PREVALENCE OF *PLASMODIUM FALCIPARUM MALARIA* AMONG PATIENTS ATTENDING UNIVERSITY OF ILORIN TEACHING HOSPITAL, ILORIN, NIGERIA

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ABSTRACT

This study reports malaria infection caused by the parasite Plasmodium falciparum in University of Ilorin Teaching Hospital (UITH), Ilorin, Kwara State, Nigeria. This study provides information on the infectivity rate of this parasite in dry season and the variation of laboratory diagnosed cases of malaria to clinically diagnosed cases. A total of 200 patients attending University of Ilorin Teaching Hospital (UITH) clinically diagnosed to have malaria were recruited into the study. Their blood samples were collected and analyzed microscopically for the presence of the parasite. Questionnaires were collated to obtain demographic and associated risk factors of the people to the infection. The study showed that microscopy stills remain a golden method for analyzing malaria infections in relation to the clinical methods; it also showed that malaria parasitaemia is low at dry season. 116(58.0%) were positive and 84(42.0%) negative of the subjects to the infection. The level of parasitaemia varied between 200 parasites/µl to 800 parasites/µl. 74.1% had lower parasitaemia of ≤ 500µl while 25.9% had a mild parasitaemia of 500µl. It is suggested that all clinically diagnosed cases of malaria should be followed up by microscopy test to ascertain the presence of the parasite before drug prescriptions are made so as to avoid drug misuse.

Keywords: *Plasmodium falciparum,* Clinical symptoms, Laboratory diagnosis, Malaria Infection, Malaria parasitaemia

INTRODUCTION

Malaria is an infectious disease caused by female *Anopheles* mosquitoes. Of the over 400 *Anopheles* species, only 30 – 40 can transmit malaria with *Anopheles gambiae* being the principal vector (Mbogo *et al.,* 2003). *Anopheles gambiae* transmits malaria to man through the malarial parasite – *Plasmodium.* There are so many species of this genus but four species are highly recognized as pathogens of humans, namely; *Plasmodium falciparum*, *P. vivax*, *P. ovale* and *P. malariae*. Of the four common species that cause malaria, the most serious type is *P. falciparum* malaria; it is life-threatening (Hay *et al.,* 2004). The other three common species of malaria (*P. vivax, P. malariae* and *P. ovale*) are generally less serious and are usually not life-threatening. A wide and unexplained spectrum of clinical disease caused by the malaria parasite *P. falciparum* is responsible for approximately one million deaths each year, mostly in African children in highly endemic populations but also in adults in areas of lower endemicity (Rowe *et al.,* 2006).

Malaria is a major health threatening disease, which results in approximately 200 – 300 million clinical cases and 1 – 3 million deaths each year worldwide. Malaria transmission is intense and stable in Nigeria with associated economic losses estimated to be about 132 billion Naira. In Nigeria and rest of endemic Africa, the bulk of malaria episodes are attributable to *P. falciparum.* With an estimated 28 million cases and 38 000 deaths in 2011, malaria remains a significant public health problem in Sub-Saharan Africa. The parasite destroys the red blood cells, leading to the clinical signs and symptoms such as fever, flu-like, chills, headache, muscle aches, tiredness, nausea, vomiting, diarrhea, and anemia and jaundice due to loss of red blood cells unless treated quickly the disease can kill within 24 hours: children under the age of five are particularly at risk (Wells *et al.,* 2009). Methods used in order to prevent the spread of disease, or to protect individuals in areas where malaria is endemic, include prophylactic drugs, mosquito eradication and the prevention of mosquito bites. The continued existence of malaria in an area requires a combination of high human population density, high mosquito population density and high rates of transmission from humans to mosquitoes and from mosquitoes to humans. If any of these is lowered sufficiently, the parasite will sooner or later disappear from the country, as in North America, Europe and much of the Middle East. Many countries are seeing an increasing number of imported malaria cases owing to extensive travel and migration. The mainstay of malaria diagnosis has been the microscopic examination of blood, utilizing blood films (Krafits *et al.,* 2011). Although blood is the sample most frequently used to make a diagnosis, both saliva and urine have been investigated as alternative and less invasive specimens (Sutherland and Hallett, 2009). Areas that cannot afford laboratory diagnostic tests often use subjective history of fever as the indication of malaria but this is not reliable. There is need for cautious diagnosing and treating as patients with fever without the presence of a headache may have dengue and not malaria (Cunha, 2011). Nigeria is yet to eradicate malaria because of low awareness of the magnitude of malaria problem, antimalarial drug abuse and lack of interest on the part of our government to provide good social amenities, e.g. good drainage system, insecticide treated nets (ITNs), and provision of affordable insecticides among many others. This particular study reports the prevalence of malaria infection and associated risk factors among people infected with the parasite in Ilorin metropolis, Nigeria.

