

# Burden of Anemia among Pregnant Women with Asymptomatic Malaria Parasitaemia at Booking Visit in Abuja, Nigeria.

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## ABSTRACT

**Background:** Malaria parasitaemia in pregnant women is associated with adverse maternal and fetal complications including anemia. The study aimed at determining prevalence of anemia among pregnant women with asymptomatic malaria parasitaemia at booking in a tertiary hospital in Abuja, Nigeria. **Methods:** This was a cross-sectional descriptive study of consented 659 pregnant recruited consecutively at booking for antenatal care. Structured questionnaire was administered on each subject and then blood was taken for their packed cell volumes estimation using Hawksley's microhaematocrit reader as well as thick and thin blood films for malaria parasites assessment. The data were analysed using 2008 EPI-info 3.5.1 (CDC, Atlanta Georgia, USA). **Results:** Out of 659 pregnant women screened, 255 (38.7%) had significant malaria parasitaemia. Among women with significant malaria parasitaemia, 176 (69.0%), 68 (26.7%) and 11 (4.3%) had mild, moderate and severe malaria parasitaemia respectively. Prevalence of anemia (PCV < 33%) in the entire study population screened was 38.4% (253/659). Among pregnant women with significant malaria parasitaemia, 163 of them were anaemic, giving prevalence of anaemia of 63.9% (163/255) while anemia was noted in 22.3% (90/404) of women with no malaria parasitaemia. The risk of anemia was significantly higher as the severity of parasitaemia increases among the study (P < 0.00001). **Conclusion:** Anaemia in pregnancy is common among asymptomatic women with malaria parasitaemia and the risk increased significantly as the severity of malaria parasitaemia increases depicting malaria as a common cause of anemia in our obstetric population. Routine screening for malaria infestation at booking is therefore recommended.

**Keywords:** Anemia, Malaria parasitaemia, Pregnancy, Nigeria.

## INTRODUCTION

Anemia is a significant maternal problem during pregnancy and contributes significantly to maternal and perinatal morbidity and mortality. Though the World Health Organization (WHO) defined anemia in pregnancy as hemoglobin concentration of 11 g/dL or less, it is generally accepted as hemoglobin concentration less than 10 g/dL or Packed Cell Volume (PCV) less than 30% in the tropics.<sup>[1,2]</sup> Blood loss during delivery and puerperium is unavoidable and an anemic pregnant woman is therefore more at increased jeopardy.<sup>[2]</sup> Adopting this lower level, the incidence of anemia in pregnancy range widely from 40 – 80% in the tropics compared to 10 – 20% in the developed countries. Anemia is responsible for 20 percent of maternal deaths in the third-world countries.<sup>[2,3]</sup> In Nigeria, prevalence rates range from 35.3% in Lagos to 72.0% in Kano.<sup>[4,5]</sup>

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In developing countries like Nigeria, the cause of anemia is multi-factorial including nutritional

deficiencies of iron and folate, parasitic diseases such as malaria and hookworm infestations, hemoglobinopathies especially sickle cell anemia and recently Human Immunodeficiency Virus (HIV) infection.<sup>[6]</sup> Although most of the causes are preventable including the use of iron and folate supplementation and anti-malarial prophylaxis, prevalence of anemia in pregnancy is still high in the country.

In Nigeria, anemia contributes to the high maternal mortality which ranges from 14.6% in North-Central region to 20% in the Western region of the country.<sup>[7,8]</sup> Anemia is estimated to contribute to 59,000 perinatal deaths globally per year.<sup>[9]</sup> The etiological factors for anemia in pregnancy are multiple and their relative contributions is expected to vary by geographical area and season.<sup>[10,11]</sup> Knowledge of the relative importance of the different causes in a community should form the basis for intervention strategies to control anemia.<sup>[10,11]</sup>

The importance of malaria in causing anemia in pregnant women and the general population in sub-Saharan African cannot be overemphasized. Malaria eradication has eluded most tropical countries, therefore prevention of malaria in pregnancy is a major public health challenge.<sup>[12]</sup> Pregnant women have been shown to have an increased susceptibility to infection by malaria parasite.<sup>[13-15]</sup> Malaria is the commonest cause of hospital attendance in all age groups in Nigeria. Each year, tens of thousands of

pregnant women in malaria endemic areas like Nigeria are affected by *Plasmodium* infestations. It is an important public health parasitic infestation in the tropics and tropical Africa bears the greatest burden of the world's malaria.<sup>[13]</sup>

