BEST: International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS)
Vol. 1, Issue 2, Nov 2013, 45-50

PREVALENCE OF MALARIA PLASMODIUM PARASITE AMONG BLOOD DONORS AT NSUKKA AREA, SOUTHEAST NIGERIA

BADGER-EMEKA LORINA[1], EMEKA PROMISE[2] & EGBU VICTOR[3]

[1]Assistant Professor, Department on Biomedical Sciences, College of Medicine, King Faisal University, Hofuf, Kingdom of Saudi Arabia

[2]Assistant Professor, Department of Pharmaceutical Sciences, College of Clinical Pharmacy, King Faisal University, Ministry of Education, Kingdom of Saudi Arabia

[3]Department of Microbiology, Faculty of Biological Sciences, University of Nigeria, Nsukka, Nigeria

ABSTRACT

Transmission of malaria through blood transfusion potentially negates the progress made in malaria control particularly in malaria endemic regions. This study looks at the prevalence of malaria parasite among blood donors at the Nsukka area of Nigeria. Samples were collected from blood donors attending two health centres in the region. A total of 200 blood samples collected, were examined for the presence of the Plasmodium parasite. Giemsa stained thick and thin blood films were prepared and examined using basic methods for microscopic diagnosis of malaria parasite. Male blood donors accounted for a total of 63 % while 37 % were females. Of the 200 samples examined, 115(57.5%) of them were positive with malaria parasite. About 58% of the male donors were found to be infected while 57% of the females were infected. The study also revealed a high incidence of parasitaemia amongst blood donors with blood group **O** group and fewer cases with the **AB** group.

KEYWORDS: Malaria, Plasmodium, Blood Donors, Parasitaemia, Blood Group

INTRODUCTION

Globally, malaria has become one of the most wide spread and most important single disease entities of the tropics with unprecedented high morbidity and mortality. Studies have shown that there may be about 350 -500 million cases of malaria each year, Ghimre et al., (2007), WHO (2010). About 41 % of the world population is said to be at risk of infection causing up to 2.7 million deaths annually (WH0 2010). Efforts to eradicate malaria has been global in outlook, but Kitchen and Chiodin (2006) were of the view that these efforts have fallen short in many malaria endemic countries due to general lack of resources needed to sustain them and or the migration of populations. Although huge sums of time and money have been expended in the control of malaria through drug and vaccine research, malarial re-infection by blood transfusion continues to receive less attention (Kitchen and Chiodini, 2006).

This could be due to a general lack of consensus among sub-Saharan malaria endemic region in using sensitive methods to screen donated blood before transfusion (Adewuyi 2001). There are high levels of blood demanding health conditions in Nigeria such as severe anaemia in pregnancy and some haemorrhagic complications could occur particularly in child bearing, road accidents hence the need of blood transfusion may arise. These could amplify the possibility of the transmission of blood – borne diseases (Uneke et al., 2006). Jackson (2002) observed that blood for transfusion is usually provided by professional blood donors in most of countries in African and this in itself is risky when it is the last resort. Therefore there is the danger of recipients receiving malaria-infected blood. The spread of multidrug resistant *Plasmodium falciparum* (the deadliest plasmodium parasite) can be acquired equally by transfusion and the infection can be life

threatening in a patient population that is impoverished and vulnerable (Bronner et al., 2009, van Hellemond et al., 2009, Daneshvar 2010). Being unexpected, morbidity and mortality could result due to delay in diagnosis and prompt treatment. Frequent occurrence of blood transfused malaria has raised concerns about potential infection worries in the fight to eradicate malaria. Also children under 5 years, pregnant women, accident victims, immuno-suppressive patients and others requiring emergency blood transfusion are constantly at risk of its attendant infections (Okocha et al., 2005).

In sub-Saharan Africa where malaria is endemic, blood screening from blood donors for malaria parasites is not top of the list, although international policies demands that it should be quality assured, free of transfusion-transmissible infection amongst which is malaria (Tagny 2008). Infection of malaria through blood transfusion could portend a significant problem due to the fact that malarial infection exhibits certain characteristics. These include asymptomatic blood donors who are semi-immune have low levels parasitaemia, malaria parasite of the plasmodia specie survive in the blood stored at 4 ^{0}C and current methods used in the screening blood samples from donors cannot detect the level of parasitaemia capable of causing transmission infection (Dubey et al., 2012). Due to the fact that most of the people living in malaria endemic regions are semi-immune, test used to screen blood must be sensitive.

