873.07 \times 10^9/\text{l}$). This study have shown that the adverse consequences of malaria in pregnancy has great impact on hematological parameters which may affect not only the neonate and infant but also increase the risk of non communicable diseases when the child grows into an adult and the risk of low birth weight in the next generation.

Keywords: Malaria, Haematological Profile, Pregnant Women, Abakaliki

1. INTRODUCTION

Malaria is widespread in tropical and subtropical regions in a broad band around the equator, including much of Sub-Saharan Africa, Asia and the Americas. Five species of *Plasmodium* can infect and be transmitted by humans. The vast majority of deaths are caused by *P. falciparum* while *P. vivax*, *P. ovale* and

P. malariae cause a generally milder form of malaria that is rarely fatal (Beare *et al.*, 2006).

It has been recognized for nearly a century that pregnant women are especially prone to severe malaria (Nayak *et al.*, 2009). Approximately 50 million pregnant women are exposed to malaria each year (Gamble *et al.*, 2009). The burden of Malaria In Pregnancy (MIP) remains high in endemic areas, where despite

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considerable immunity, pregnant women continue to have symptomatic and asymptomatic parasitaemia resulting in adverse pregnancy outcomes (Olukemi *et al.*, 2011). Malaria and pregnancy usually affect the course of each other adversely. The physiological changes of pregnancy and pathological changes due to malaria have a deleterious effect on the course of each other. In endemic areas, clinical episodes of malaria are more frequent and more severe during pregnancy and mortality rate is higher among them as compared to non-pregnant (Ramsay, 2003).

Many studies from areas with different malaria transmission patterns have investigated the consequences of malaria in pregnancy on both maternal health and birth outcomes (DeBeaudrap *et al.*, 2013). Malaria in pregnancy has been associated with significant degree of intrauterine growth restriction, 36% of preterm deliveries, 30% of preventable low birth weight deliveries, 14% of low birth weight deliveries and 15% of maternal anaemia (Steketee *et al.*, 2001). While the consequences of MIP on maternal health are dominated by anaemia, data on malaria-related maternal mortality are sparse (Desai *et al.*, 2007).

The World Health Organization recommends the use of Intermittent Presumptive Treatment with sulphadoxine pyrimethamine (IPTsp), household use of Insecticide Treated Nets (ITNs) and effective and prompt case management as malaria control strategies in pregnancy (WHO, 2012). In areas of stable malaria transmission in sub-Saharan Africa, ITNs are highly effective in reducing childhood mortality and morbidity from malaria (Lengeler, 2004). Although ITNs are being promoted as a major tool in the fight against malaria in pregnancy, the available evidence about their effect in pregnancy appears inconsistent (Gamble *et al.*, 2009). Other malaria control measures recommended include personal protection measures against vectors such as use of residual sprays, window screening and mosquito repellent creams. In Nigeria, traditional remedies against malaria have always been employed, though with unproven efficacy, while chemoprophylaxis with weekly pyrimethamine and chloroquine which were widely utilized in several African countries are no longer efficacious because of emergence of resistance (WHO, 2013; Nahlen *et al.*, 2012; Sirima *et al.*, 2003).

Despite numerous studies conducted over the last decades, Malaria In Pregnancy (MIP) remains an important public health problem that has proved difficult to tackle (DeBeaudrap *et al.*, 2013). The relationship between malaria in pregnancy and its outcome on birth in endemic areas such as Nigeria

continues to be a subject of research. Hence this present work is carried out to ascertain the haematological profile of pregnant women infected with malaria parasites at Federal Teaching Hospital Abakaliki, Ebonyi State.

2. MATERIALS AND METHODS

2.1. Study Area

The study was carried out at Federal Teaching Hospital Abakaliki II (FETHA II), Ebonyi State. The study area is located between Latitude 06° 4'N and longitude 08° 5'E and rainfall pattern is bimodal (April-July), September-November with a short spell sometimes in August. The annual rainfall is between 1000-1500 mm. The vegetation of the area is predominantly derived Savannah. The mean annual temperature is about 24°C and the relative humidity is between 60-80%.

