http://dx.doi.org/10.4314/bajopas.v4i2.16

Bayero Journal of Pure and Applied Sciences, 4(2): 83 – 86
Received: March, 2011
Accepted: July, 2011
ISSN 2006 – 6996

STUDIES ON THE INCIDENCE OF ASYMPTOMATIC *PLASMODIUM* INFECTION AMONG APPARENTLY HEALTHY SUBJECTS IN ORPHANAGES IN KADUNA AND ZARIA, NIGERIA

Inabo*, H.I. and Umaru, B.Z.
Department of Microbiology, Ahmadu Bello University, Zaria, Nigeria
*Correspondence author: heleninabo@yahoo.co.uk

ABSTRACT
The incidence of asymptomatic Plasmodium falciparum infection among orphans between age groups, gender and blood groups was investigated. Standard microscopic methods were used to screen for malaria parasites in the blood specimens obtained from eighty-five (85) subjects in three orphanages in Kaduna and Zaria, Nigeria. An overall incidence of 14.1% was observed in this study. The age group 0-3 years had the highest overall incidence of 28.5% and lowest in the age group 16-19 years (0.0%). With respect to gender, a higher incidence was recorded among female subjects (17.50%) than males (11.11%) . There was no significant difference in the age and sex of the subjects studied (p>0.5). There was no correlation between asymptomatic Plasmodium infection and the blood groups of subjects. To reduce morbidity and mortality rate among children in orphanages, there is a need for the use of chemoprophylaxis and insecticide- treated nets in orphanages.

Key words: Plasmodium falciparum, Orphanage, blood group, Age group.

INTRODUCTION

Malaria is a major public health problem in the world and particularly in developing countries and is an important cause of human morbidity and mortality (Lou *et al*., 2001). The prevalence of asymptomatic malaria parasitaemia in apparently healthy subjects living in endemic malarious areas has been of interest for many years (WHO, 2000). It is estimated that about 250 million people in Africa are carriers of malaria parasites. It is the most common cause of out-patient visits to health facilities and it is reported as one of the leading causes of death. Asymptomatic malaria parasitaemia is a condition in which a healthy individual has anumber of malaria parasites in the blood without showing any malaria symptom. *Plasmodium falciparum* is the dominant strain causing malaria with complications such as cerebral malaria (UNICEF, 2006). In Nigeria, malaria results in 25% infant and 30% childhood mortality (FMH, 2005). Infants and children living in endemic regions have the highest prevalence of asymptomatic parasitaemia in various age groups. Earlier reports showed that splenomegaly in younger age groups was indicative of a developing immunity and the absence of an enlarged spleen in older age groups represented established immunity (Yusuf *et al*., 2010). Njama-Meya *et al.* (2004) had reported that a risk of developing symptomatic malaria within 30 days was significantly higher in those with a positive routine smear than in those with a negative one. Against this background information, this study was carried out to assess the asymptomatic malaria parasitaemia among subjects in some orphanages in some parts of Kaduna State, Nigeria

MATERIALS AND METHODS

Study population

A total of 85 Subjects all aged between 0-19 years were randomly selected in 3 orphanages in Kaduna State, Nigeria: Zaria orphanage (16), Adoni orphanage, Kaduna (26), City of Refuge orphanage, (43). All subjects were interviewed using a structured questionnaire to obtain information about age, sex, blood group. Questions and answers were in Hausa and later translated into English Language. Informed consent was obtained from the guardian of all the participating subjects in the three orphanages.

Subjects with Asymptomatic malaria parasitaemia

Apparently healthy subjects (asymptomatic subjects) in the orphanages were enrolled in this study if they met the following criteria: age 0–19 years; no history of treatment for malaria in the previous 2 weeks or fever in the previous 48 h..

Preparation of Giemsa stained Thin and Thick blood smears

Blood was collected by using sterile disposable lancets to prick disinfected thumbs of the children. Thick and thin blood films were made on clean – grease free slides. A slide was considered negative if no parasites were found after scanning 100 high power fields. Thick and thin smears of blood samples were made from the subjects under study. The smears were stained using 2% Giemsa solution for the thick film and 100% Leishman solution for the thin film for the identification and speciation of the parasite respectively.

Data analysis

The analysis was done using the Epi-info database package and SPSS (Statistical Package for SocialSciences) version 17.0.Differences in the prevalence of infection between age and gender groups were determined using the χ2 tests from the contingency tables.