MATERIALS AND METHODS

Study Design: This study was a cross sectional descriptive study involving subjects (children and adults) diagnosed with uncomplicated malaria. This study was conducted at the General Outpatient Department (GOPD) of the University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria.

Ethics: This study obtained an ethical clearance from the Ethical Review Committee (ERC) of the University of Ilorin Teaching Hospital after it has met all the necessary requirement of the committee. In addition, oral and written informed consents were obtained from individual parents/guardian after a clear explanation of the objectives, logistics and potential benefits of the study.

Sampling: The patients were recruited based on the clinical manifestation of febrile (high fever), headache, chills and other symptoms of malaria, but were still confirmed for the presence of *Plasmodium* by microscopic method. Sample collection was carried out between the periods of October 2011 to March 2012. 1ml of the blood sample of each patient was collected intravenously using sterile syringe after carefully swabbing the surface with cotton wool soaked in absolute ethanol. Standard laboratory protocols to ensure safety of both patients and health worker were ensured. The blood sample was dispensed into anticoagulant bottle and used for testing for the presence of the parasite and its characterization using microscopic method on thin film and for classifying the degree of parasitaemia using thick film (WHO, 2010).

Parasite: The thin and thick smears were made from the blood samples. Giemsa stain (strength 1:10) was used to flood both the thin and thick film for 30 minutes, after fixing the thin smear with methanol. The slides were washed off using clean water and read under Olympus microscope using oil immersion technique (x100). Parasite density was determined using the formula: Number of parasites / 200 x white blood cell counts x 8000. The 8000 is the average number of the WBCs per micro liter of the blood.

Parasitaemia: The malaria parasite density was graded as follows; (i) ≤ 500 parasites/µl of blood = low density, (ii) 500 - 5,000 parasites/µl of blood = medium density and (iii) > 5000 parasites/µl of blood = high density (Wendy *et al.,* 2005).

Genotype and blood group: Information on the genotype and blood group of falciparum malaria patients attending University of Ilorin Teaching Hospital were collected using a closed ended structured questionnaires.

Data Analysis: Descriptive statistics and percentage were used for data analyzed. Continuous and discrete variables were generated from the data. The relationship between discrete and continuous variables and outcome of interest was tested using the Chi-squared test. All statistical analyses were done using Statistical Package for Social Sciences (SPSS) version 16.1.

RESULTS

Out of the 200 blood sampled using microscopic method, 116(58.0%) were positive and 84(42.0%) negative for *Plasmodium.* The level of parasitaemia varied between 200 parasites/µl to 800 parasites/µl. Out of the 116 positive cases, 74.1% had lower parasitaemia of ≤ 500, while 25.9% had a mild parasitaemia of >500.

Prevalence of malaria in relation to age: The prevalence of malaria parasite frequency and parasite density by age among the subjects indicated that out of the 22(11.0%) infants, 9.0% were infected with parasite density of 463.33 ± 79.01, while 16(8.0%) of children with ages between 6 – 12 years were infected with the highest parasite density of 493.75 ± 143.61. The adults of 36 years and above had the highest prevalence (20.0%), but with the lowest parasite density (439.17 ± 106.47). The adolescents with ages between 21 – 35 years recorded 36(18.0%) positive cases with parasite density of 468.89 ± 122.31 (p = 0.018) (Table 1).

Prevalence of malaria in relation to sex: The distribution of the parasite found in 117(58.5%) positive subjects showed that 55(27.5%) of the male tested positive with a parasite density of 446.55 ± 110.70, the females recorded the highest prevalence of 62(31.0%) with parasite density of 467.62 ± 117.63, but this was not significantly different (p = 0.908) (Table 2).

