Asymptomatic *Plasmodium* Parasitaemia in Ilorin, North Central Nigeria

[1]Udeze AO, [1]Nwokocha EJ, [2]Okerentugba PO, [1]Anibijuwon II, [2]Okonko IO

[1]Department of Microbiology, University of Ilorin, P.M.B. 1515 Ilorin-Nigeria
[2]Medical Microbiology Unit, Department of Microbiology, University of Port Harcourt, P.M.B, 5323 Choba, East-West Road, Port Harcourt, Rivers State, Nigeria
*Corresponding author: austok90@yahoo.com, udeze.ao@unilorin.edu.ng, Phone: +234(81)35586003

ABSTRACT: This study was carried out to determine the prevalence of malaria parasites infection among apparently healthy students of the University of Ilorin, Ilorin-Nigeria. A total of 200 students {98 (49.0%) males and 102 (51.0%) females; age range: 16-30 years} were recruited for the study after informed consent. Both thick and thin films were made and stained using parasitological standard procedures after collection of blood samples from the students. Analysis of the result showed that 100 (50.0%) of the subjects had malaria parasitaemia. Highest prevalence (56.9%) was recorded among the females than the males (42.9%). Age distribution showed 48.8% among subjects of age range 15-20 years, 48.3% among subjects of age range 21-25 years and 40.0% among subjects of age range 26-30 years. The result also showed that 84.0% of the infection occurred among subjects with haemoglobin genotype AA while 16.0% of the infection occurred among subjects with haemoglobin genotype AS. Frequency distribution of the Plasmodium species showed that *Plasmodium falciparum* has the highest occurrence (75.0%). This is followed by *Plasmodium malariae* with a frequency of 13.0% and *Plasmodium ovale* with a frequency of 8.0% while *Plasmodium vivax* has the least occurrence of 4.0%. This finding has further confirmed the endemicity of this infection among students population. Control measures to stop the spread are therefore advocated.
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1. INTRODUCTION

Malaria remains a global health problem despite all efforts aimed at eradicating it. The disease remains a major public health problem in Nigeria where it is endemic especially in rural populations, as is the case elsewhere in Africa (Klinkenberg *et al.,* 2005). In Nigeria, malaria results in 25% infant and 30% childhood mortality (FMH, 2005a). More than 90% of the total population is at risk of malaria and at least 50% of population suffers from at least one episode of malaria each year (RBM, 2005; FMH, 2005b). The parasites are known to show resistance to common first line anti malarial drugs, in various part of the country (Falade *et al*., 1997). The disease affects about 500 million people and kills about 2 million, mostly children, each year (WHO, 2000). The burden of this disease falls heaviest among children below the age of five in sub- Saharan Africa.

Human malaria is commonly caused by four species of plasmodium, a unicellular protozoan. It includes species of *P. falciparum, P. vivax, P. malariae, and P. ovale.* All of these have different manifestations with *P. falciparum* having been described as the most dangerous (Snow *et al*., 2003). *Plasmodium knowlesi* is one of the five malaria species known to cause human malaria (Cox-Singh and Singh, 2008).

Transmission is principally by bite of an infected female Anopheles mosquito and rarely by direct inoculation of injected red blood cells through blood transfusion, congenital transfer or sharing of needles. Among the predisposing factors of transmission are stagnant water, overcrowding and improper sanitation (Atif *et al.,* 2009). Host immunity and types of haemoglobin (Hb) genotype have been found to be crucial to the rate of parasite invasion, multiplication, and destruction as well as outcome of the disease (Pasvol and Weatherall, 1980). However, the relationship between Hb genotype and level of protection conferred against severe forms of malaria remains unclear. Children with heterozygous sickle cell traits have been reported to have lower parasite rates and less fatal infections as compared to children with HbAA (Okam, 2002). On the other hand, some other researchers have reported that children with sickle cell disease are not immuned to cerebral malaria (Konotey-Ahulu, 2001; Jones, 2008). The seasonal incidence of malaria infection depends on the feeding and resting habits of female Anopheles mosquitoes, its infectivity, climatic factors and the presence of susceptible human population and transmission.

In Nigeria, works have been carried out to determine the prevalence and distribution of the parasite in different subpopulations (Anosike *et al*.,

2004; Eke *et al*., 2006; Adefioye *et al*., 2007; Epidi *et al*., 2008; Ibekwe *et al*., 2009; Ilozumba and Uzozie, 2009; Okonko *et al*., 2009). However, continuous study is required in order to keep track of the ever dynamic nature of the infection. This study was carried out to determine the distribution of the different species of Plasmodium parasites among the students of the University of Ilorin, Ilorin Nigeria.

