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Incidence of Malaria Parasite in Blood Donors at Kwali General Hospital, FCT Abuja

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Abstract

Malaria, although preventable and curable, is still one of the most potent killer diseases known to mankind. The disease has successfully been eradicated in some advanced countries, but the disease is still very well around in the developing countries, most especially in the tropical African countries where the climatic conditions favour the development of the vector. Nigeria is endemic for the disease. This research was conducted to determine the incidence of malaria parasite in donated blood at Kwali General Hospital, Abuja. Blood film examination for malaria parasites was carried out for 250 blood donors of which 140 (56%) tested positive to malaria parasite. Information was gotten from respondents on their sex, age and social status. The sample collections span from rainy to dry season between August, 2012 to July, 2013. The sex distribution of the infection, which was not statistically significant in the research showed a higher incidence of malaria infection for males with an incidence of 53.66%. The age of the donors examined ranged between 21 and 65 years. The donors that were between the ages 31- 40 years had the highest incidence of malaria infection with an incidence of 90.59%. The respondents at the lower class for social status had the highest incidence of 83.33%, out of the three social status classes, and a season distribution with a higher incidence of 81.93% at the rainy season. Based on the result of this research, it is recommended that in a bid to save lives, there is the need for blood banks to include malaria parasite species screening as a routine test of blood from the donors.

Keywords: malaria, blood donors, parasitemia, blood films, infection

INTRODUCTION

The term malaria is used for infection caused by four species of protozoa of the genus plasmodium, which include *Plasmodium falciparium, Plasmodium vivax, Plasmodium malariae, Plasmodium ovale* (Weatheral & Matin, 1984), and the fifth, *Plasmodium Knowlesi* (Fong, *et al*., 1971), each with its own morphology and clinical characteristics. Amongst the five Plasmodium genuses, *Plasmodium falciparium* causes more mortality and morbidity (Weatheral & Matin, 1984). The parasite is transmitted from man to man in nature by the bites of certain anopheles mosquito in which they pass essential part of their life cycle. Although blood transfusion is generally believed to save human lives, blood can nonetheless be a dreadful vehicle for the transmission of some infectious and parasitic diseases including malaria fever. For a mosquito to transmit malaria it must be specie that allows complete development of malaria parasite, it must bite a man at least two times and must have lived long enough for sporozoites to have reached its salivary gland before the final bite (Fedoric & Noniod, 1978).

Malaria is one of the most successful parasites ever known to mankind. After thousands of years, it remains the world's most pervasive infection, affecting at least 91 different countries and some 300 million people (W.H.O, 1991). The disease causes fever, shivering, joint pain, headache, and vomiting. In severe cases, patients can have jaundice, kidney failure, and anemia, retinal damage and convulsion (Beare, *et al*., 2006).

It is ever-present in the tropics and countries in sub-Saharan Africa, which account for nearly 90 percent of all malaria cases. The majority of the remaining cases are clustered in India, Brazil, Afghanistan, Sri Lanka, Thailand, Indonesia, Vietnam, Cambodia, and China. It is estimated that the population at risk is about 2.6 billion with 100 million clinical cases and causes about 1 to 1.5 million deaths each year, and in Africa, it accounts for 25 percent of all deaths of children under the age of five (David & Ann, 2002).

Diagnosis of malaria involves identification of malaria parasite or its antigens or products in the blood of the patient. Although this seems simple, the efficacy of the diagnosis is subject to many factors. The different forms of the four malaria species; the different stages of erythrocytic schizogony; the endemicity of different species; the population movements; the interrelation between the levels of transmission, immunity, parasitemia, and the

symptoms; the problems of recurrent malaria, drug resistance, persisting viable or non-viable parasitemia, and sequestration of the parasites in the deeper tissues; and the use of chemoprophylaxis or even presumptive treatment on the basis of clinical diagnosis can all have a bearing on the identification and interpretation of malaria parasitemia on a diagnostic test (Hanscheid & Grobusch, 2002). The diagnosis of malaria is confirmed by blood tests and can be divided into microscopic and non-microscopic tests (Moody & Chiodini, 2000).

For nearly a hundred years, the direct microscopic visualization of the parasite on the thick and/or thin blood smears has been the accepted method for the diagnosis of malaria in most settings, from the clinical laboratory to the field surveys. The careful examination of a well-prepared and well-stained blood film currently remains the "gold standard" for malaria diagnosis (Moody and Chiodini, 2000).