Prevalence of malaria in relation to genotype and blood group: The patients who did not know their genotype had the highest prevalence rate of 57.5%, followed by AA genotype with prevalence rate of 37.0% and also having the highest parasite density of 468.30 ± 124.34, AS or AC had 2.5% positive cases while genotype SS or SC was just 1.0% and with the lowest parasite density of 400.00 ± 0.000. This result was significant (p = 0.000) (Figure 1).

The frequency and distribution of falciparum malaria parasite among patients by blood group revealed that most of the patients 126(63.0%) don't know their blood group. Among those that knew their blood groups; blood group O had the highest prevalence of 11.5% with parasite density of 467.83 ± 116.58. The least prevalence of 2.0% was recorded among blood group AB with the least parasite density of 426.67 ± 46.19. Blood group B has the highest parasite density of 514.28 ± 141.29. This result was not significant (p = 0.827) (Figure 2).

Prevalence of malaria in relation to socio-economic status: The highest prevalence of 47.5% was recorded among those with western

Table 1: Prevalence of malaria infection and parasite density by age goups of patients receiving treatment at University of Ilorin Teaching Hospital, Ilorin, Nigeria

Age	Number tested (%)	Number positive (%)	Number negative (%)	Parasite Density (parasite/µl of blood)
Infants <6 years	22(11.0)	18(9.0)	4(2.0)	463.33 ± 79.01
Children 6 – 12 years	22(11.0)	16(8.0)	6(3.0)	493.75 ± 143.61
Teenagers 13 – 20 years	11(5.5)	6(3.0)	5(2.5)	433.33 ± 102.50
Adolescent 21 – 35 years	60(30.0)	36(18.0)	24(12.0)	468.89 ± 122.31
Adults 36 years and above	85(42.5)	40(20.0)	45(22.5)	439.17 ± 106.47
Total	200	116(58)	84(42)	457.80 ± 114.45

$\chi 2$ = 11.865, df= 4, p=0.018, p<0.05 is significant, p>0.05 is not significant

Table 2: Frequency and distribution of malaria infection and parasite density by sex groups of patients receiving treatment at University of Ilorin Teaching Hospital, Ilorin, Nigeria

Sex	Number tested (%)	Number positive (%)	Number negative (%)	Parasite Density (parasite/µl of blood)
Male	93(46.5)	55(27.5)	38(19.0)	446.55 ± 110.69
Female	107(53.5)	62(31.0)	45(22.5)	467.62 ± 117.63
Total	200	117(58.5)	83(41.5)	457.80 ± 114.45

$\chi 2$ = 0.13, df= 1, p=0.908, p<0.05 is significant, p>0.05 is not significant

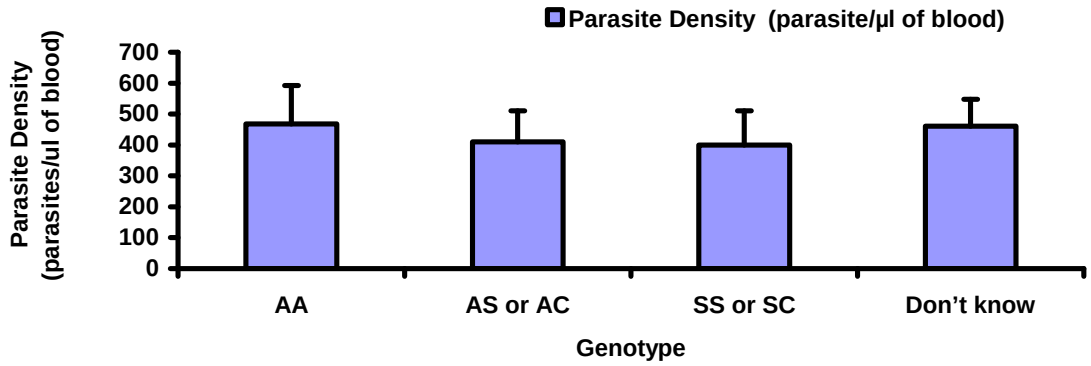

Figure 1: Genotype and parasite density distribution among *Plasmodium falciparum* malaria patients receiving treatment at University of Ilorin Teaching Hospital, Ilorin, Nigeria