RESULTS

The type of *Plasmodium* spp identified in Giemsa stained smears was *Plasmodium falciparum*. Table 1 shows the incidence of subjects with asymptomatic *Plasmodium* infection among orphans by age. The incidences for this age group in the three orphanages were: 13.9% (City of refuge orphanage), 15.3% (Adonai orphanage) and 12.5% (Zaria orphanage).

Though Chi-square evaluation of asymptomatic *Plasmodium* infection among the age groups indicated that there was no statistically significant difference among the age groups at 95% confidence interval i.e. $p > 0.05$ ($\chi^2 = 5.684$, df = 4, p = 0.224, mean (x) = 2.00, Std Devia. =1.206).

The incidence of asymptomatic *Plasmodium* infection among orphans by gender is presented in Table 2. The incidences for this age group in the three orphanages were: 13.9% (City of refuge orphanage), 15.3% (Adonai orphanage) and 12.5% (Zaria orphanage). Chi-square (χ^2) analysis among males and females was not significantly different ($\chi^2 = 0.713$, df = 1, p = 0.398, mean (x) = 1.58, Std. Devia. = 0.515).

Table 3 shows the incidence of asymptomatic *Plasmodium* infection among orphans by blood group. In this study, group O subjects dominated the study population, followed by B, A, and AB which is in consistent with previous reports that group O is the dominant blood group among Nigerians13,14.Chi-square (χ^2) analysis of malaria parasite among blood groups at 95% confidence interval i.e. p = 0.05 indicates that the difference among blood groups is not statistically significant($\chi^2 = 4.833$, df = 3, p = 0.184, mean = 3.00, Std. Devia =1.206).

Table 1. Incidence of asymptomatic *Plasmodium falciparum* Infection among apparently healthy children by age

	COR		AO		ZOC		Overall Incidence	
Age(yrs)	**NE**	**No. (%)**	**NE**	**No. (%)**	**NE**	**No. (%)**	**NE**	**No. (%)**
0-3	13	4(30.7)	4	1 (25.9)	4	1 (25.0)	21	6 (28.5)
4-7	13	1(7.6)	11	0(0.0)	6	1(16.6)	30	2 (6.6)
8-11	7	1(14.2)	5	1(20.0)	2	0(0.0)	14	2(14.3)
12-15	8	0(0.0)	5	2 (40.0)	3	0(0.0)	16	2 (12.5)
16-19	2	0(0.0)	1	0 (0.0)	1	0(0.0)	4	0(0.0)
Total	43	6 (13.9)	26	4 (15.3)	16	2 (12.5)	85	12 (14.1)

$\chi^2 = 5.684$, df = 4, p = 0.224, mean (x) = 2.00, Std Devia. =1.206

Key: COR = City of Refuge orphanage, AO = Adonai orphanage, ZO = Zaria orphanage, NE = Number of Subjects Examined, No = Number of Subjects Positive

Table 2. Incidence of asymptomatic *Plasmodium falciparum* Infection among apparently healthy children by gender

	COR		AO		ZOC		Overall Incidence	
Age(yrs)	**NE**	**No. (%)**	**NE**	**No.(%)**	**NE**	**No. (%)**	**NE**	**No. (%)**
Male	25	5(20)	15	0 (0.0)	5	0 (0.0)	45	5(11.11)
Female	18	1(5.5)	11	4 (36.3)	11	2(18.18)	40	7(17.50)
Total	43	6 (13.9)	26	4 (15.3)	16	2(12.5)	85	12(14.11)

$\chi^2 = 0.713$, df = 1, p = 0.398 ; mean (x) = 1.58, Std. Devia. = 0.515

Key: COR = City of Refuge orphanage, AO = Adonai orphanage, ZO = Zaria orphanage, NE = Number of Subjects Examined, No = Number of Subjects Positive

Table 3. Incidence of asymptomatic *Plasmodium falciparum* Infection among apparently healthy children by blood group

	COR		AO		ZOC		Overall Incidence	
Age(yrs)	**NE**	**No. (%)**	**NE**	**No. (%)**	**NE**	**No. (%)**	**NE**	**No. (%)**
O	24	3(12.5)	17	2(11.7)	10	1(10.0)	51	6 (11.7)
A	12	1(8.3)	4	0(0.0)	3	1(33.3)	19	2(10.5)
B	6	2(33.3)	3	0(0.0)	2	0(0.0)	11	2(18.18)
AB	1	0(0.0)	2	2(100.0)	1	0(0.0)	4	2(50.0)
Total	43	6 (13.9)	26	4(15.3)	16	2(12.5)	85	12(14.1)

