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Malaria Parasitaemia and Anaemia among Pregnant Women Attending a Secondary Health Care Facility in Benin City, Southern Nigeria

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Abstract: Three hundred women, comprising 250 pregnant individuals attending antenatal clinic and 50 non-pregnant volunteers at a secondary health facility in Benin City, Edo State, Nigeria, were recruited for this study. Their blood samples were collected and examined for malaria parasites and packed - cell volume estimation, using standard methods. The overall prevalence of malaria parasitaemia for the pregnant women was 19.2% while that of the non-pregnant women (Controls) was 12% ($P<0.05$). A significant relationship was established between malaria parasitaemia and age of pregnant women. The highest prevalence of 35.8% was recorded in the third trimester while the first trimester was least with 4.7%. The difference in prevalence among the trimesters was significant ($P<0.05$). In the gravidity groups, primigradidae and multigravidae recorded 21.4% and 16.2% prevalence of malaria parasitaemia respectively. Pregnant women recorded a 47.4% prevalence of severe anaemia while non-pregnant women recorded no case (0%) of severe anaemia. The difference was statistically significant ($P<0.05$). The findings from this study, carried out on subjects in an urban setting will be useful for further planning, delivery and evaluation of malaria control efforts especially during pregnancy.

Key words: Malaria · Parasitaemia · Anaemia · Pregnancy · Packed-Cell Volume

INTRODUCTION

Malaria disease in man is caused by species of the protozoan parasite, *Plasmodium*. Malaria is the leading cause of morbidity and mortality especially among pregnant women and children under the age of five years [1]. Globally, the annual mortality due to malaria is estimated to be between 0.5–2.5 million people. More than 90% of the world's malaria occurs in sub-Saharan Africa. The transmission rate and the degree of severity are worse in *Plamodium falciparum* malaria [2]. The continued public health burden of malaria is due to a combination of factors, which include: increasing resistance of malarial parasites to chemotherapy, increasing resistance of Anopheles mosquito vector to insecticides, ecologic and climate changes and increasing international travel to malaria-endemic areas by non-immune travelers [3].

Malaria during pregnancy has serious consequences to the mother, her foetus and the neonate and it is an important health challenge. Pregnant women in endemic areas are vulnerable to malaria, as pregnancy reduces a woman's immunity to malaria, making her more susceptible to infection than non-pregnant women and increasing the risk of severe anaemia and death [4]. For the foetus, maternal anaemia increases the risk of spontaneous abortion, still-birth, premature delivery, child's brain damage and low birth-weight [2, 5]. Thus, malaria is widely recognized as an infection which seriously jeopardizes the outcome of pregnancy.

The evidence of malaria infection can be obtained from the density of peripheral parasitaemia during pregnancy at various trimesters (Three months). The preferential susceptibility of malaria among the different parities may be related to some evidence that immune-suppression is associated with pregnancy. Age has also been implicated as epidemiological studies have shown that malaria in pregnancy is more prevalent in younger than older age groups [6].

A package of interventions recommended for the control of malaria during pregnancy include: Intermittent Preventive Treatment (IPT), use of Insecticide Treated Nets (ITNs) and effective case management of malaria illness and anaemia [7] and the provision of adequate nutritional support in poor socio-economic settings [8]. These measures, if well implemented, will ensure optimal

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health and reduction in the incidence rate of malaria infection in pregnancy. Episodes of malaria in pregnancy elicit various complications and symptoms which depend on the intensity of malaria transmission and acquired immunity within the population [7].

In areas of unstable (Low) transmission, pregnant women are more susceptible to severe forms of malaria because acquired immunity is low. The risk of mortality in these areas is 2-10 folds higher to that of non-pregnant women [4]. Sometimes, *Plasmodium falciparum* infections during pregnancy in Africa rarely result in fever and therefore remain undetected and untreated. In areas of stable (Moderate-to-high) transmission, most adult women have developed an adequate level of immunity which results in asymptomatic infection. Thus, maternal morbidity is mainly due to malaria-related anaemia. The major effect on the foetus is low birth weight due to the presence of malaria parasites in placenta. Low birth weight is responsible for higher infant mortality and impaired child development [4]. Analyses of intervention trials show that successful prevention of malarial infections reduces the risk of maternal anaemia by 38%, low birth weight by 43% and perinatal mortality by 27% among paucigravidae [9].

