Original Article

Association of low birth weight and placental malarial infection in Nigeria

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Abstract

Background: Malaria causes significant morbidity and mortality among pregnant women in Nigeria. However, the contribution of malaria infection to neonatal development is incompletely understood. Here we determined the prevalence of placental malarial infection in six communities in Anambra State, Nigeria, between 2005 and 2006, and compare these data to neonatal birth weight.
Methodology: Blood samples were obtained from the placenta of 500 parturient mothers and examined for the presence of malaria parasites. Newborn birth weight was then compared with the malaria status of their mothers.
Results: Placental malarial infection was found in 322 of 500 mothers (64.4%). The prevalence of infection did not differ among the six different Nigerian communities (P = 0.978). Furthermore, there was no difference in infection rates between rural and urban areas (64.9% vs. 64.0%, respectively, P = 0.827). Interestingly, neonates born from mothers with placental malaria had lower birth weights than neonates born from uninfected mothers [2500 g (range 1900 g - 3200 g) vs. 3800 g (range 3200 g - 4700 g), P < 0.001]. Forty-five percent (145/322) of the newborns born from infected mothers were of low birth weight (defined as birth weight less than 2,500 g).
Conclusion: Malaria infection during pregnancy is common in Nigeria and is likely associated with low newborn birth weight.

Key words: malaria, placenta, pregnancy, newborns, low birth weight

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Introduction

In sub-Saharan Africa, 25 million pregnant women are at risk of *Plasmodium falciparum* infection every year [1] and one in four women have evidence of placental infection at the time of delivery. *P. falciparum* infections during pregnancy rarely result in fever and therefore often remain undetected and untreated [1]. Maternal malarial infection during pregnancy is associated with maternal anemia, stillbirth, low infant birth weight (defined as birth weight less than 2,500 g) and maternal mortality [2].

In areas with stable malaria transmission, where prevalence during pregnancy ranges from 10% to 65%, maternal malaria infection accounts for almost 30% of all the causes of low birth weight that can be prevented during pregnancy [3]. Malaria-related low birth weight has been described as a leading cause of poor infant survival and development in Africa [4,5]. The immediate consequences of low birth weight include neonatal hypothermia, hypoglycemia, and increased risk of mortality. In addition, low birth weight is associated with prolonged hospital stay, incubation, and nutritional support. Long-term sequelae of neonatal malarial infection include impaired neurological and metabolic development, poor growth, and chronic health problems in adult age. Each of these will have future cost implications [6,7]. Maternal malaria is estimated to account for 3% to 8% of all infant deaths [8].

Because of the severe consequences of malarial infection during pregnancy and its association with low infant birth weight, we sought to determine the prevalence of placental malaria and the contribution of maternal malaria in the delivery of low birth weight neonates in communities in Anambra State, Nigeria.

Materials and Methods

Study area

The study was conducted in six communities in Awka North and Awka South Local Government Areas (LGAs) in the Anambra Central geopolitical

Table 1. Prevalence of placental malaria among pregnant women in Awka North and Awka South LGAs, Anambra State, Nigeria

L.G.A.	Communities	No. Sampled	No. Positive	Prevalence (%)
Awka North	Amansea	13	08	69.2
	Amanuke	24	16	66.7
	Mgbakwu	38	26	68.2
	Total	75	50	67.7
Awka South	Awka	272	174	64.0
	Mbaukwu	70	43	61.4
	Nibo	83	55	63.3
	Total	425	272	64.0
	Grand total	500	322	64.4

zone of Anambra State, southeast Nigeria, between 2005 and 2006. Awka North LGA is made up of eleven communities and Awka South LGA contains eight communities. Awka North and Awka South Local Government Areas are within the area mapped out as the capital territory of Anambra State. The selection of study communities was randomized. The communities studied included Awka, Nibo, and Mbaukwu in Awka South LGA; and Amansea, Amanuke, and Mgbakwu in Awka North LGA. Of all the communities selected, only Awka qualify as an urban area. Based on the 1991 Nigerian National Census, the available data before the commencement of the research, Awka North and Awka South LGAs have a female population of 67,007 and 31,210, respectively.

Study populations and sample size

The study protocol underwent institutional review and approval by the Nnamdi Azikiwe University Research Board and Anambra State Ministry of Health. This study was conducted in accordance with outlined ethical policies for conducting clinical research in resource-limited settings. The informed consent of pregnant women participants was obtained. All parturient mothers in hospitals/health centres during the study period were eligible for inclusion. After obtaining informed consent, the placenta from study participants was sampled for malaria. This was matched with newborn birth weight. A total of 500 mothers and their newborns were sampled.

Collection of blood samples, determination of malaria status of parturient mothers, and birth weight of newborns

After delivery of the baby and the placenta, a punch was made at the placenta using a disposable lancet. One drop of blood from the placenta was placed on a clean slide. The blood was used to make thick film, which was later stained with Giemsa stain and examined under the microscope for malaria parasites as described by [9]. Newborn birth weight was recorded to one decimal place. Statistical analysis was performed using the Statistical Package for Social Sciences 11.0 (SPSS). Chi-square, T-test, and Binomial were used to compare the variables under study.