OBJECTIVES OF STUDY

The present study was undertaken to determine and evaluate the prevalence of malaria parasite among blood donors in Nsukka area of Nigeria, an endemic malaria area.

MATERIALS AND METHODS

Study Area

The study was conducted from May 2012 to August 2012. Samples were collected from the University of Nigeria Nsukka medical centre (UNMC) and Bishop Shanahan hospital both of which are located in Nsukka local government area of Enugu State, Nigeria. Nsukka lies in latitude 6^0 52 N; and longitude 7^0 23 E. The region is characterized by poor environmental sanitation especially in areas with high density populations and has two major seasons, the raining and dry seasons. The rainfall pattern of this area is between heavy and moderate, lasting for a period of six months, with average atmospheric temperature of 20-30^{oC}. The two collection centres chosen are those patronised by blood donors and are also reference centre for buying blood by those needing transfusion.

Study Population

Samples from a total of 200 persons (126 males and 74 females) attending both hospitals (University of Nigeria medical centre (UNMC) and Bishop Shanahan hospital) were used for the study. The subjects were apparently healthy individuals who did not show any signs of malaria fever or any other type of symptoms of malaria. They had been screened for HIV and Hepatitis B virus but not for malaria parasite, thus were confirmed fit to donate blood. The age of all donors was recorded. Informed consent for the study was obtained from the directors of the medical laboratories where the study was conducted. All donors presenting at the laboratories for blood donation gave their consent for blood examination for malaria parasites. The blood samples used for the study were taken from the donated blood. Numbers were allocated to each donor, names were not used.

Sample Collection

2mls of venous blood was collected into an Ethylene Diamine Tetra Acetic acid (EDTA) bottles for the study, by vein puncture techniques of (Ibhanasehor 1996, Okocha et al., 2005).

LABORATOR ANALYSIS

The collected blood samples were analyzed within 1-2 h of collection. Laboratory analysis was carried out to determine the blood group of the donors using the direct smear of Kinde-Gazard et al., (2000). Thick blood films were also prepared according to the technique outlined in Cheesebrough (2004). A drop of each blood sample was placed in the center of a grease-free clean glass slide, allowed to dry and fixed. All films were stained in 10% Giemsa stain for 30 minutes (Marlies and Brain 1997). All slides were examined microscopically under oil immersion and slides were confirmed positive by the presence of Plasmodium parasites. Parasite count was determined using the plus system (WHO 2002).

STATISTICAL ANALYSIS

Data obtained were presented as mean ± SD and subjected to chi^2 statistical analysis using Microsoft Excel statistical graphics version 2010. A p value ≤0.05 was declared significant.