The microscopic tests involve staining and direct visualization of the parasite under the microscope. Light microscopy of thick and thin stained blood smears remains the standard method for diagnosing malaria. It involves collection of a blood smear and staining with Romanowsky stains like Giemsa or field stains and examination of the Red Blood Cells for intracellular malarial parasites (Cheesbrough, 2005). Thick smears are 20 times more sensitive than thin smears for screening of Plasmodium parasites, with a detection limit of 10-50 trophozoites. Thin smears allow one to identify malaria species (including the diagnosis of mixed infections), quantify parasitemia, and assess for the presence of schizonts, gametocytes, and malarial pigment in neutrophils and monocytes. The diagnostic accuracy relies on the quality of the blood smear and experience of laboratory personnel (Andrej *et al*., 2003).

The smear can be prepared from blood collected by venupuncture, finger prick and ear lobe stab. In obstetric practice, cord blood and placental impression smears can be used. In fatal cases, post-mortem smears of cerebral grey matter obtained by needle necropsy through the foramen magnum, superior orbital fissure, and ethmoid sinus via the nose or through fontanelle in young children can be used (Torres, 2003). Sometimes no parasites can be found in peripheral blood smears from patients with malaria, even in severe infections. This may be explained by partial antimalarial treatment or by sequestration of parasitized cells in deep vascular beds. In these cases, parasites, or malarial pigment may be found in the bone marrow aspirates. Presence of malarial pigment in circulating neutrophils and monocytes may also suggest the possibility of malaria (Andrej *et al*., 2003).

The non-microscopic tests involve identification of the parasitic antigen or the antiplasmodial antibodies or the parasitic metabolic products. Nucleic acid probes and immunofluorescence for the detection of Plasmodia within the erythrocytes; gel diffusion, counter-immunoelectrophoresis, radio immunoassay, and enzyme immunoassay for malaria antigens in the body fluids; and hemagglutination test, indirect immuno fluorescence, enzyme immunoassay, immunochromatography, and Western blotting for anti-plasmodial antibodies in the serum have all been developed. These tests have found some limited applications in research, retrograde confirmation of malaria, investigation of cryptic malaria, transfusion blood screening, and investigation of transfusion acquired infections (Andrej *et al*, 2003).

Rapid diagnostic tests detect species-specific circulating parasite antigens targeting either the histidine-rich protein-2 of *P. falciparum* or a parasite-specific lactate dehydrogenase. Although the dipstick tests may enhance diagnostic speed, microscopic examination remains mandatory in patients with suspected malaria, because occasionally these dipstick tests are negative in patients with high parasitemia, and their sensitivity below 100 parasites /ul is low. Tests based on polyrnerase chain reaction for species-specific Plasmodium genome are more sensitive and specific than are other tests, detecting as few as 10 parasites/ul blood. Antibody detection has no value in the diagnosis of acute malaria. It is mainly used for epidemiologic studies. Therefore, the simplest and surest test is the time-honored peripheral smear study for malarial parasites (Moody, 2002).

In Nigeria, malaria results in 25% infant and 30% childhood mortality. More than 90% of the total population is at risk of malaria and at least 50% of the population suffers from at least one episode of malaria each year (RBM, 2009), a reasonable proportion of the infection could be through blood transfusion.

Epidi *et al*. in 2008, worked on the prevalence of malaria in blood donors at Abakaliki Metropolis, Ebonyi State of Nigeria. The research was carried out for five months (February-June). 200 samples were examined with an overall prevalence of 51.5%, and were varied according to age, blood group, month but not sex because majority of the donors were males. Other similar studies carried out around the country include a study carried out in South East of Nigeria which showed a prevalence of 40.9% (Uneke, *et al*., 2007), while Erhabor *et al*., (2006) obtained 10.2 % in port Harcourt. Another report by Abdullahi *et al*., (2009), who obtained a malarial prevalence of 23.4% in Sokoto metropolis in their study carried out between the month of October to December.

Agboola *et al*. in 2010 also worked on Prevalence of malaria parasite among blood donors in Lagos University teaching hospital, Lagos Nigeria. Between May-July, 200 samples were examined with an overall prevalence of 28% with highest prevalence among male donors and blood group O.