$\chi^2 = 4.833$, df = 3, p = 0.184, mean = 3.00, SD =1.206

Key: COR = City of Refuge orphanage, AO = Adonai orphanage, ZO = Zaria orphanage, NE = Number of Subjects Examined, No = Number of Subjects Positive

DISCUSSION

This study has shown the overall incidence of asymptomatic *Plasmodium* infection to be 14.1% (Table 1; p = 0.224) among subjects in some orphanages in Kaduna State. In Africa, asymptomatic *P. falciparum* infections are widespread (Rogier and Trape, 1995). The incidence of asymptomatic malaria parasitemia among children was higher in children less than five (<5) years of age when compared to children more than (> 5) years in this study (Table 1). This is agreement with the work done by Ekeh and Teclire (2008) in Abia South Local Government Area though a higher prevalence of asymptomatic (33.1%) *Plasmodium* infection was found among school children.

The finding that 14.1% of children were asymptomatic indicates that subjects in the selected orphanages seem to have acquired the ability to tolerate malaria parasites without having clinical symptons. This may be due to the fact that individuals become immune to malaria due to age – function of the number of exposures. Children born to immune mothers are protected against the disease (malaria) during their first half year of life by maternal antibodies. As they grow older, after continued exposure from multiple malaria infections over time, they build up an acquired immunity and become relatively protected against disease

In this study, females showed higher levels of asymptomatic *Plasmodium* infection than males (p = 0.398) though there was not statistical significance between the both infected males and females. However, females may be more exposed to mosquito bites than males as they engage in outdoor activities such as communal food preparation. This report agrees with the finding of Daboer *et al.* (2010) who reported a prevalence of 46.6% among females and 29.9% among males. Earlier reports by Olarenwaju and Johnson (2001); Adeleke (2007) showed that males were more infected than females.

In this study, group O subjects dominated the study population followed by A, B, and AB which is in consistent with previous reports that group O is the dominant blood group among Nigerians (Bakare *et al.*,2006; Enosolease and Bazuaye, 2008).

Cserti and Dzik (2007) had reported an especially high prevalence of group O coupled with a low prevalence of group A is found throughout subSaharan Africa,where *P falciparum* persists to this day. The effect of the ABO blood grouping on severe *falciparum* malaria has received little attention, although previous studies have suggested that in African children, blood group A may predispose them to severe malaria. However, Rowe *et al.*(2008) observed that blood group O protects against severe *Plasmodium falciparum* malaria. *Plasmodium falciparum* rosetting, a parasite virulence phenotype associated with severe malaria, is reduced in blood group O erythrocytes compared with subjects with groups A, B, and AB. (Jeremiah *et al.*, 2010). Available data suggest survival from malaria has been the most significant selective force acting on the blood (Antse 2010).

Recently, Deepa *et al.*(2011) reported that group O subjects have an advantage over the other three groups when considering the outcomes of severe malaria. They suggested that clinical severity, rather than incidence or prevalence of detectable parasitemia, is a more relevant outcome to assess ABO group and survival. Studies reporting clinical features such as cerebral malaria carry more weight than those reporting only laboratory markers such as percent parasitemia, because the latter does not always predict survival.

Thus, in this study, there was no correlation between asymptomatic *Plasmodium* infection and ABO blood grouping. However, the direction of future studies will involve relationship between symptomatic patients and ABO blood grouping.

In conclusion, this study has shown that *Plasmodium falciparum* infection is prevalent among subjects in selected orphanages in some parts of Kaduna State. Thus, the public health and economic implications of these findings should not be overlooked. Concrete steps should be taken to protect subjects in orphanage. Thee include the use of control measures such as mosquito bed nets and the screening of doors and windows of houses with nets.

REFERENCES

Adeleke,S.I.(2007).Malaria Parasitaemia and its correlation with age in children diagnosed at Aminu Kano Teaching Hospital, Kano, Nigeria.*Int. Jor. P. App. Scs.*, 1(2): 39 – 42,

Antsee, D.J (2010). The relationship between blood groups and disease. *BLOOD,* 115,(23):4635-4645

Bakare A.A, Azeez M.A, Agbolade J.O. (2006) Gene frequencies of ABO and Rhesus blood groups and haemoglobin variants in Ogbomosho, south-west Nigeria. *African J Biotechnol* ; *5:* 224–9.

