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RESEARCH PAPER

THE PREVALENCE OF MALARIA PARASITIC INFECTIONS IN CORD BLOOD: ASSOCIATION WITH SOME SOCIO DEMOGRAPHIC PROFILE.

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ABSTRACT

This study aimed at investigating the relationship between some selected socio demographic profile and malaria parasitic infections in cord blood. It involved 100 cord blood samples of newly delivered babies at the Irrua Specialist Teaching Hospital, Irrua, Edo State. Samples were subjected to microscopic examinations following standard protocols and the prevalence of malaria parasitic infections in cord blood were identified using thick and thin blood films. Plasmodium species and packed cell volume were identified and determined using rapid antigen techniques and microhaematocrit respectively. Results showed that malaria parasite was present in 9.0% of samples and was higher in babies with weights ≤1.0kg (66.70%) and PCV of 25.50% (15.40%). As regards species distribution, *Plasmodium falciparum* had the highest prevalence (6%). Based on the methods used, microscopic method had higher prevalence (9%) over rapid detection technique (6%). On the methods used, malaria parasitic infections was also higher among the age 36-40 years (12.5%), primigravidae (15.6%), rural dwellers (16.1%), unskilled labour (22.2%), educational status ≤SSCE (12.5%) and mothers that do not use prophylaxis (45.5%). Overall, the prevalence of malaria parasites in cord blood is low in the studied area, yet the associated consequence of mother-to-child transmission can not be ignored.

Keywords: Babies, Cord blood, Demographic profile, Malaria parasites, Relationship.

INTRODUCTION

Malaria parasites belong to the Genus; *Plasmodium* (*Phylum Apicomplexa*). In humans, malaria is caused by *Plasmodium falciparum, Plasmodium malariae, Plasmodium ovale, Plasmodium vivax*, and *Plasmodium knowlesi* (Mueller *et al*., 2007; Collins, 2012). However, there have been documented human infections with several species of Plasmodium from higher apes (Collins and Barnwell, 2009; Collins, 2012).

The definitive (primary) hosts for malaria parasites are female mosquitoes of the Anopheles genus, which act as transmission vectors to humans and other vertebrates, the secondary hosts. A mosquito becomes infected when it takes a blood meal from an infected vertebrate. Once ingested, the parasite gametocytes taken up in the blood will further differentiate into male and female gametes and then fuse in the mosquito's gut (Talman et *al*., 2004).

In addition, congenital malaria can be acquired by transmission of parasites from mother to child during pregnancy or perinatally during labour (Opara, 2010). In fact, malaria and pregnancy are generally believed to be mutually aggravating conditions. The pathological changes due to malaria and the physiological changes associated with pregnancy have a synergistic effect on the course of each other (Kakkilaya, 2009).

Maternal Malaria has been adjudged the major cause of infant death and is mostly prevalent in Africa (Hartman *et al*., 2010). Similar reports have shown that neonatal malaria infection is established as a result of transplacental infection from the mother to the foetus (Alphose *et al*., 2012) and malaria being the major cause of morbidity and mortality in pregnant women and infants (McDermott *et al*., 1996).

On the other hand, 'cord blood' is the blood that remains in the blood vessels of the placenta and in the portion of the umbilical cord that remains attached to the placenta after childbirth. This blood is called placental blood or umbilical cord blood: "cord blood" for short. It contains a rich source of stem cells, which could potentially be used in the treatment of over 75 different diseases, including leukemia, lymphoma and anemia (Cairo and Wagner, 1997). Cord blood is obtained from the placenta through the umbilical cord at the time of childbirth, after being detached from the newborn (Cairo and Wagner, 1997). This study therefore, is designed to investigate the prevalence of malaria parasitic infections in cord blood.

MATERIALS AND METHODS

Study Area: This study was carried out at the Irrua Specialist Teaching Hospital (ISTH), Irrua in Esan Central Local Government Area of Edo State. Geographically, Irrua is located at latitude 6^{o} 45 to 0.1^{o}N and Longitude 6^{o} 15 to 48^{o} E. It has a population of 10,000 people whose major occupation includes farming, teaching, civil service and trading (World Gazetter Nigeria, 2007).

Study Population: A total of 100 Cord blood samples from newly delivered babies at Irrua Specialist Teaching Hospital (ISTH) Irrua, was used for this study.

Ethical Approval: Before the commencement of this study, ethical approval was obtained from the ethical committee of Irrua Specialist Teaching Hospital (ISTH) with the ethical clearance code; "ISTH/ETHIC COM/41". Also, informed consent from the subjects' mothers was appropriately sought for.

Research Design: This study was designed to determine the prevalence of malaria parasitic infections in cord blood. In this study, questionnaires were used to obtain relevant information of the subjects. The period of administration of questionnaires, collection of samples and actual laboratory analysis of the samples lasted for four months.