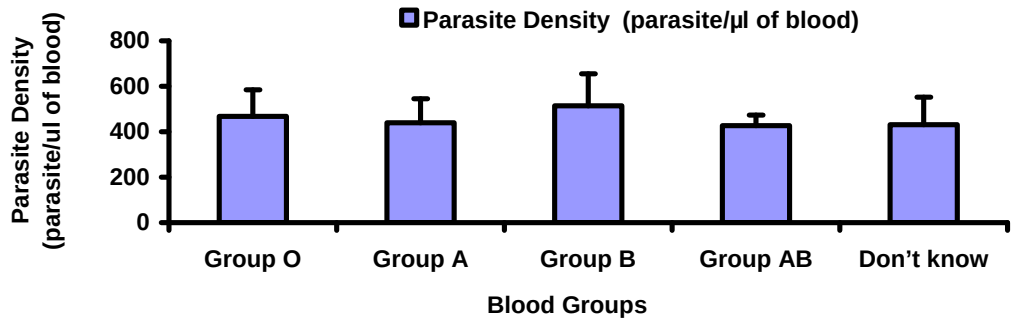

Figure 2: Blood groups and parasite density distribution among *Plasmodium falciparum* malaria patients receiving treatment at University of Ilorin Teaching Hospital, Ilorin, Nigeria

education with parasite density of 459.58 ± 118.03, but the highest parasite density of 471.11 ± 116.24 was recorded among those with Quaranic education, they also have the least prevalence of 4.5%. There was significant difference in prevelence of malaria among

patients belonging to the varoius educational groups (p = 0.045) (Table 3).

The junior staffs/petty traders had the highest prevalence of 19.7% with parasite density of 446.67 ± 119.80, followed by artisans 15.4%. Middle class and small scale business men and women had the lowest prevalence of 9.4% but with the highest parasite density of 480.00 ± 119.80. The top civil servants and executives of companies had a prevalence rate of 10.25% and parasite density of 447.27 ± 106.47. There was significant difference (p = 0.000) in malaria prevelence among patients belonging to the various occupational groups (Figure 3).

DISCUSSION

Malaria is a very dangerous infection especially with *P. falciparum* which is more in this part of the country and have to be treated properly. This requires proper diagnosis of malaria before drug prescription. This is necessary so as to avoid any form of resistance that might arise from drug overuse or improper prescriptions. This study on the serological diagnosis of malaria among 200 clinically diagnosed malaria cases at the University of Ilorin Teaching Hospital was carried out to know if there is any need of diagnosing the infection based on laboratory test or that clinical diagnosis is sufficient, this was proven to be wrong. This may also suggest that there have been a lot of wrong and over diagnoses of malaria infection either by professionals in the field or individuals, and must be stopped.

The highest prevalence of *Plasmodium* positive blood samples occurred among the 36 years and above, while the least prevalence was in the age group of 13 – 20 years (teenagers), this could be as a result of impaired immune system which occurs with age. The teenagers also recorded the highest parasite density; this also could be as a result of low immune system, low exposure to the disease and long time frame taken for their immunity to build up. This result was in line with the study carried out by Montoya *et al.* (1994) which showed that the prevalence of malaria was highest among children as compared with older age.

The females recorded the highest prevalence and also the highest mean parasite density when compared to the males. The high prevalence of the female could be that they were the dominant sex in the study. This is in support of the study carried out by Montoya *et al.* (1994) and Okonko *et al.* (2009) where the prevalence was not significantly higher in females than in males, but contrary to the work done by Gupta and Chowdhuri (1980) which showed significantly higher malarial parasite prevalence in females than in males. Furthermore, the study carried out by Tin-Oo (2001) provided an evidence of not significant sex difference in malaria incidence in Laputta, Myanmar.

Prevalence of parasitaemia by genotype of the patients showed that those having genotype AA had the highest number of *Plasmodium* positive cases and also highest parasite density than AS, AC, SS and SC. Salimonu (2003) reported that genotype AA subjects were more prone to malaria infection than the other genotypes. Genotype AA is the most prevalent genotype in this part of the world and also more prone to malaria infection than other genotypes because of the absence of any sickle cell molecules in the blood. It has been recorded by Friedman (1978) that the lowering of oxygen which causes sickling shape in the blood of SS and AS people reduces the parasite growth and can cause the parasites to die, but this is not so with the AA genotype.

