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Transplacental *Plasmodium falciparum* infection: Its incidence, parity related effects on birth weight in Abraka, Nigeria.

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The present study was designed to determine the incidence of malaria in pregnant women residing in Abraka, Nigeria and to evaluate its effects on pregnancy outcome, in terms of birth weight, and in relation to parity.

Cord blood of 45 consenting pregnant women at the General Hospital, Abraka, Nigeria, were used for this study. The cord blood was examined for malaria parasites by microscopy of Giemsa-stained thick blood films.

Results showed incidence of 66% for malaria parasite and lower birth weight babies this was statistically significant ($p<0.05$). Results also showed an incidence of 56.3% for the primigravida group compared with 34.5% for the multigravida group and a relatively lower birth weight babies that were statistically not significantly different ($p>0.05$). The malaria infection incidence was due mainly to *Plasmodium falciparum* infection.

We conclude that the incidence of malaria in pregnancy in Abraka, Nigeria is comparable with the reports of several other authors elsewhere and that this incidence has a bearing on birth weight with a greater severity in primigravida women.

Keywords: Transplacental malaria, *Plasmodium falciparum* malaria, malaria incidence, birth weight, Abraka.

In sub-Saharan Africa, where 80–90% of the world's malaria cases occur, about 19–24 million women are at risk for malaria and its adverse consequences during pregnancy (Guyatt and Snow, 2001; Steketee *et al,* 1996). In areas with stable malaria transmission, which represents most of sub-Saharan Africa, the vast majority of malaria infections in pregnancy remain asymptomatic, undetected and untreated (Desowitz and Alpers, 1992; Shulman, 1999). More than 95% of these infections are due to *Plasmodium falciparum*, and almost all of the remainder is *P. malariae*. Infections with *P. ovale* are rare (Bloland *et al,* 1999).

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Plasmodium falciparum infection during pregnancy can have detrimental consequences for both the mother and the fetus. Pathology associated with malaria during pregnancy is due in part to the ability of the parasite to render infected erythrocytes adhesive to host receptors expressed within the placenta, resulting in sequestration of parasitized erythrocytes in the intervillous space (IVS) (Andrews and Lanzer, 2002). One of the consequences of parasite sequestration in the placenta is the increased migration and recruitment of monocytes and macrophages to the IVS (Menendez *et al,* 2000; Suguitan *et al,* 2003) thus emphasizing the role of maternal blood cells, particularly macrophages, as important sources of inflammatory mediators during placental malaria infection (Suguitan *et al,* 2003).

Primigravidae and secundigravidae are most at risk (Bray and Anderson, 1984; McGregor, 1984), but in areas with moderate-to-intense transmission, women of higher parity (multigravidae) are also affected (Desowitz and Alpers, 1992; Reinhardt *et al,* 1978; Diagne *et al,* 1997; Shulman *et al,* 2001; Steketee and Mutabingwa, 1999; Beck *et al,* 2001).

The major impact of malaria during pregnancy in these regions is caused by persistence or recurrent, predominantly low-grade, sometimes sub-patent (Shulman *et al,* 1998; Mockenhaupt *et al,* 2000; Leke et al 1999) parasitemia, resulting in maternal anemia and a reduced birth weight (Brabin, 1983; McGregor, 1984; Bulmer *et al,* 1993; Watkinson and Rushton, 1983; McGregor *et al,* 1983; Jelliffe, 1968; Cot *et al,* 1995) which is a risk factor for several adult-onset pathologies (Barker, 1992; Hales and Barker, 1992; Desai *et al,* 2005; Lau and Rogers, 2005).

The aim of the present study was to determine the incidence of malaria in pregnant women residing in Abraka, Nigeria and to evaluate its effect on pregnancy outcome, in terms of birth weight, and in relation to parity.

MATERIAL AND METHODS

Research Design

The study was based on the investigation of cord blood samples (withdrawn from 45 consenting pregnant women at delivery) for level of parasitaemia as well as the measurement of the birth weight of the babies.

