



ASN-PH-020919
ISSN: 2315-5388

International Journal of Basic, Applied and Innovative Research
IJBAIR, 2012, 1(4): 111 - 115
www.antrescentpub.com

RESEARCH PAPER

RELATIONSHIP BETWEEN MALARIA PARASITAEMIA AND PACKED CELL VOLUME AMONG PRIMARY SCHOOL PUPILS IN EKPOMA

¹Oseghale FO., ^{*1}Okogun GRA., ¹Akpile A., ¹Omolumen LES.

Department of ¹Medical Laboratory Science, Faculty of Basic Medical Sciences, College of Medicine, Ambrose Alli University, Ekpoma, Edo state, Nigeria.

*Corresponding Author: graokogun@yahoo.com

Received: 23rd July, 2012

Accepted: 21st October, 2012

Published: 31st December, 2012

ABSTRACT

Malaria parasitic infection is a disease causing high morbidity and mortality in most tropical parts of the world, where climatic conditions and sanitation practices favour their prevalence. The aim of this study is to determine the prevalence of malaria parasitaemia and its influence on pack cell volume among Primary School Pupils. The study was conducted in Ekpoma, Edo State, Nigeria and involves two hundred primary school children between the ages of 7 and 14 years. Blood was collected by finger prick to determine the presence of malaria parasitaemia using thick and thin film methods while packed cell volume (PCV) was determined by haematocrit method. The prevalence of Plasmodium infection was found to be 20.5% with only two species of *Plasmodium* detected *Plasmodium falciparum* (20%) and *Plasmodium malariae* (1%). The haematocrit of malaria infected pupils (33.3±3.55) was significantly different ($p < 0.05$) from those of non malaria infected subjects (35.9±3.28). Our study revealed that malaria is still a major public health problem and may be a contributory factor to morbidity, mortality, school absenteeism and poor academic performance of pupils in the study area.

Keywords: Pack cell volume; Primary School Pupils; *Plasmodium falciparum*; *Plasmodium malariae*.

INTRODUCTION

Malaria is a mosquito-borne infectious disease of humans caused by eukaryotic protist of the genus *Plasmodium*. The cause of malaria was discovered in 1880 by Charles Louis and Alphonse Laveran; while they were working in the military hospital in Constantine, Algeria, where they observed the parasite in a blood smear taken from a patient who has just died of malaria (Bruce-Chwuatte, 1981).

Five species of plasmodium have been reported to infect and be transmitted by humans. Malaria caused by *Plasmodium vivax*, *Plasmodium ovale curtisi*, *Plasmodium ovale wallikeri* and *Plasmodium malariae* are generally milder disease that is rarely fatal while the severe disease is largely caused by *Plasmodium falciparum* (Sutherland and Hallett., 2010). According to Singh *et al.* (2004), fifth specie, *plasmodium Knowlesi*, is a zoonotic that causes malaria in macaques but can also infect humans. While World malaria reports 2.23% of deaths worldwide, each year, there are more than 225 million cases of malaria (Philip, 2010), killing around 781,00 people each year according to the World Health Organization (2010). The majority of deaths are of young children in sub-Saharan Africa (Snow *et al.*, 2005).

In the last two decades, malaria epidemics have increased in frequency and intensity in most sub-sahara African populations due to the emergence of drug resistance (Bremen, 2001). In addition, ninety percent of malaria related death occurs in sub-Saharan Africa. Hence, malaria poses an enormous public health burden and >75% of the

global clinical episodes caused by *Plasmodium falciparum* each year are concentrated in Africa according to Snow *et al.* (2005).

The assertion that malaria is commonly associated with poverty and can indeed be a cause of poverty and a major hindrance to economic development necessitated this study. This present study therefore investigates the prevalence of malaria infection and its influence on haematocrit value among primary school pupils.

MATERIALS AND METHODS

Study Area: Ekpoma the study area is a town located in Esan West local Government Area, Edo State, Nigeria. Ekpoma is located 6.70°N and longitude 6.13°E having a population of about 61,870 people whose major occupations are farming, trading, civil servant jobs and students (World Gazetteer Nigeria, 2007). Some of the neighboring communities around Ekpoma Town are Uhiele, Emuhi, illeh and Ujemen. Some of the neighboring Towns include: Irukpen, Irrua, uromi and Ubijaja.