Malaria is an important cause of anaemia in primigravidae [10]. The etiology of anaemia in pregnancy is multifactorial. Causes such as poor nutrition (Which involves iron and folate deficiencies), haemoglobinopathies and infections with other parasites (Mainly hookworm) add to the syndrome. Most studies show a strong association between malarial infection of the placenta or the peripheral blood and haemoglobin levels, confirming that this is a major cause of anaemia, even when other factors are present [2, 4, 10, 11]. This study was undertaken to assess the prevalence of malaria parasitaemia and anemia among pregnant women in an urban setting in Benin City, Southern Nigeria.

MATERIALS AND METHODS

Study Location: The study was carried out at Stella Obasanjo Women and Children Hospital, Benin City, Edo State, Nigeria. The state is in the tropical rain forest zone of southern Nigeria. It lies approximately between longitude 6°40'E – 6°43'E and latitude 5°44'N – 7°34'N.

Study Population: Ethical clearance was obtained from the relevant authority of the hospital. Thereafter, informed consent was obtained from all the subjects recruited by random sampling for the study. They comprised of 250 pregnant women who attended antenatal clinic regularly at the hospital and 50 non-pregnant women, who served as controls. The age range of the women was from 16 to 45 years. The pregnant women consisted of primigravidae and multigravidae, at various trimesters. Women excluded from the study were those on any form of malaria chemoprophylaxis as well as human immunodeficiency virus (HIV) positive patients or those with sickle-cell disease. These data were obtained from structured questionnaires administered to the women at the start of the study. All the subjects were literate.

Laboratory Methods: After cleaning the volar surface of the arm with cotton wool moistened with methylated spirit, peripheral blood sample was collected with sterile hypodermic needle from each subject into a sterile container. Thin and thick blood smears were made on clean slides and labeled properly. The thin films were fixed with methanol and stained with 3% Giemsa stain and then examined under the microscope. Identification of parasites species was done using the thin blood smear. The malaria parasite density was estimated with the thick blood smear using the method described by Kakkilaya and Clark [12]. To screen for anaemia, the packed - cell volume (PCV) was estimated using the microhaematocrit centrifugation method as described by Cheesebrough [13].

Statistical Analysis: Results were presented as simple percentages. The statistical significance of variables was done using the Chi-square test. P-values of equal to or less than 0.05 were considered as significant.

RESULTS

Plasmodium falciparum was identified as the causative agent of malaria parasitaemia. Table 1 shows the prevalence of malaria parasitaemia in relation to the ages of the women. The overall prevalence of malaria parasitaemia was 19.2% among pregnant women, while the prevalence among non-pregnant women was 12%. Furthermore, the prevalence of malaria parasites in pregnancy was highest (32.5%) among women in the age range of 26 - 30 years. For the non-pregnant women, the highest prevalence of malaria parasites (33.3%) was recorded in the age range of 36 - 40 years.

Table 2 shows the prevalence of malaria parasitaemia in trimester and gravidity distribution. Malaria parasitaemia was most prevalent in the third trimester (35.8%), followed by the second trimester (15.3%) and lastly, first trimester (10.6%). From a total of 145

Table 1: The prevalence of malaria parasitaemia according to age

	Pregnant women, n= 250			Non-pregnant women (controls), n=50		
Age (years)	Total n (%)	Positive for malaria parasites n (%)	Negative for malaria parasites n (%)	Total n (%)	Positive for malaria parasites n (%)	Negative for malaria parasites n (%)
16-20	5 (100)	1 (20.0)	4 (80.0)	9 (100)	0 (0)	9 (100)
21-25	17 (100)	3 (17.6)	14 (82.4)	14 (100)	1 (7.1)	13 (92.9)
26-30	80 (100)	26 (32.5)	54 (67.5)	18 (100)	3 (16.7)	15 (83.3)
31-35	40 (100)	11 (27.5)	29 (72.5)	4 (100)	1 (25.0)	3 (75.0)
36-40	80 (100)	5 (6.2)	75 (93.8)	3 (100)	1 (33.3)	2 (66.7)
41-45	28 (100)	2 (7.1)	26 (92.8)	2 (100)	0 (0)	2 (100)
Total	250 (100)	48 (19.2)	202 (80.8)	50 (100)	6 (12.0)	44 (88.0)