Results

Of the 500 parturient mothers whose placental blood samples were examined for malaria infection, 322 (64.4%) were positive. The prevalence by communities was Awka 64.0% (174/272), Mbaukwu 61.4% (43/70), Nibo 66.3% (55/83), Amansea 69.2% (8/13), Amanuke 66.7% (16/24), and Mgbakwu 68.2% (26/38). There was no statistical difference in the prevalence of placental malaria among the various communities (P = 0.978) (Table 1). When comparing the prevalence in rural communities [64.9% (148/228)] and urban areas [64.0% (174/272)], a Chi-square value of 0.048 and a P value of 0.827 were obtained (Table 2). This showed that the prevalence of placental malaria is independent of the communities.

Table 2. Prevalence of placental malaria among pregnant women in rural and urban areas of Anambra State, Nigeria

Area	No, Sampled	No. Positive	% Prevalence
Rural	228	148	6.9
Urban	272	174	64.0
Total	500	322	

Table3: Birth weight of newborns by pregnant mothers positive and negative for malaria parasites in the placenta, in Awka North and Awka South LGAs, Anambra State, Nigeria

Mothers positive for placental malaria					Mothers negative for placental alaria				
Range(Kg)	Mid-range (x)	Positive mothers (f)	Fx	Mean (x) (Kg)	Range(Kg)	Mid-range(x)	Negative mothers(f)	Fx	Mean(x) (Kg)
1.5-1.9	1.7	18	30.6		3.0-3.4	3.2	39	124.8	
2.0-2.4	2.2	127	279.4		3.5-3.9	3.7	70	259	
2.9-2.9	2.7	145	391.5	2.49	4.0-4.44	4.2	61	256.2	3.80
3.0	3.2	32	102.4		4.5-4.9	4.7	8	37.6	
Total		322	803.9				178	677.6	

Birth weight recorded for newborns whose mothers were positive for malarial infection ranged from 1,700 g to 3,200 g with a mean of approximately 2,500 g (2,497 g) (Table 3). Birth weight of newborns whose mothers were negative for malaria infection ranged from 3,200 g to 4,700 g with a mean of approximately 3,800 g (3,806 g) (Table 3). This difference was statistically significant ($P < 0.001$).

Of the 322 newborns whose mothers were positive for malarial infection of the placenta, 45.0% (14 5/322) were of low birth weight with a mean of 2,140 g (Table 4). Infants born from uninfected women in our study (177/322, 55%) had a mean birth weight of 2,790 g and were thus not of low birth weight by our predetermined definition (Table 4). This difference was not statistically significant ($P = 0.084$).

Discussion

Here we sought to determine the prevalence of malarial infection in parturient females and the relationship between maternal infection and infant birth weight in Nigeria using data gathered from six communities. We found that malarial infection was common among pregnant women in our study (64.4%). A myriad of studies have reported on the prevalence of placental malaria in areas of stable endemic malaria transmission in Africa [1,8]. In a review of eleven studies since 1980 [2], the median prevalence of placental malaria in all gravidae was 26% (range 5-52%). This study, however, revealed that at least 60% of pregnant mothers have evidence of placental malaria. Apart from the holoendemicity [10,11] of malaria, the factors responsible for this significant increase may include the quality of antenatal care services received by pregnant mothers before delivery. It may also be important to investigate the problem of drug resistance. The observation that there was no statistical difference in the prevalence of placental malaria between the rural and urban areas may also be explained by the holoendemicity of malaria in the study area as well as the quality of antenatal care received by pregnant mothers. It is possible that the same physicians who attend to pregnant mothers in urban areas also consult in the rural areas.

We also show that infants born to mothers positive for malaria parasites at the time of delivery have low birth weight compared to controls. Previous studies indicate that malaria in pregnancy contributes to 35% of the preventable low birth weight of babies born in women of all pregnancy orders in sub-Saharan Africa [2,6,8]. The implication of this result is that, despite current efforts to reduce the burden of malaria in pregnancy, the association between low birth weight and marked increase in infant mortality in stable malaria transmission areas is most probably on the rise. The association between low birth weight and increase in infant mortality has also been reported [12,13].

The fact that 45% of the newborns of mothers who were positive for placental malaria were actually of low birth weight (birth weight lower than 2,500 g) while 55% were not of low birth weight (birth weight above 2,500 g) could be explained by the quality of nutrition as well as existing immunity to placental malaria among pregnant mothers whose newborns weighed above 2,500 g at birth. In high-transmission areas, primigravidae are at greater risk of malarial infection than multigravidae; furthermore, young

maternal age is also an independent factor for malaria in pregnancy [14].

The findings of this study are an indication that the problem of malaria in pregnancy is not abating. Periodic evaluation of the impact of available tools in reducing the burden of malaria in pregnancy is recommended. The quality of antenatal care received by pregnant mothers needs remarkable improvement.

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