Study design: A cross-sectional systematic sample survey was undertaken at four primary schools in Ekpoma. Namely: Ujoelen Primary School, Ujoelen Ekpoma (49 pupils), Emiala Primary School, Uwen-obo, Ekpoma (70 pupils), Awolowo Primary School, Akahia, Ekpoma (50 pupils) and Ukpoke Primary School, Ukpoke, Ekpoma (31 pupils).

The research was designed to assess two urban and two rural public primary schools. It was also intended to cut across all age groups represented in the schools and both sexes. Sampling was carried out for malaria parasites on all apparently healthy subjects and the haematocrit of sampled subjects was determined. Apparently healthy subjects with peripheral blood malaria parasitaemia were considered to have asymptomatic malaria. Control subjects were apparently healthy subjects without parasites in their peripheral blood.

The routine diagnostic practices were assessed for all pupils during the research and research slides were obtained for later reading. Primary outcome measures were the use, interpretation and accuracy of routine microscope and malaria parasites density graded by the method recommended WHO (2010).

Inclusion criteria: Subjects were all apparently healthy primary school children between the ages of 7 and 14 years.

Exclusion criteria: No subject outside Ekpoma was used in this study and no subject was ill. Subjects below 7 years and those above 14 years were excluded.

Ethical consideration: Before the start of the study, ethical approval was obtained from Head of schools (Head Master or Head Mistress) and informed consent from guardians.

Study duration: This study was carried out from 21st November 2011 to 30th November 2011.

Sample collection: Capillary blood was collected via finger prick using a sterile lancet. The puncture area was warmed to allow blood flow, cleaned with cotton wool and moistened with methylated spirit and allowed to dry. A rapid puncture, sufficiently deep to allow free flow of blood was made, the first drop of blood was wiped off with a dry piece of cotton wool.

Heparinized capillary tube was filled to 2/3rd its length by capillary action and one end of the tube sealed using flame. Blood films (thick and thin) were stained by Giemsa and Leishman's technique respectively and examined for the presence of malaria parasites. Estimation of packed cell volume was done to screen for anaemia by haematocrit method.

Data analysis: The statistical package, SPSS version 2.2 was used for data analysis. Result of pupils positive for malaria parasitaemia and those not positive was compared and *p* values < 0.05 indicated statistical significance.

RESULTS

Of the 200 primary school pupils, 9 (4.5%; 7 males and 2 females), 54 (27%; 20 males and 34 females), 98 (49%; 58 males and 40 females) and 39 (19.5%; 20 males and 19 females) were within the age 7- 8 years, 9-10 years, 11-12 years and 13-14 years respectively. Overall, there were 105(52.5%) males and 95(47.5%) females in the total 200

pupils screened. Table 1 shows the prevalent distribution of malaria parasite among primary school pupils according to age group. Although the prevalence of malaria parasite in the study was 20.5%, pupils between the ages of 11-12 years had the highest prevalence of malaria parasite (11%) with those between the ages of 13-14 years having the least. However, the difference between the prevalence rates of malaria parasite infection among the different age groups was not significant (Chi square test).

Table 2 shows the various *Plasmodium* species present among the studied pupils. Of the 41 pupils with Plasmodium infection, 40 pupils were positive to *P. falciparum* and only one pupil was positive for *P. malariae*. The prevalence of malaria parasite by sex is as presented in table 3. Females (10.5%) had a higher prevalence of malaria compared to their male (10.0%) counterparts but the difference was not statistically significant (Chi square test).

Table 4 is a comparative table of the heamatocrit fraction volume of pupils infected with malaria parasite and those not infected. Pupils positive for malaria parasite have a lower mean PCV value compared to those who tested negative for malaria parasite. Furthermore, the difference between heamatocrit fraction volume of those positive to malaria parasite and those negative to malaria parasite was statistically significant (P-value=0.000018).