Inclusion and Exclusion Criteria: All subjects used for this study were only newly delivered babies at the Irrua Specialist Teaching Hospital (ISTH), Irrua. Babies born outside the hospital and those older than a day after delivery were not used for the study.

Sample Collection: Just after delivery and after the cord had been clamped, 5mls of cord blood samples was obtained from the umbilical cord vein using sterile needle and syringe. It was placed into ethylene diamine tetra acetic acid (EDTA) container, thoroughly mixed by gentle inversion and taken to the laboratory for examination.

Laboratory Examination of Samples: The packed cell volume and rapid antigen detection technique of the samples was determined using the method described by Cheesbrough (2005), while the method for the thin and thick blood films was done as described by Ochie and Kolhatkar (2000).

Data Analysis: The data generated from this study were analyzed using Chi- square with the aid of a statistical package known as Statistical package for social sciences (SPSS). Results were presented in Tables and a confidence interval of $P \leq 0.05$ was considered significant.

RESULTS

Out of the 100 cord blood samples from newly delivered babies examined, the prevalence of malaria parasite in cord blood was found to be 9 (9%). The results on PCV also showed that the prevalence rate was higher in the mean PCV values of 25.5 (15.4%) while the result on species distribution revealed that *Plasmodium falciparium* had the highest prevalence (6%). Also the detection of malaria parasite showed a higher prevalence in the microscopic method (9%) over the rapid detection technique (6%). The observed differences were not statistically significant ($P>0.05$) (Table 1).

Table 2 shows the prevalence of malaria in relation to weight and sex of the babies. As regards sex, infection rate of malaria parasite was 5 (7.4%) out of 68 subjects for males and 4 (12.5%) out of 32 subjects for females. The weight range of ≤ 1 (66.7%) however, had the highest prevalence rate of malaria parasite. The differences also were not statistically significant (P>0.05).

The socio demographic profiles of the mothers are presented in table 3. The results showed that the infection rate was highest among the age range of 36-40 years (12.5%) with the lowest prevalence occurring within the age range 26- 30 (5.6%). However, the age range of 41 -45 years showed no prevalence (0 %). Furthermore, a higher prevalence was observed in mothers of an educational status ≤ SSCE (12.5%), unskilled labour (22.2%), rural settlement (16.1%), primigravidae (15.6%), and women that responded negatively to the use of prophylaxis treatment (45.5%).

Table 1: Prevalence of malaria parasite in cord blood according to species and method

SAMPLE/ INVESTIGATION	NO EXAMINED	NO INFECTED	PREVALENCE (%)
CORD BLOOD	100	9	9
SPECIES[a]: *P. falciparium*	100	6	6
Other species	100	3	3
METHOD: Microscopy	100	9	9
RDT	100	6	6

Key: RDT-Rapid detection Technique; a- (X^2=1.00; X^2 tab= 3.841; P= 0.32; P> 0.05; df= 1).

Table 2: Prevalence of malaria parasite in cord blood using the babies' profile

PARAMETERS	NO EXAMINED	NO INFECTED	PREVALENCE (%).
Weight[a] (kg)			
≤1.0	3	2	66.7
1.1-2.0	2	0	0
2.1-3.0	37	5	13.5
3.1-4.0	53	2	3.8
4.1-5.0	5	0	0
Sex[b]			
Male	68	5	7.40
Female	2	4	12.5
PCV range[c]			
21-30 (25.5)	13	2	15.4
31-40 (37)	44	5	11.4
41-45 (45.5)	7	1	14.3
51-60 (55.5)	36	1	2.8

a = (X^2 = 9.33 X^2 tab = 9.488; P = 0.42; P> 0.05; df = 4); b = (X^2= 0.111; X^2 tab = 3.481; P = 0.74; P> 0.05; df =1);
c = (X^2= 4.778; X^2 tab = 7.815; P = 0.19; P> 0.05; df =3).

DISCUSSION

The observed prevalence of malaria in this study is in agreement with the study done by Omalu *et al*., (2012) in Minna, North central Nigeria, where a prevalence of 2.63% and 4.63% from 152 samples of peripheral blood of new born babies and placental blood respectively were reported. This prevalence is supported by the fact that this study was conducted in dry season (November to March) which is a period of low mosquito density and perhaps, low level malaria transmission rates.

However, our finding in this study disagrees with the work done by Obiajunwa *et al*., (2005) where a prevalence of 46.70% was reported in a study of 120 newborn babies at Ile-Ife, Southwestern Nigeria. Also supporting this assertion is the prevalence of 13.00% reported among 546 in-born neonates at Calabar Teaching Hospital (Ekanem

et al., 2008). These findings represent a new trend since parasitaemia in peripheral blood of newborns was considered rare in highly endemic areas (Covell, 1950; Logic and McGregor, 1970; Falade *et al.*, 2007).

Consequently, there was low prevalence of malaria in neonates from mothers who used prophylaxis. This could be due to that fact that many of the women enrolled for this study were constantly on malarial prophylaxis as a preventive measure against malarial infection which was routinely administered by their antenatal care givers.