Malaria parasite prevalence by the blood group indicated high incidence among blood group O, while blood group AB recorded the lowest prevalence. Blood group O being the universal donor and most common in the study area. Bayoumi *et al.* (1986) reported the susceptibility of blood group O to malarial parasite in central Sudan, while Akinboye *et al.* (2009) had similar findings in western Nigeria. This is in contrast with that of Osisanya (2003), who reported that ABO blood groups had significant relationship with malaria susceptibility.

In relation to their education, those that had western education had the highest prevalence, while the least prevalence was recorded among those with Quaranic education.

Table 3: Prevalence of malaria infection and parasite density by type of education of patients receiving treatment at University of Ilorin Teaching Hospital, Ilorin, Nigeria

Type of Education	Number tested (%)	Number positive (%)	Number Negative (%)	Parasite Density (parasite/µl of blood)
Western Education	159(79.5)	95(47.5)	64(32.0)	459.58 ± 118.03
Quaranic Education	15(7.5)	9(4.5)	6(3.0)	471.11 ± 116.24
No Formal Education	26(13.0)	12(6.0)	14(7.0)	450.00 ± 92.05
Total	200	116(58.0)	84(42.0)	459.48 ± 114.71

χ2 = 485, df= 2, p=0.785, p<0.05 is significant, p>0.05 is not significant

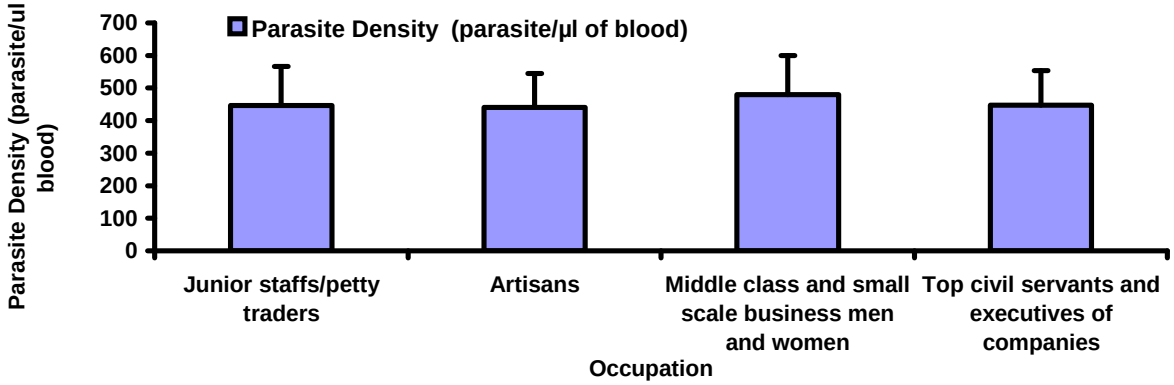

Figure 3: Occupation in relation to parasite density of *Plasmodium falciparum* malaria patients receiving treatment at University of Ilorin Teaching Hospital, Ilorin, Nigeria

This could be due to the fact that the type or level of education does not confer resistance to malaria infections but only provides the educated mind with preventive measures. This was in contrast to the findings of Kolawole *et al.* (2006) which reported highest cases of malaria among those with no formal education, closely followed by secondary school leavers and the lowest was seen among the graduates. A study by Yared *et al.* (2007) revealed that respondents from College/University were twice as likely to identify mosquito bites as a mode of malaria transmission when compared to those with no formal education.

The prevalence among the patients based on their occupation recorded that the junior staffs and petty traders had the highest prevalence of malaria followed by the artisans, the middle class civil servants and small scale business men and the women followed by top civil servants and executives of companies had the lowest prevalence of malaria. This result indicated that those with better wages take adequate preventive measures against malaria infection. This results was similar to the work of (CHESTRAD, 2011), which reported that in Nigeria heavier malaria burden occurred in the poor than in the rich. However, this was in contrast to the report of Biritwum *et al.* (2000) which recorded no significant difference from the poorer and richer community, though incidence of ill health was higher among the poor than the rich.

Conclusion: This strengthens the need to have proper diagnosis of malaria before drug administration, in order to avoid any chance of drug resistance, because not all the cases of clinically diagnosed malaria were positive microscopically. It also helps people to better understand the predisposing factors to malaria infection and what can be done to be protected. Microscopy still remains a good method of diagnosing malaria when done by trained microscopists.

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