Each year in sub-Saharan Africa where 80 – 90 percent of the world malaria cases occur and approximately 19 – 24 million of women are at risk of malaria and its adverse consequences during pregnancy.<sup>[15,16]</sup>

In regions where malaria transmission is stable such as Nigeria, majority of the infestations during pregnancy are asymptomatic, undetected and untreated with attending major impacts on the mother and the unborn fetus. Women in their first and second pregnancies are most susceptible to *Plasmodium falciparum* infection.<sup>[15,17,18]</sup> Malaria infestation carries an extremely high risk of developing life threatening pathology for both mother and fetus with associated increased morbidity and mortality.<sup>[19 – 22]</sup> A national survey conducted in Nigeria in 2000 shows that malaria caused 48.2% of the ailment experienced by pregnant women presenting to the medical practitioner.<sup>[23]</sup>

Malaria is also a major cause of miscarriage, preterm labor, increased uterine activity, anemia in pregnancy, intrauterine fetal death (IUFD) and severe maternal morbidity and mortality.<sup>[24,25]</sup> It also causes maternal hypoglycemia, acute pulmonary edema, cerebral edema and maternal death.<sup>[26,27]</sup> Malaria has been responsible directly and indirectly for 10% maternal deaths in Calabar, 8% in Enugu, 7.8% in Lagos and 8.2% in Kano.<sup>[27]</sup> A recent study from Mozambique has also indicated that malaria is responsible directly for 10% of maternal deaths.<sup>[28]</sup> This is unacceptably high for a disease like malaria which is preventable and curable in pregnancy.

Although adults living in endemic areas acquire protective immunity against developing severe malaria, they become more susceptible when pregnant.<sup>[27– 30]</sup> Generally, a decrease in cell-mediated and humoral immunity tends to be more severe in primigravida than in multigravida.<sup>[25,28,31]</sup> The resultant effect are more frequent episodes of *Plasmodium* parasitaemia and greater severity of malaria.<sup>[15,27,32]</sup> Placental parasitaemia may sometimes exceed 50 percent of placental erythrocytes without any parasite in the peripheral blood.<sup>[13,33 – 35]</sup>

Anemia in pregnancy significantly caused by malaria is associated with a high fetal wastage and an important contributor to maternal morbidity and mortality especially in the tropics. Hence, this study was undertaken to ascertain the burden of anemia as well as its relation to severity of malaria parasitaemia among pregnant women with asymptomatic malaria parasitaemia in this obstetric population in Abuja, Nigeria.

## **MATERIALS AND METHODS**

This was a prospective observational study among asymptomatic women with malaria parasitaemia during pregnancy at antenatal booking over a two-month period at Garki Hospital, Abuja. Garki Hospital is a tertiary health facility and a referral centre involved in the training of undergraduate and postgraduate doctors, situated in Abuja metropolis of the Federal Capital Territory, North-Central geopolitical zone of Nigeria. The vegetation is savannah and has a mean annual rainfall of 250 cm. Malaria transmission is throughout the year.

Informed consent was obtained from the women after counseling. Women who were symptomatic of malaria and or anemia were excluded from the study. A structured questionnaire was completed for each participant recruited. Information obtained included socio-demographic and obstetric features, malaria treatment in the current pregnancy as well as malaria chemoprophylaxis. Also for each recruited subject, blood samples were taken for malaria parasites and PCV assessment.

About 2 ml of blood was obtained from a peripheral vein into an ethylenediamine tetra acetic acid (EDTA) bottle for preparation of thick and thin blood films as well as packed cell volume. Two glass slides were labeled for each participant. Thin and thick blood films were prepared for parasites identification and assessment of the density of malaria parasites. This was immediately fixed in absolute methanol for 5 seconds and allowed to air-dry completely before staining using giemsa staining technique. A drop of oil immersion was placed on each side and examined using a compound microscope with aX100 objective magnification. Parasite enumeration was done according WHO approved method.<sup>[36,37]</sup> [Parasites count (per dL) = number of parasites x 6000/number of leucocytes] For the purpose of this study, the following quantification was used to describe the densities of malaria parasitaemia.