Although it is not usual to screen donated blood for malaria parasite, it is of great importance that transmission of malaria through blood transfusion should not be neglected even in an important town as the FCT Abuja, as its population is growing rapidly, and medical cases requiring blood transfusion are expectedly to increased. In view of this, we investigated in this work the incidence of malaria parasite in the donated blood at Kwali General Hospital, Abuja, with a view to highlight the extent of parasitemia and make useful suggestions for control of the disease, malaria.

MATERIALS AND METHODS

Study Area

The research was carried out at the medical laboratory section of Kwali General Hospital (KGH) located off Abaji/Lokoja Road, Near Area Council Secretariat, and Kwali-Abuja. Kwali is a local Government Area of the Federal Capital Territory (FCT), which has an area of 1,206 km and a population of 85,837 at the 2006 census. Kwali has latitude of 852'7.992°N and a longitude of 70°18.8000°E.

Ethical Consideration

Permission was taken from the hospital authorities through the Laboratory Scientist in charge before the commencement of the research. Consent was also sought of the blood donors used for the study.

Specimen Collection

Blood samples were obtained from 250 individuals that came for blood donation at Kwali General Hospital. Information like age, sex and social status was collected from the blood donors. The date of sample collection was also recorded which covered from September 2012 to July 2013, and was categorized into the rainy and dry seasons. Blood samples were collected in EDTA bottles and transported to the laboratory and examined for malaria parasites.

Smear Preparation, Staining, and Microscopy

Thick smears were prepared and stained following the procedure described by Cheesbrough (2005). A drop of each blood sample was placed in the center of a grease-free clean glass slide and smeared to give a thick film. Slides were waved vigorously in the air to ensure blood films dry within the shortest possible time before staining. Giemsa stain (3%) was used to stain the blood films for 30 minutes and then rinsed with distilled water. The slides were kept vertical on the bench and allowed to dry at room temperature. When completely dried, the slides were viewed under the microscope using 100x objectives after the addition of a drop of immersion oil.

The search for the parasite was done by viewing the edges and the tails of the films, since the parasite cells tend to be found more along these sites (Cheesbrough, 2005). The process of searching was characterized by continuous adjustment of the stage of the microscope to get different fields of each slide. The different stages of the parasite searched for included the trophozoites, schizonts and gametocyte. A positive slide of malaria parasite showing the different stages of the parasite was used as a control to guide in the identification of the parasite. Film was considered positive (p+) when any of the erythrocytic stage was observed. Film was considered negative (p) when the erythrocytic stages were absent (Cheesbrough, 2005). Statistical analysis of the results was done using Chi square and SPSS software.

RESULTS

Out of a total of 250 samples examined, 140 (56%) were found to be positive of malaria parasite. Amongst the males (205 samples), 110 (53.66%) had malaria, while amongst the 45 female samples, 30 (66.67%) were infected with malaria.

Table 1: Incidence of malaria parasite in donated blood by Sex

SEX	No. POSITIVE (%)	No. NEGATIVE (%)	TOTAL
MALE	110 (53.66)	95 (46.34)	205
FEMALE	30 (66.67)	15 (33.33)	45
TOTAL	140 (56.0)	110 (44.0)	250

The calculated value is 2.53 while that of the tabulated value is x = 0.00393at 95% level of significance, (2.53 > 0.00393). This means that sex is not significant in the incidence of malaria parasite in donated blood.

The distribution of positive blood by social status of the donors showed that most of the positive bloods came from the lower class (low income persons) of a value 85 (83.33%) of 102 examined, followed by the middle class with a value 32 (36.365) of 88 examined and the high class with 23 (38.33%) of 60 examined.

Table 2: Incidence of malaria parasite in donated blood by Social status

SOCIAL STATUS	No. POSITIVE (%)	No. NEGATIVE (%)	TOTAL
HIGH CLASS	23 (38.33)	37 (61.67)	60
MIDDLECLASS	32 (36.36)	56 (63.64)	88
LOWER CLASS	85 (83.33)	17 (16.67)	102
TOTAL	140 (56.0)	110 (44.0)	250

The calculated value is 52.30 while the tabulated is x^2 = 0.103 at 95% level of significance (52.03 > 0.103),

which means that social status is not significant (a determinant) in the incidence of malaria parasite in donated blood.

Majority of the donors were from persons of age range 31-40 with value 77 (90.59%) of 85 examined, followed by 21-30 with 20 (57.14%) of 35 examined and followed by age range 41-50 with value 38 (34.54%) of 110 examined, finally 51-60 with 5 (25%) of 20 examined.