Table 2: The prevalence of malaria parasitaemia showing gestational age (trimester) and gravidity distribution

Variables	Positive for malaria parasites n (%)	Negative for malaria parasites n (%)	Total n (%)
Trimester (n=250)			
First (n=85)	9 (10.6)	76 (89.4)	85 (100)
Second (n=98)	15 (15.3)	83 (84.7)	98 (100)
Third (n=67)	24 (35.8)	43 (64.2)	67 (100)
Total	48 (19.2)	202 (80.8)	250 (100)
Gravidity (n=250)			
Primigravidae (n=145)	31 (21.4)	114 (78.6)	145(100)
Multigravidae (n=105)	17 (16.2)	88 (83.8)	105 (100)
Total	48 (19.2)	202 (80.8)	250 (100)

Table 3: The prevalence of anaemia according to gestational age (trimester)

	Anaemia in Pregnancy		
Trimester	Positive n (%)	Negative n (%)	Total n (%)
First	4 (4.7)	81 (95.3)	85 (100)
Second	10 (10.2)	88 (89.8)	98 (100)
Third	16 (23.9)	51 (76.1)	67 (100)
Total	30 (12)	220 (88)	250 (100)

Table 4: The relationship between PCV and malaria

	Pregnant women, n= 250			Non-pregnant women (controls), n=50		
PVC% (remarks)	Number examined (%)	Number positive for malaria parasites (%)	Number negative for malaria parasites (%)	Number examined (%)	Number positive for malaria parasites (%)	Number negative for malaria parasites (%)
11-20(severe anaemia)	19 (100)	9 (47.4)	10 (52.6)	0 (0)	0 (0)	0 (0)
21-30(mild anaemia)	130 (100)	21 (16.3)	109 (83.8)	10 (100)	2 (20)	8 (80)
31-40(normal PCV)	101 (100)	18 (17.8)	83 (82.2)	40 (100)	4 (10)	36 (90)
Total	250 (100)	48 (19.2)	202 (80.8)	50 (100)	6 (12)	44 (88)

primigravidae, 31 tested positive with a prevalence of 21.4% while the multigravidae recorded a prevalence of 16.2%

Table 3 shows that the prevalence of anaemia according to the gestational age (Trimester) was 12%. Pregnant women in the third trimester recorded the highest prevalence of 23.9%, followed by those in the second trimester with 10.2% and lastly, those in the first trimester recorded a prevalence of 4.7%.

For the 250 pregnant women examined, out of nineteen (8%) with severe anaemia (PCV; 11 - 20%), nine (47.4%) were positive while ten (52.6%) were negative for malaria parasites (Table 4). From 130 (52%) that had mild anaemia (PCV; 21 – 30%), twenty one (16.3%) were positive and 109 (83.8%) were negative for malaria parasites. For the 50 non-pregnant women (controls), none of them recorded severe anaemia. Out of the ten that had mild anaemia, two (20%) were positive for malaria parasites, while eight (80%) were negative for malaria parasites.

DISCUSSION

Pregnant women recorded a higher prevalence of malaria parasitaemia (19.2%) than that of non-pregnant women (12%). The difference in the frequency of

parasitaemia was significant (P<0.05). This finding is compatible with earlier reports [4, 14, 15] which have shown that pregnant women in endemic areas are highly susceptible to malaria. Both the frequency and severity of the disease is higher in pregnant than non-pregnant women [2]. At pregnancy, immunity has been altered, hence with malaria, 70 - 80% of pregnant women in endemic areas are susceptible [4]. The risk of developing severe malaria for pregnant women in endemic areas is 2 – 3 times higher than that of non-pregnant women living in the same area [1, 7].

The prevalence of 19.2% of malaria parasitaemia in this study is higher than the 8.4% prevalence in Ibadan [16] but lower than the 29% prevalence reported in Abakaliki [17] and 26% prevalence in Port Harcourt [18]. However, higher prevalence rates have been reported in other studies; 63.5% in Awka [19], 58.4% in Enugu [6] and 63.5% at Ibadan [15]. Variations in environmental factors of the study locations, could have accounted for the different prevalence rates of malaria parasitaemia. In this study, the relatively low prevalence of malaria parasitaemia may be due to the fact that the investigation was conducted in an urban setting. In rural areas, mosquito breeding and malaria transmission is known to be more intense. Besides, all the subjects were literate women who would have been better informed about malaria prevention and treatment.