Mild parasitaemia = <1000/dL

Moderate parasitaemia = 1000 – 2999/dL

Severe parasitaemia >3000/dL

Also using two sealed heparinized capillary tubes, 4 – 5 cm column of blood was obtained from blood already collected so as to obtain average PCV value for each subject. Samples were assembled in the centrifuge (haematocrit machine) and spun at 5000 revolutions per minute for 5 minutes. Packed cell volume was read using Hawksley's micro-haematocrit reader. Anemia was diagnosed when packed cell volume was less than 33%, according to World Health Organization recommendation.

The data was analyzed using Epi-info 2008 statistical software of the Centre for Disease Control and Prevention (CDC) Atlanta, USA. Associations between categorical variables were compared using chi-square test. A p-value <0.05 was considered

significant. Formal approval for the study was obtained from the research ethics committee of the Garki Hospital, Abuja.

## RESULTS

A total of 700 women were initially counselled but only 659 gave consent and participated in the study thus giving a rate of participation of 94.1 percent. The age of the women screened for malaria parasitaemia was between a range of 16 and 45 years. About 79.1% (521/659) of the women were aged  $\leq 30$  years while 20.9% (138/659) were aged  $\geq 31$  years. Three hundred and eighty one (57.8%) of them were primigravida while 278 (42.2%) were multigravida. Among the 659 pregnant women screened, 255 (38.7%) of them had significant malaria parasitaemia while 404 (61.3%) had no significant malaria parasitaemia.

Among the 255 women with significant parasitaemia, 68 (26.7%) of them booked for antenatal care in the first half of pregnancy while 187 (73.3%) booked in the second half of pregnancy with a range of 8 – 37 weeks of gestation. Younger women ( $\leq 30$  years) and primigravida, had higher prevalence of malaria parasitaemia. Malaria parasitaemia was noted in 53.5% of primigravida while it was noted in 18.7% of multigravida. [Table 1] shows the socio-demographic and obstetric features of the women with malaria parasitaemia.

Prevalence of anemia (PCV < 33%) in the entire study population screened was 38.4% (253/659). Among the 255 pregnant women with significant malaria parasitaemia, 163 of them were anaemic, giving prevalence of anemia of 63.9% (163/255). However, prevalence of anemia among pregnant women with no significant parasitaemia was 22.3% (90/404). Hence, anemia was about three times commoner among pregnant women with malaria parasitaemia compared to those without malaria parasitaemia.

Among women with significant malaria parasitaemia, 176 (69.0%), 68 (26.7%) and 11 (4.3%) had mild, moderate and severe malaria parasitaemia respectively. Among those with mild parasitaemia, 105 of them were anaemic with a prevalence of 59.7% (105/176). In addition, 49 and 9 of the women with moderate and severe malaria parasitaemia had anemia in pregnancy with prevalence rates of 72.1% (49/68) and 81.8% (9/11) respectively [Table 2]. The risk of anemia was significantly higher as the severity of parasitaemia increases among the study especially in women with significant malaria parasitaemia ( $P < 0.00001$ ) as depicted in [Table 3].

**Table 1:** Socio-demographic and obstetric features of the women with malaria parasitaemia

| Characteristics           | Frequency | Percentage |
|---------------------------|-----------|------------|
| <b>Age (years)</b>        |           |            |
| ≤ 30                      | 207       | 81.2       |
| ≥ 31                      | 48        | 18.8       |
| Total                     | 255       | 100.0      |
| <b>Educational Status</b> |           |            |
| Illiterate                | 8         | 3.1        |
| Primary                   | 21        | 8.2        |
| Secondary                 | 55        | 21.6       |
| Tertiary                  | 171       | 67.1       |
| Total                     | 255       | 100.0      |
| <b>Gravidity</b>          |           |            |
| Primigravidity            | 147       | 57.6       |
| Multigravidity            | 108       | 42.4       |
| Total                     | 255       | 100.0      |

**Table 2:** Severity of malaria parasitaemia and packed cell volume among the women.

| Severity of parasitaemia | Total Frequency | No (%) of women with anemia |
|--------------------------|-----------------|-----------------------------|
| Mild                     | 176             | 105 (59.7)                  |
| moderate                 | 68              | 49 (72.1%)                  |
| severe                   | 11              | 9 (81.8%)                   |
| Total                    | 255             | 163 (100%)                  |