2. MATERIALS AND METHOD

2.1. Study population

A total of 200 {98 (49.0%) males and 102 (51.0%) females} asymptomatic students of the University of Ilorin who gave their consent after thorough explanation of the purpose of the study were recruited for the study. The age range of the students was from 16 to 30 years.

2.2. Collection of Samples

The method of sample collection employed was venepuncture technique (Carmel *et al*., 1993; Ibhanesebhor *et al*. 1996; Okocha *et al*. 2005). Soft tubing tourniquet was fastened to the upper arm of the patient to enable the index finger feel a suitable vein. The puncture site was then cleansed with methylated spirit (methanol) and venepuncture made with the aid of a 21g needle attached to a 5 ml syringe. When sufficient blood had been collected, the tourniquet was released and the needle removed immediately while the blood was transferred into an EDTA bottle. Biodata of the students were collected from students' clinical records which include; gender, age and genotype.

2.3. Examination of Blood for Malaria Parasites

Microscopy is the main tool for laboratory diagnosis of malaria (WHO, 1992). 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 and 100% Leishman solution for the thin film for the identification and speciation of the parasite respectively. The ring forms of the merozoites were identified and counted in 100 filed using x 100 objective lens. The count was done per 200 leucocytes, assuming a leucocyte number of $600mm^{-3}$.

3. RESULTS

This analysis showed that 200 subjects were recruited out of which 98 were males and 102 were females. Prevalence of *Plasmodium* parasitaemia among these subjects was 50%. Presence of ring forms of *Plasmodium* and Trophozoites of *Plasmodium* indicated positive results. Gender distribution showed a higher prevalence (56.9%) of *Plasmodium* parasitaemia among the female subjects and 42.9% *Plasmodium* parasitaemia among the male subjects as shown in Table 1.

Table 1: Gender distribution of *Plasmodium* infections

Gender	No. tested (%)	No. positive (%)
Males	98 (49.0)	42 (42.9)
Females	102(51.0)	58 (56.9)
Total	**200(100.0)**	**100 (50.0)**

Figure 1 shows frequency and distribution of *Plasmodium* parasitaemia in relation to age. The results showed that age group 15-20 years has the highest prevalence (48.8%) followed by age group 21-25 years with prevalence of 48.3% while the least prevalence (40.0%) was observed in age group 26-30 years.

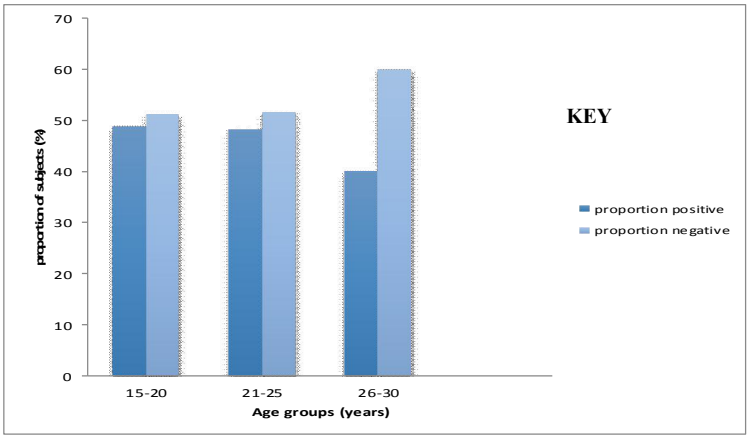

Figure 1: Frequency and distribution of *Plasmodium* parasitaemia in relation to age.

The results also showed highest prevalence (84.0%) of *Plasmodium* parasitaemia among subjects of HbAA genotype followed by subjects of HbAS genotype with prevalence of 16.0%. None of the subjects had HbSS or HbSC genotype (Table 2).

Table 2: Frequency distribution of *Plasmodium* species among subjects of different Haemoglobin genotypes

Genotype	% Distribution				Total (%)
	P. falciparum	*P. vivax*	*P. malariae*	*P. ovale*	
HbAA	68	3	8	5	84
HbAS	7	1	5	3	16
HbSS	0	0	0	0	0
HbSC	0	0	0	0	0
Total	**75**	**4**	**13**	**8**	**100**

Analysis of the results also showed highest frequency of *Plasmodium falciparum* (75.0%) among the subjects indicating that the bulk of the infection is as a result of this parasite. This is followed by *Plasmodium malariae* with frequency of 13.0%, while the least frequency (4.0%) was observed for *Plasmodium vivax* as shown in Figure 2.