Table 3: Prevalence of malaria parasite in cord blood using the mothers' socio demographic profile

PARAMETERS	NO EXAMINED	NO INFECTED	PREVALENCE (%)
Age [a]			
<20	5	1	20
21-25	14	1	7.1
26-30	54	3	5.6
31-35	15	3	20
36-40	8	1	12.5
41-45	4	0	0
Educational[b]			
≤SSCE	16	2	12.5
>SSCE	84	7	8.3
Occupation[c]			
Farming	15	3	20
Trading	21	1	4.8
Civil Service	41	0	0
Skilled Labour	14	3	21.4
Unskilled Labour	9	2	22.2
Settlement[d]			
Rural	31	5	16.1
Semi Urban	69	4	5.8
Gravidity[e]			
Primigravidae	32	5	15.6
Multigravidae	68	4	5.9
Prophylaxis[f]			
Yes	89	4	4.5
No	11	5	45.5

A=(X^2= 5.00; X^2 tab= 11.070; P= 0.42; P> 0.05; df= 5); b=(X^2= 2.778; X^2 tab=3.841; P= 0.09; P> 0.05; df =1); c= (X^2= 3.778; X^2 tab=9.488; P= 0.44; P> 0.05; df =4); d= (X^2= 0.111; X^2 tab=3.481; P= 0.74; P> 0.05; df =1); e=(X^2= 0.111; X^2 tab= 3.841; P= 0.74; P> 0.05; df= 1); f=(X^2= 0.111; X^2 tab= 11.070; P= 0.42; P> 0.05; df =1)

It was also observed in this study that prevalence of malaria in cord blood is more in microscopic method of examination of blood films than in Rapid detection technique. This could be as a result of the limitation in the sensitivity of rapid detection methods to specifically very low malaria parasites density (Cheesbrough, 2005) as higher number of the neonates were from the lowest range of the parasites density.

Moreover, there was a high prevalence of malaria in neonates with mean PCV range of 25.5%, this observation gives a clue to the possible development of anemia. This is supported by the fact that the prevalence of fetal anemia is reportedly very high in sub-Saharan Africa. In two separate studies conducted in southern Malawi, fetal anemia prevalence of 23.4 percent (Brabin *et al*., 2004) were recorded, while in Maputo Mozambique, up to 93 percent of newborns were found to have fetal anemia (Bergstrom *et al*., 1993). Interestingly, a statistically significant link was established between fetal anemia and maternal malaria infection in all of these studies.

Also, the observation that infection with *Plasmodium falciparum* had the highest prevalence, agrees with the widely accepted view that *Plasmodium falciparum* is the predominant species of malarial parasites found in Nigeria (Bouyou-Akotet *et al.,* 2003). In a multicentre study done at Ibadan a prevalence of 5.10% was reported in University College Hospital (Falade *et al*., 2007).

On the average, the highest infection rate was observed in neonates who had the lowest weight range. Though it is not very clear whether the observed low birth weight was due to infection of cord blood with malarial parasites, the observation is in consonance with the study done by Okoko *et al*. (2002) that low birth weight could be as a result of placental infection with malaria parasites in which parasites interfere with placental functions (Galbraith *et al*., 1980; Moshi *et al*., 1995). However, there was higher prevalence of malaria in females when compared to the males though the reasons were not clear.

The lack of proper education could also lead to increased prevalence as observed in this study. Comparing the occupational status of the mothers, it was also observed that neonates from farmers and unskilled labourers had the highest prevalence of malaria in cord blood. This could be due to exposure of farmers and other unskilled labourers to predisposing factors such as increased mosquito bites (to which they are mostly susceptible) and stress that could lead to reduced immunity. Also, prolonged exposure to mosquito bite in the rural settlement which is often surrounded by bushes (a suitable breeding environment for mosquitoes) is a predisposing factor for malaria infection. Furthermore, lack of adequate enlightenment on the preventive measures against malaria infection could also explain the reasons for the increase in prevalence of malaria in unskilled mothers.

On the other hand, the observed higher prevalence was observed in neonates from primigravidae than neonates from multigavidae could be as a result of the fact that primigravidae are more susceptible to malaria attack because of the reduced lymphoproliferative response sustained by elevated cortisol, loss of cell mediated immunity, and presence of placental; a new organ in the primigravidae as reported by Kakkilaya, (2009).

Judging by the results of this study, the prevalence of malaria parasites in cord blood can be said to be low in the study area. However, the associated consequence of mother-to-child transmission can not be ignored.

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AUTHOR(S) CONTRIBUTION

Ekpuka B.M., conducted this study under the supervision of Dr. Okogun G.R.A., with technical assistance from Obodo B.N., Itua E.E., Olagboye J.A., and Obhakhan J.O. All the authors contributed to the final presentation of this article.