**Table 3:** Correlation between Degree of parasitaemia and anemia among the study population.

| Packed cell volume | Degree of Parasitaemia |      |          |        |       |
|--------------------|------------------------|------|----------|--------|-------|
|                    | None                   | Mild | Moderate | Severe | Total |
| 21 - 32            | 90                     | 105  | 49       | 9      | 253   |
| ≥ 33               | 314                    | 71   | 19       | 2      | 406   |
| Total              | 404                    | 176  | 68       | 11     | 659   |

Chi-square    df    P-value  
119.3683    3    < 0.00001

## DISCUSSION

Malaria infestation and anemia in pregnancy are associated with adverse maternal, fetal and neonatal outcomes. This study found 38.7% prevalence rate of malaria parasitaemia among the asymptomatic women screened. This is however lower than figure of 78.9% reported from Benin City, Nigeria<sup>[38]</sup> but higher than 18.0% from Kisumu, Western Kenya and 24.0% from Ouagadougou, Burkina Faso <sup>[39,40]</sup>. These variations in prevalence of malaria parasitaemia among asymptomatic pregnant women may be attributed to differences in the obstetric populations, use of preventive measures for malaria among the women and pattern of malaria transmission in the different study areas.

The overall prevalence of anemia in pregnancy at first antenatal visit among the screened subjects was 38.4%. Data from literatures in developing countries have reported range of prevalence of anemia in pregnancy to be between 35.0 - 75.0%.<sup>[1,4,5,11]</sup>

However, anemia was noted in 63.9% of asymptomatic pregnant women with malaria parasitaemia while it was noted in 22.3% of pregnant women without malaria parasitaemia. The overall prevalence of anemia in this study is lower than

reported figures of 46.2% and 69.1% from Benin City, Nigeria and Kisumu, Western Kenya [38,39]. However, the prevalence of anemia among women with malaria parasitaemia is more or less comparable to 59.6% reported from similar study group in Calabar, Nigeria<sup>[41]</sup>. Anemia was three times higher among those with malaria parasitaemia compared to those without malaria parasitaemia in this study. This direct correlation between severity of parasitaemia and anemia was noted by other researchers elsewhere<sup>[15,27,32,38,40,41]</sup>. This higher prevalence rate of anemia among women with malaria parasitaemia is attributed to increased haemolysis of parasitized red blood cells by the reticuloendothelial system in the body<sup>[4,42,43]</sup>. The degree of haemolysis leading to increase prevalence of anemia is related to the density and severity of malaria parasitaemia<sup>[43,44]</sup>. This was noted in this study as the prevalence of anemia increases significantly as well as the severity of parasitaemia increases. Women with mild parasitaemia had prevalence rate of anemia of 59.7% while those with severe parasitaemia had prevalence of 81.8%. Though adults living in malaria endemic areas acquire immunity, they become more susceptible to malaria attack when pregnant<sup>[43]</sup>. Hence, in malaria endemic areas like Abuja, Nigeria, most malaria infestations are asymptomatic and this emphasizes the importance of routine screening of malaria and anemia at booking antenatal visit. This will assist in early treatment of both malaria and anemia so as to avert adverse obstetric outcomes among our women. The prevalence of anemia among women with malaria parasitaemia was higher among primigravida compared to multigravida in our study. This was contrary to finding in Calabar<sup>[41]</sup> but agrees with findings elsewhere<sup>[38,39]</sup>. This is a reflection of previous reports of decreased immunity to malaria among this subgroup of pregnant women and as a result anemia is likely to be more severe in them<sup>[42,43]</sup>.

Limitations of this study include the inability to screen for stool helminthic infestations and assessment of the women nutritional status which are both significant contributors to anemia in pregnancy in our environment.

## CONCLUSION

In conclusion, malaria parasitaemia is associated with anemia in pregnancy and the prevalence rate of anemia is directly correlated with severity of malaria parasitaemia. Routine screening of pregnant women at booking visit for malaria parasitaemia and anemia and administration of effective anti-malarial drugs for parasite clearance is recommended especially among primigravidae.

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