2.2. Study Population

A total of 100 pregnant women were randomly selected from FETHA II between December, 2013 and March, 2014. The sample population was selected irrespective of age, level of education, marital status, occupation and religion.

2.3. Ethical Consideration

Consent was also obliged and obtained from the husbands of the pregnant women. Informed consent was also obtained from all study subjects. Ethical clearance was obtained from Federal Teaching Hospital Abakaliki II (FETHA II), Ebonyi State.

Semi-structured questionnaires were administered to obtain vital information such as age, level of education, marital status and religion.

2.4. Blood Collection, Staining and Microscopy

Two milliliter of blood was collected intravenously under a sterile condition. The blood samples were put in EDTA bottles, labeled and sent to Department of Medical Laboratory Science Laboratory, Ebonyi State University, Abakaliki, where thick was prepared and stained with 10% Giemsa as described by Ochei and Kolhatkar (2007). The blood films were examined microscopically using 40× and 100× objectives (with oil immersion) and 7× eye piece.

2.5. Complete Blood Count

Complete Blood Count (CBC) absolute count of white blood cell (total and differential), haemoglobin estimation,

platelets and lymphocyte where determined using an automated full counter (Abacus Junior Analyzer).

2.6. Statistical Analysis

Percentage, mean and Standard Deviation (SD) were used to analyze data obtained in this study.

3. RESULTS

Out of the 100 pregnant women screened for malaria parasite, 44 (44.0%) pregnant women were positive for malaria parasite as shown in **Table 1**.

Out of the 44 pregnant women positive for malaria parasite (as shown in **Table 1**), the age range of 26-30 years were more infected with malaria parasite 14 (31.8%), followed by 21-25 years age range 10 (22.7%), while pregnant women within the age range of 41-45 years were the least infected with malaria parasite 2 (4.5%). The level of education of the pregnant women with respect to infection of malaria parasite showed that pregnant women with no formal education were most infected with malaria parasite 16 (36.4%), followed by primary education 12 (27.3%), while secondary education showed the lowest rate of malaria in pregnancy 6 (13.6%) as shown in **Table 2**.

With respect to occupation, housewives reported the highest cases of malaria in pregnancy 13 (29.5%), followed by petty traders 11 (25.0%), civil servants 10 (22.7%), casual labourers 6 (13.6%), students reported the lowest 4 (9.2%) as shown in **Table 3**. In terms of marital status, married women reported the highest cases of malaria in pregnancy 35 (79.5%), followed by unmarried women 5 (11.4%), divorced/separated 3 (6.8%) and widow reported the lowest 1 (2.3%) as shown in **Table 4**. With respect to religion, Christians reported the highest case of malaria in pregnancy 33 (75.00%) and Muslim the least 11 (25.0%).

The haematological parameters (haemoglobin, packed cell volume, white blood count, neutrophils, lymphocytes, mesophils, eosinophils, basophils and platelets) of the pregnant women attending FETHA II were also ascertained as shown in **Table 4**.

4. DISCUSSION

Malaria remains a major public health problem in sub Saharan Africa and the extent of utilisation of malaria preventive measures may impact on the burden of malaria in pregnancy (Tongo *et al.*, 2011). Pregnant women are more susceptible to malaria than their non-

pregnant counterparts (Boel *et al.*, 2012). Maternal, placental or foetal malaria infection during pregnancy adversely affects development and survival of foetus through low birth weight, maternal anemia and possibly abortion and stillbirth. These malaria induced medical problems constitute major clinical, public health and research challenges (Murphy and Breman, 2001). This infection can aggravate other infections; dual infection has additional detrimental effects on maternal and infant survival (Ticconi *et al.*, 2003). Malaria also remains the preventable cause of low birth weight deliveries worldwide (Saba *et al.*, 2008). Despite numerous studies conducted over the last decades, Malaria in Pregnancy (MiP) remains an important public health problem that has proved difficult to tackle (DeBeaudrap *et al.*, 2013).