Bottius E, Guanzirolli A, Trape JF, Rogier C, Konate L & Druilhe P (1996) Malaria: even more chronic in nature than previously thought; evidence for subpatent parasitaemia detectable by the polymerase chain reaction. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 90: 15–19

Cheesbrough, M. (2005). District Laboratory practice in Tropical Countries. *Cambridge University Press.*

Cserti, C.M and Dzik, W.H.(2007). The ABO blood group system and *Plasmodium falciparum* malaria. *BLOOD,* 110(7):2250-2258.

Daboer, J.C., Chingle, M.P.and Ogbonna,C.(2010). Malaria Parasitaemia and Household use of Insecticide Treated Bed Nets: A cross sectional survey of Under fives in Jos,Nigeria. *Nigerian Med. J.* 51(1):1-5

Deepa, V. A. Alwar, K. R. and Ross,C.(2011) ABO blood groups and malaria related clinical outcome *J Vector Borne Dis* 48, March 2011, pp. 7–11

Ekeh, E.L. and Teclire,N.N.(2008).Prevalence of Malaria parasitaemia and associated factors in febrile under- five children in PHC centers in Jos, North Central Nigeria. *Nigerian Postgraduate Medical Journal.* 15(2):65- 69

Enosolease M.E and Bazuaye G.N.(2008). Distribution of ABO and Rh-D blood groups in the Benin area of Niger Delta: implication for regional blood transfusion. *Asian J. Transfus Sci. 2:* 3–5.

FMH- FEDERAL MINISTRY OF HEALTH (2005). National Treatment Guidelines Federal Ministry of Health. Publication of the FMH, Nigeria, p. 44.

.Jeremiah, Z.A; Jeremiah,T.A AND Emelike, F.O.(2010). Frequencies of some human genetic markers and their association with *Plasmodium falciparum* malaria in the Niger Delta, Nigeria. *J Vector Borne Dis* 47: 11–16

Lou J. Lucas R and Grau, E.G. (2001). Pathogenesis of cerebral malaria. Recent experimental data and possible applications for humans. *Am J Clin Nutr,*14:810-820.

Moulds,J.M.(2007).Blood group O protects against severe *Plasmodium falciparum* malaria through the mechanism of reduced rosetting. *Proc Natl Acad Sci.* 104(44): 1741–1747

Njama-Meya, D,Kamya, M.R.and Dorsey G (2004). Asymptomatic parasitaemia as a risk factor for symptomatic malaria in a cohort of Ugandan children *Trop. Hlth and Internat. Hlth*. 9 (8):862–868

Olarenwaju, W.I and Johnson, A.W. (2001).Malaria in children in Ilorin.*East Afri. Med J.*.78(3):131-134.

Rowe, J. A., Handel, I.G., Thera, M.A., Deans,A.M., Lyke, K.E., Kone, A., Diallo, D.A.,Raza,

A., Kai, O., Marsh, K., Plowe, C.V.,Doumbo, O.K, and Moulds, J. M. (2008).Blood group O protects against severe *Plasmodium falciparum* malaria through the mechanism of reduced rosetting. *PNAS* 104(44):17471-17476.

Rogers, W.O. (1999). *Plasmodium* and *Babesia*.In Manual of Clinical Microbiology (Eds: Lynne, S.G. and Michael, A.P.) 7th Edit. American Society for Microbiology. 1355 -1364

Rogier, C.and Trape J.F. (1995). Study of premonition development in holo and mesoendamic malaria areas in Dielmo and Ndiop (Senegal): preliminary results, 1990-1994. *Med Trop (Mars)* 55:71-76

Rowe, J. A., Handel, I.G., Thera, M.A., Deans,A.M., Lyke, K.E., Kone, A., Diallo, D.A.,Raza, A., Kai, O., Marsh, K., Plowe, C.V.,Doumbo, O.K, and Moulds, J. M. (2008).Blood group O protects against severe *Plasmodium falciparum* malaria through the mechanism of reduced rosetting. *PNAS* 104(44):17471-17476.

UNICEF (2006.) Childhood under treat. The state of the world's children. United Nations Children Fund Geneva p.118.

Yusuf,O.B., Adeoye, B.W., Oladepo, O. O., Peters., D. H., Bishai, D. (2010). Poverty and fever vulnerability in Nigeria; a multilevel analysis. *Malaria Journal*.9;235

WHO (World Health Organisation).(2000).Current global malaria situation.WHO Expert committee on malaria.WHO Technical Report Series.892: 3 – 12.