Table 3: Incidence of malaria parasite in donated blood by Age

AGE	No. POSITIVE (%)	No. NEGATIVE (%)	TOTAL
21-30	20 (57.14)	15 (42.86)	35
31-40	77 (90.59)	8 (9.41)	85
41-50	38 (34.55)	72 (65.45)	110
51-60	5 (25.0)	15 (75.0)	20
TOTAL	140 (56.0)	110 (44.0)	250

The calculated value is 69.64 while the tabulated is x = 0.352 at 95% level of significance (69.64 > 0.352), which means that age is not significant in the incidence of malaria parasite in donated blood.

The incidence of infection was also carried out for rainy and dry season (**Table 4**), with a higher incidence at rainy season (61.93%).

Table 4: Incidence of malaria parasite in donated blood by season.

SEASON	No. POSITIVE (%)	No. NEGATIVE (%)	TOTAL
DRY SEASON	72 (43.11)	95 (56.89)	167
RAINY SEASON	68 (81.93)	15 (18.07)	83
TOTAL	140 (56.0)	110 (44.0)	250

The calculated value is 33.90 while that of the tabulated value is x = 0.00393 at 95% level of significance (33.90 > 0.00393). This means that season is not significant (a determinant) in the incidence of malaria parasite in donated blood.

DISCUSSION AND CONCLUSION

The high rate of malaria incidence in the blood samples examined, which exceeded 50% is quite worrisome. Out of 250 samples examined, 140 (56%) were positive to malaria, depicting the endemic nature of the infection. This result compares favourably well with the results of Epidi., *et al*., (2008), who reported 51%. This is a reflection of the high rate of asymptomatic malaria parasitemia in endemic malaria regions. A similar report was made by Achidi *et al*., (1995). The implication of this with regard to blood transfusion is enormous. The majority of the blood recipients, pregnant mothers and children are actually people who are highly vulnerable to malaria (Qari, 1993).

In the research, sex was not really significant in the incidence of malaria infection. Donors were mostly males, because of the high rate of male commercial donors in the study population (Adewuyi, 2001), which is similar to the research done by Epidi *et al*., (2008). The reason for the much lower number of females is that females are culturally inhibited as far as commercial blood donation is concerned due to the loss of blood during monthly menstruation (Agboola *et al*., 2010).

Social status was not statistically significant in the research, incidence of malaria parasite was highest among the lower class group (83.33%). This can be explained by the submission of Adams & Margaret, (1975) who reported that the severity and duration of malaria attack depends on many factors among which includes the nutritional status of the host. This can be justified from the high incidence recorded from donors of the lower class, who are the low income earners. Due to low income, proper feeding becomes a challenge which makes their body system highly vulnerable to diseases, especially malaria.

The high incidence of malaria at the lower class can also be associated with poverty, which is in consonance with Roll Back Malaria (2009), that malaria is understood to be both a disease of poverty and a cause of poverty.

A high rate of incidence was observed in the age group 31-40 and 41-50. Age group 51-60 had the lowest number of donors, with the least incidence of 25% possibly because donors in these groups were mainly volunteers and replacement blood donors and this is in accordance to the research done by Epidi *et al*., (2008).

In this research, although seasonality was not statistically significant in the incidence of malaria infection, a higher incidence was recorded at the rainy season. This is in accordance with Ayanlade *et al*., (2010) who reported that rainfall plays an important role in the distribution of breeding sites for the mosquito vector, thereby influencing malaria transmission. Though relative humidity and temperature play an important role in the survival and longevity of the mosquito vector, but it is rainfall that regulates the development rate of both the mosquito larvae and pupae. A high relative humidity lengthens the life of the mosquito and helps the parasite to complete the necessary life cycle so that it can transmit the infection.

In conclusion, this research has shown that malaria is very prevalent in donated blood at Kwali local government of FCT-Abuja. Many of the donors carried malaria parasites but were asymptomatic, and this leaves the recipient at the risk of malaria

infection. In light of the above, it is therefore recommended as follows:

- All donated blood be screened for malaria parasites (post-donor screening) and marked negative or positive as the case may be.
- In case a patient is transfused with malaria parasite-positive blood, he/she could be given a curative regimen of anti-malarial, especially if he/she falls into the malaria vulnerable group.
- Alternatively, it might be considered desirable to give a curative dose of anti-malarial prophylactically to all patients transfused with blood (Adewuyi, 2001).

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