Table 1: Prevalence of malaria parasite in Primary School Children in relation to age

Age (years)	Frequency (%)	No. Infected (%)	No. not Infected (%)	Prevalence rate (%)	X ²	P-value
7-8	9 (4.5)	4 (44.4)	5 (55.5)	2.0		
9-10	54 (27.0)	12 (22.2)	42 (77.8)	6.0		
11-12	98 (49.0)	22 (22.4)	76 (77.6)	11.0		
13-14	39 (19.5)	8 (20.5)	31 (79.5)	1.5		
Total	200 (100)	41 (20.5)	159 (79.5)	20.5	4.605	0.10

Table 2: Prevalence of malaria parasite and different species encountered among Primary School Children in relation to age

Age (years)	Frequency (%)	No. Infected (%)	No. Positive for <i>P. falciparum</i> (%)	No. Positive for <i>P. malariae</i> (%)
7-8	9 (4.5)	4 (2.0)	4 (2.0)	0 (0.0)
9-10	54 (27)	12 (6.0)	12 (6.0)	0 (0.0)
11-12	98 (49)	22 (11.0)	21 (10.5)	1 (0.5)
13-14	39 (19.5)	3 (1.5)	3 (1.5)	0 (0.0)
Total	200 (100)	41 (20.5)	40 (20)	1 (0.5)
X ²			7.345	1.046
P-value			0.06	0.79
X ² _{tab}			6.251	1.005
			(Not significant)	(Not significant)

Table 3: Prevalence of malaria parasite in 200 Primary School Children in relation to sex in the study

Sex	Frequency (%)	No. Infected (%)	No. not Infected (%)	Prevalence rate (%)	X ²	P-value
Male	105 (52.5)	20 (10.0)	85 (42.5)	19.0		
Female	95 (47.5)	21 (10.5)	74 (37.0)	22.1		
Total	200 (100.0)	41 (20.5)	159 (79.5)	20.5	0.286	0.70 (Not significant)

Table 4: Comparative Haematocrit of primary school pupils infected with malaria parasite

PCV	Mean ± SD PCV (Infected)	Mean ± SD PCV (not Infected)	T-cal	P-value
PCV	33.3 ± 3.55	35.9±3.28	- 4.39	0.00008 (Sig.)

DISCUSSION

The high prevalence of asymptomatic malaria (20.5%) recorded in this study confirms previous reports that malaria is hyperendemic in Nigeria. However, the prevalence reported in this study is lower compared to previous work done in Osogbo, Osun State, Nigeria where a prevalence of 30% was reported (Ojurongbe *et al.*, 2007). Also, the mean values observed are lower compared to asymptomatic values found in a longitudinal survey of malaria infection in individuals living in other highly malarious endemic region of Papua New (Bruce *et al.*, 2000; Cox *et al.*, 1994). It was previously observed that the majority of malaria infections in individuals living in endemic regions are asymptomatic with the young bearing the highest burden for most of the time (Greenwood, 1987; Greenwood *et al.*, 1987). This fact that malaria infections in endemic region are asymptomatic by previous study is in line with the present findings as apparently health pupils were involved in this study.

The decline of *Plasmodium falciparum* parasite density with age observed in this study is characteristic of both symptomatic and asymptomatic infection in endemic regions as previously reported by Bruce *et al.* (2000), Smith *et al.* (1995) and Rogier *et al.* (1996). Similarly, the decline of *Plasmodium falciparum* parasite density with age has been reported to be due to immunity development observed above 5 years of age sufficient to suppress severe pathogenesis as stated by Baird (1998) and Bruce-Chwatt (1952).

Furthermore, the present study showed that malaria parasite exacerbates anaemia giving a significant result when compared to pupil negative to malaria parasite. Similar finding has previously been reported by Van den Broek and Letsky (2000). In line with this finding, young children from rural areas have been reported to be principal victims of malaria (Nkwo-Akenji *et al.*, 2006) and anaemia (Ekvalli *et al.*, 2001).

Conclusively, our study revealed that malaria is still a major public health problem in the study area and has remained a major contributory factor to morbidity and mortality among children in the study area which also lead to reduction in the packed cell volume. Therefore primary school pupils should go for regular checkup for the presence of malaria parasite so that appropriate measures can be taken to prevent the complications of malaria in childhood.

ACKNOWLEDGEMENT

The authors are grateful to the head teachers and teachers of the four primary Schools used for this study and the staff of Medical Diagnostic Laboratory, College of Medicine, Ambrose Alli University, Ekpoma.

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AUTHOR(S) CONTRIBUTION

Oseghale, F.O. and Omolumen, L.E.S. were involved in pupil mobilization, recruitment and sample collection with supervision from Dr. Okogun, G.R.A. and assistance from Mr. Akhile, A.; who also performed the sample analysis. All authors were involved in the development of this article from the very beginning to the point of acceptance.