Younger women were more susceptible to malaria parasitaemia in this study. This may be due to the effect of parity, since most of the younger pregnant women were primiparous rather than multiparous. The prevalence was highest among the age group 26 – 30 years (32.5%) and lowest among the age group 36 – 40 years (6.2%). Besides, there was a relative increase in the prevalence of malaria parasitaemia in the younger pregnant women from 16 – 35 years, implying that they were more vulnerable, whereas there was a comparative decline in the frequency of parasitaemia in the older pregnant women from 36 – 45 years. A significant relationship was established between malaria parasitaemia and age of pregnant women (P<0.05), similar to findings from other studies [15, 16, 21].

Primigravidity is a known risk factor of malaria in pregnancy. It has been shown that in endemic countries, especially African countries, prevalence of malaria, based either on placental infection or parasitaemia varies between 8.8 to 36.2% in multigravidae and between 15.7 to 64.0% in primigravidae [1, 20]. Malaria not only becomes more prevalent in primigravidae but also more intense [2]. Indeed, [4] asserted that malaria does not have such a strong effect on foetal growth reduction in multiparous women as it does in primiparous women living under holoendemic conditions for malaria. In this study, the primigravidae and multigravidae recorded malaria parasitaemia prevalence of 21.4% and 16.2% respectively. This finding confirms previous reports which have shown a significantly higher malaria parasitaemia in primigravidae than in multigravidae [4, 15, 18, 21, 22].

Malaria parasitaemia occurred more in the third trimester (35.8%) than in the other two trimesters. The difference in the prevalence of parasitaemia among the trimesters was significant (P<0.05). This finding is similar to the observation reported by Akinboro *et al*. [15]. This occurrence may be due to the relatively small number of subjects that were involved in the study. Besides, many pregnant women, especially those in their third trimester registered late for antenatal care. However, other studies have reported that the highest prevalence of infection occurs in the primigravidae during the second trimester [6, 21, 23] or in the first trimester [8, 18, 22].

The prevalence of severe anaemia was 47.4% among pregnant women but none (0%) was recorded for the non-pregnanat women (Table 4). The difference was statistically significant (P<0.05). Furthermore, the highest frequency (23.9%) occurred in the third trimester. However, other studies have reported higher prevalence rates of anaemia in pregnancy [4, 6, 8, 10]. In a study, it was reported that over 70% of primigravid mothers, 45% of the multiparae and only 22% of the control group recorded severe anaemia (<11.0 g/dl). Anaemia was highly dependent on malaria parasitaemia, pregnancy status and parity of pregnancy [14]. In another investigation, it was observed that parasite density and prevalence of anaemia was highest among primigravidae and decreased with subsequent pregnancies and hence complication rates were higher in primigravidae as compared to multigravidae patients [15].

Severe anaemia and mild anaemia were more prevalent among patients without malarial parasitaemia than those that were positive (52.6% versus 47.4%) and (83.8% versus 16.3%) respectively (Table 4). This finding is similar to the observation reported by Achidi *et al*. [24]. They found that the prevalence of anaemia was significantly higher in mothers whose peripheral blood and placental biopsy were free of malaria parasites (69.9%) than those whose peripheral and placental samples had malaria parasites. Also, Jimoh [2] in a similar study reported that there was a destruction of both parasitized and unparasitized blood cells leading to a greater level of anaemia than can be explained on the basis of parasitization of the red blood cells alone. These observations suggest the existence of other causes of anaemia in the various communities studied.

Further investigations into factors other than malaria parasites may help in the development of appropriate strategy for the control of anaemia during pregnancy in those communities. However, reports from several studies have shown that malaria parasitaemia was a significant determinant of anaemia in pregnant women [10, 14, 15, 16, 21, 25].

CONCLUSION

Pregnant women in malaria endemic areas, with or without fever should be screened for malaria parasitaemia. Timely diagnosis as well as good antimalarial treatment, adequate health education about malaria, supportive services and sustained preventive measures, if effectively implemented should essentially reduce the scourge of malaria and its consequences in pregnancy.

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