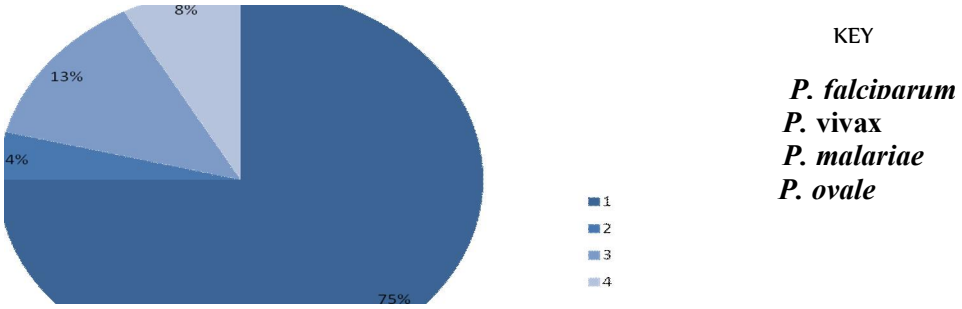

Figure 2: Frequency distribution of different *Plasmodium species* in the study population

4. DISCUSSION

Despite advances in the understanding of the pathogenic and clinical aspects of malaria, it is not well known why some people tolerate malaria infection with few or no symptoms whereas others are severely affected (Azeez and Raji, 2007). In this study, 50.0% of the 200 students of the University of Ilorin who were tested had *Plasmodium* parasitaemia yet they are asymptomatic. The result also shows a higher prevalence (56.9%) among the female students than the male students with prevalence of 42.9%. This finding is similar to Epidi *et al.* (2008) who reported a total prevalence of 51.5% among blood donors in Abakiliki, Southeastern Nigeria. Earlier, Eke *et al.* (2006) reported a slightly lower prevalence of 45.1% in a suburb of Aba Town, also in Nigeria. In a similar study conducted among first year students of Nnamdi Azikiwe University, Awka, Southeastern Nigeria, a prevalence of 80.0% was reported (Ibekwe *et al.*, 2009). These findings further confirm the endemicity of this infection even among the students' population.

The higher prevalence (56.9%) observed for the females in this study is in agreement with findings of researchers who have observed a similar trend (Ibekwe *et al.*, 2009; Okonko *et al.*, 2009). Other investigators however, have found higher prevalence among the males than the females (Eke *et al.*, 2006; Epidi *et al.*, 2008; Ilozumba and Uzozie, 2009). However, there appears to be no scientific evidence linking malaria prevalence to gender.

Generally, our finding showed that the highest prevalence of malaria was in age group 15-20 years, followed by age group 21-25years while the least prevalence was among age group 26-30 years. This result agrees with the finding of Munyekenye *et al.* (2005) that parasite density falls as age increases suggesting age-dependent immunity to Plasmodium among adults.

The result also shows that 84.0% of the *Plasmodium* parasitaemia occurred among students

with haemoglobin genotype AA while 16.0% of the parasitaemia occurred among students with haemoglobin genotype AS. This result is in consonance with earlier finding by Akhigbe *et al*. (2011).

Analysis of the result also showed that *Plasmodium falciparum* has a prevalence of 75.0% thereby accounting for the bulk of the infection. The finding is consistent with report by other investigators in other locations and populations in Nigeria (Ahmed *et al*., 2001; Ibekwe *et al*., 2009; Ilozumba and Uzozie, 2009; Nebe *et al*., 2002). *Plasmodium malariae* is the second most prevalent species in our study population with a prevalence of 13.0%. This species was reported as the second most prevalent by Ibekwe *et al*. (2009) and third most prevalent by Ilozumba and Uzozie (2011). *Plasmodium ovale* is the third most prevalent in this study with a prevalence of 8.0% while the least prevalence (4.0%) was observed for *Plasmodium vivax*.

Immunity/tolerance to malaria parasitaemia does not occur naturally, but only in response to repeated infections with multiple strains of malaria, especially among adults in areas of moderate or intense transmission conditions (Farnert *et al.,* 2009; WHO, 2010). Detection of the parasite in asymptomatic subjects could be as a result of acquired immunity in the subjects due to repeated exposure to mosquito bites. The subjects included in this study are students who are undergoing medical screening at the University health center most of who must have come from rural areas of the country where the infection is highly endemic. Although levels of transmission in urban area may be lower than in contiguous rural areas, high population densities and possible lower immunity may result in more disease impact in urban setting (Klinkenberg *et al*., 2005). Therefore mixture of these subjects with the relatively unprotected people of Ilorin metropolis (urban area) could lead to more disease impact if the chain of transmission is not broken.

Vector control (reducing mosquito breeding grounds by spraying or destruction of habitat), use of insecticide-treated nets (ITN), indoor residual spraying, and targeted chemoprophylaxis for those most at high risk, e.g. pregnant women and travelers are therefore advocated.

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