Sample collection and microscopy

Cord blood smear of pregnant women at the General Hospital, Abraka, Nigeria, at delivery were examined for malaria parasites by microscopy of Giemsa-stained thick blood films, as described elsewhere (Rogerson *et al,* 2000). Clinical information was obtained using questionnaires, and information on antenatal clinic (ANC) care from patients' records.

Parasite density per cubic millimeter was estimated from the number of parasites per 200 leukocytes and a leukocyte count of 8,000/mm^3 (WHO, 1991).

Birth Weight

Birth weights of the babies were recorded within one hour of birth with a Salter scale accurate to 50grams.

Statistical Analysis

Results are presented as M±SEM (mean ± standard error of mean). Statistical differences were evaluated by Students t-test. $P<0.05$ was considered as statistically significant.

RESULTS

A total of forty-five (45) pregnant women were sampled for this study. Out of these, 66% (29.7) had positive blood smear for malaria parasite and lower birth weight of babies, this was statistically significant ($p<0.05$).

Of the 30 positive blood smears for malaria parasite, the primigravida group showed an incidence of 56.3% compared with 34.5% for the multigravida group and a relatively lower birth weight babies that were statistically not significantly different ($p>0.05$) from the multigravida group.

Results also showed that the malaria infection incidence was due mainly to *plasmodium falciparum* infection.

Table 1. Malaria incidence and birth weight

Malaria status	Number	Prevalence	Mean birth weight
Positive	30	66%	2.48±0.12
Negative	15	34%	3.35±0.15

DISCUSSION

Our results have shown a malaria incidence of over 66% in pregnancy with about 95% of cases caused by *P. falciparum*. This is in agreement with earlier report (Bloland *et al,* 1999).

We have also shown that the primigravida group is more at risk of malaria infection and the attendant sequelae than the multigravida group, judging by the higher incidence of malaria infection in this group of women. This observation is also consistent with the reports of several authors (Bray and Anderson, 1984; McGregor, 1984; Brabin, 1991). The precise mechanism for the reduction of the risk

Table 2. Parity related incidence and birth weight

Parity	No examined	No infected	Mean birth weight	Incidence
Multigravida	29	10	3.27±0.17	34.5%
Primigravida	16	9	3.09±0.18	56.3%

Table 3. Parasite subspecies prevalence

Subspecies	Number of infected samples	Prevalence
Plasmodium falciparum	18	94.74%
Plasmodium malariae	0	0%
Plasmodium ovale	1	5.26%
Plasmodium vivax	0	0%

of malaria infection and the attendant sequelae in multigravida women is not entirely clear. It maybe that pregnant women do acquire a form of pregnancy-associated immunity during their earlier pregnancies that helps to protect them during subsequent pregnancies (McGregor, 1984; Brabin, 1983; Fried *et al,* 1998; Suguitan *et al,* 2004).

In conformity with several reports (Brabin, 1983; McGregor, 1984; Bulmer *et al,* 1993; Watkinson and Rushton, 1983; McGregor *et al,* 1983; Jelliffe, 1968; Cot *et al,* 1995) of significant reduction in birth weight of infants born to mothers who were infected with malaria during pregnancy, we observed a statistically significant reduction in birth weight of babies of infected mothers. This was quantitatively lower than those of uninfected mothers.

The low birth weight of babies born to infected mothers maybe related to nutrient transport to the fetus since a high density of parasites and chronic parasite infection in the placental blood and the associated cellular immune response may result in consumption of glucose and oxygen that would have gone to the fetus. Histopathological studies of infected placentas have found thickening of the cytotrophoblastic membranes, which may also interfere with nutrient transport to the fetus (Ismail *et al,* 2000). Malaria-associated maternal anemia may also contribute independently to the low birth weight (Ismail *et al,* 2000), most likely through a reduction in oxygen transport to the fetus.

We conclude that the incidence of malaria in pregnancy in Abraka, Nigeria is comparable with the reports of several other authors elsewhere and that this incidence has a bearing on birth weight with a greater severity in primigravida women.

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