A total of 100 women were enrolled for this study, of which 44.0% were positive for malaria infections detected by thick film as shown in **Table 1**. The result obtained in this work is higher than the prevalence rate of 28.0% observed in Mbarara District, Southwestern Uganda by DeBeaudrap *et al.* (2013).

Most of the pregnant women within the age range of 26-30 years were more infected with malaria parasite (31.8%), followed by 21-25 years age range (22.7%), while pregnant women within the age range of 41-45 years were the least infected with malaria parasite (4.5%) as shown in **Table 1**. This is in line with the work of Matthew *et al.* (2013) who reported that MiP mostly occurred between the age range of 20-29 years (48.0%).

The rate of Malaria in Pregnancy (MiP) in association with occupation, it is notice that most of the study population with MiP were mostly the housewives (29.5%), followed by petty traders (25.0%), civil servants (22.7%), casual labourers (13.6%), while students (9.2%) the least (**Table 2**). This work is similar to that reported by Matthew *et al.* (2013) where occupations of pregnant women are mostly as full-time housewives (54.0%).

Table 1. Prevalence of malaria parasite in pregnancy with respect to demographic data (age)

Age range (years)	Number examined	Number positive (%)
<21	10	4 (9.2)
21-25	21	10 (22.7)
26-30	30	14 (31.8)
31-35	16	8 (18.2)
36-40	13	6 (13.6)
41-45	10	2 (4.5)
Total	100	44 (44.0)

A well-known risk factor for Malaria in Pregnancy (MiP) is level of education (Steketee *et al.*, 2001; Desai *et al.*, 2007). Malaria in Pregnancy (MiP) was recorded highest in pregnant women with no formal education (36.4%), followed by those who attended primary schools only (27.3%), higher institution (22.7%), this was followed by prevalence of malaria among pregnant women that had secondary education were recorded the lowest (13.6%) (Table 3). Hence low education levels were dependently associated with malaria during pregnancy in FETHA II. These findings further support the notion that it is essential to scale up malaria prevention efforts in more isolated and deprived communities as recently highlighted in a meta-analysis of datasets from 25 African countries (Eisele *et al.*, 2012). Similarly, reported that most infected with malaria infection were the pregnant women that had secondary education (38.0%), followed by those with adult literacy (30.0%); which is likely to be those no formal education in this study).

Table 2. Prevalence of malaria parasite in pregnancy with respect to demographic data (level of education)

Level of education	Number examined	Number positive (%)
No formal education	38	16 (36.4)
Primary	25	12 (27.3)
Secondary	16	6 (13.6)
Higher Institution	21	10 (22.7)
Total	100	44 (44.0)

Table 3. Prevalence of malaria parasite in pregnancy with respect to demographic data (occupation)

Occupation	Number examined	Number positive (%)
Housewife	25	13 (29.5)
Civil servant	23	10 (22.7)
Petty trader	21	11 (25.0)
Student	14	4 (9.2)
Casual labourer	17	6 (13.6)
Total	100	44 (44.0)

Table 4. Prevalence of malaria parasite in pregnancy with respect to demographic data (marital status)

Marital status	Number examined	Number positive (%)
Married	66	35 (79.5)
Unmarried	10	5 (11.4)
Divorced/separated	15	3 (6.8)
Widow	9	1 (2.3)
Total	100	44 (44.0)

With respect to religion of MiP, Christians (75.0%) were the highest of MiP and Muslim the least (25.0%). This is result is associated with religion (Christianity) of the most of the people in Abakaliki Metropolis (Table 5).

Pregnancy causes significant changes in metabolism, fluid balance, organ function and blood circulation which are driven by estrogen and the presence of the fetoplacental unit.

These dramatic changes influence a wide variety of hematological parameters. Acknowledge of these changes is essential when interpreting the result of hematological investigation to diagnose or monitor illness pregnant woman (Elgari, 2013).

With respect to marital status of MiP, married pregnant women were the highest of MiP (79.5%), followed by unmarried (11.4%) while widow recorded the least (2.3%) as shown in Table 4.

Table 5. Prevalence of malaria parasite in pregnancy with respect to demographic data (religion)

Religion	Number examined	Number positive (%)
Christianity	72	33 (46.0)
Muslim	28	11 (40.0)
Total	100	44 (44.0)

Table 6. Haematological parameters of pregnant women with respect to parasitaemia

Parameters	Mean values
Heamoglobin (g/dL)	9.78±37.45
Packed cell volume (%)	31.56±2721.14
White blood count (×10 ³ /mm ²)	8.58±50.06
Neutrophils (%)	57.96±1004.97
Lymphocyte (%)	28.24±1392.97
Mesophils (%)	7.28±110.49
Eosinophils (%)	3.62±1156.91
Basophils (%)	0
Platelets (×10 ⁹ /l)	141.88±133873.07

Values were mean ± Standard Deviation (SD)

Table 7. Mean haematological parameters

Parameters	Mean values
Heamoglobin (g/dL)	≥11
Packed cell volume (%)	38.75±3.70
White blood count (×10 ³ /mm ²)	4.93±0.90
Neutrophils (%)	44.63±13.4
Mesophils (%)	44.86±12.50
Eosinophils (%)	6.32±3.40
Basophils (%)	1.30±0.52
Platelets (×10 ⁹ /l)	260.0±66.0

Values were mean ± Standard Deviation (SD)

The World Health Organization has suggested that anemia is present in pregnancies when Hb concentration is less than 11 g/dL (Milman *et al.*, 2007). The study revealed significant decreases in haemoglobin (9.78 ± 37.45 g/dL), packed cell volume ($31.56 \pm 2721.14\%$) and platelets ($141.88 \pm 133873.07 \times 10^9/l$) (Table 6) respectively of pregnant women compared to the control (Table 7). However, mean numeric values for most of the hematological profiles were below the normal range values for pregnant women reported (Abbassi-Ghanavati and Greer, 2010).

The findings of this work are consistent with previous study which reported that the decreases in hemoglobin and packed cell volume concentration are common findings during pregnancy and results from increased plasma volume combined poor iron intake (Bashiri *et al.*, 2003; Ruchi *et al.* 2013; Elgari, 2013).

The decrease in PCV ascertained in this work, may be due to increase in plasma volume during pregnancy. Hence there is need for adequate management of their blood profiles with dietary supplementation. A study showed marked decrease in PCV in the third trimester of pregnancy might be attributed to maternal diabetes (Pilszczek *et al.*, 2008).

Significant decreases in platelet count of out pregnant women obtained in this work compared to control in agreement with study reported that: Although platelet counts remain in the normal pregnant range in most women during uncomplicated pregnancies (Matthews *et al.*, 1990). Mean platelet counts of pregnant women may be slightly lower than in healthy non pregnant women (Verdy *et al.*, 1997).

White blood cells are responsible for body defense. During pregnancy, WBC is reported to be elevated (Pitkin and Witte, 1979). We found significant increased in white blood count ($8.58 \pm 50.06\% \times 10^3/mm^2$), neutrophils ($57.96 \pm 1004.97\%$), lymphocytes ($28.24 \pm 1392.97\%$), mesophils ($7.28 \pm 110.49\%$) and eosinophils ($3.62 \pm 1156.91\%$) significant higher compared to that of the controls. The finding in agreement with previous study reported (Rouse *et al.*, 1998). Increase in these haematological parameters may be as a result of the body building the immunity of the fetus and it is achieved by a state of selective immune tolerance, in the presence of a strong antimicrobial immunity (Elgari, 2013). The result of this work agrees with previous work by Roy *et al.* (2007) that reported a total leukocyte count rising in early pregnancy which remained elevated through pregnancy.

5. CONCLUSION

Malaria in Pregnancy (MiP) adversely affects the pregnancy outcome. It is likely to increase the risk of spontaneous abortion, stillbirths, premature delivery and low birth weight. Anaemia (low haemoglobin, <11 g/dL) in pregnancy is associated with adverse consequences both for the mother and the foetus. This study has shown that the adverse consequences of MiP has great impact on hematological parameters which may affect not only the neonate and infant but also increase the risk of non communicable diseases when the child grows into an adult and the risk of low birth weight in the next generation.

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