RESULTS AND DISCUSSIONS

Out of the 200 blood donors who participated in the study, 126 were males while 74 were females. 115(58%) were infected with plasmodium parasite. Amongst the males (126 samples), 73(58%) had plasmodium parasite in their blood while 42(57%) of the 74 female donors were infected as shown in table 1. The difference however, was statistically not significant (p> 0.05). Amongst these male and female donors were those donating for the first time as well as previous donors. Of the 200 donors, 129 were first timers of whom 92(46%) had malaria parasites in their blood while 71 had donated previously. 23(11.5%) of the previous donors had positive parasitaemia indicating a lesser number of positive cases as compared with first time donors and the results are presented in table 2. All blood groups, **O, A, B**, and **AB** were involved in the study. Of these, the blood group **O** was the dominant blood type with 111 donors. The **A, B** and **AB** groups had 55, 25 and 9 blood donors. The results in table 3 show that all groups had malaria parasite, though with variations. Table 3 shows that the percentage infection rates for the **O, A, B** and **AB** groups to be 58.3%, 26.09%, 12.17% and 3.5% respectively. Thus highest prevalence was amongst the **O** group while the lowest was in blood group **AB**. This observed difference was however not statistically significant (p> 0.05). Blood donors were also grouped into five age groups. Age groups of ≥25, 26-30, 31-35, 36-40 and ≤41 years of age. There were more blood donors in the 25 – 30 years age group. Of the 74 female subjects, 62(%) were in this age group while of the 126 male donors, 80(%) were between 25 – 30 years of age as shown in tables 4 and 5. Percentage of positive films was high irrespective of the age of the donor. Female donors within the age range of ≤26 and 26 -30 showed the highest (48 and 41% respectively) of positive cases in the female group. A similar observation was made amongst the male donors with the age range of 26 – 30 showing the highest percentage positive cases of 34.25%, this was followed by the ≤25 age range with 30% of positive cases. For both the males and females, percentage of infection was found to decrease with age as shown in tables 4 and 5. The tables also shows that in the age range of 41 and above, though fewer donors, but were less infected. The difference in the prevalence of malaria parasite in both sexes is however not statistically significant (p> 0.05). The high rate of malaria prevalence in the examined blood samples in the present study reflects the high rate of asymptomatic malaria parasitaemia in endemic regions, such as Nigeria. The rather high percentage (58%) of the blood donors in the present investigation found to be infected with the plasmodium parasite is a high percentage, strongly suggesting a high risk of transfusion-transmitted malaria. The results are not unexpected as Nsukka is a rural area, characterised by heavy rainfall, vegetation and lots of stagnant water all contributing to good mosquito breeding site. Similar findings had been reported by workers such as Ibhanasebhor (1996), Okocha et al., (2005), and Uneke (2006). Also, Epidi et al., 92008) reported an overall

prevalence of malaria parasitaemia of 51.5% similar results as those obtained in this study. This therefore implies that one in two blood transfusions carries the risk of transmitting malaria parasite to receiving individual recipients. The fact that such recipients are people who are already vulnerable such as pregnant women, accident victims and children, makes it a great problem that needs to be treated with urgency. All blood groups were found to be parasitized with the plasmodium parasite indicating that there isn't any blood group that is exempted from being parasitized.

Therefore malaria can be transmitted through the transfusion of any of the blood group. That the **O** group had the highest prevalence could be because there were more donors in this group. Similar findings had been reported by Agboola et al., (2010). However it has been reported (Ekwunife et al., 2011) that people with blood group **O** are noticeably prone to malaria infection. All age group in the present study had malaria parasite in their blood film. The present study showed that most (95%) of the positive blood films were recorded from donors in the age range 20-40 years. This is in agreement with the study done in Burkina Faso by Guiguemide (1999) who found the higher densities and higher infectivity of malaria parasites in donors under 35 years old. In the present study, it was observed that for both males and females, highest donors where those in the ≤25 and 26 – 30 years of age groups. Analysis of result showed that 4% of infected male donors were between ≥40 years of age range while only 2.4% of female donors were in that age group. This is not unexpected as results reflect the findings of other workers and might be attributed to the belief that women are weaker and to have less blood because of menstruation or because of the blood loss associated with childbirth (Olaiya et al., 2004). The higher percentage of infected first time donors as seen in this study could be that previous donors might have put into practice what they learned in training and might have had antimalaria treatment prior to donating blood. The prevalence of infected donors by malaria parasite as seen in the present study is significantly high thus necessitating the need to screen blood donors for malaria, prior to donation. However as blood is in very high demand with very few donors available and limited resources, the issue of screening for malaria parasite before transfusion might take a back seat in developing countries. Inevitably, potentially infectious donors will continue to donate without a sensitive method for screening the blood of these donors. The ever-present risk of transmitting malaria by blood transfusion will continue to grow and lead to outbreaks in some countries due to international travel and freewill blood donations.

Table 1: Prevalence of Malaria Parasitaemia in Blood Donors, in Relation to Gender

Sex	No. Negative	No. Positive	% Positive
Male	53	73	63.48
Female	32	42	36.52
Total	**85**	**115**	**100 %**

$\chi^{2=}$ 0.871. DF = 1. **p>0.05**

Table 2: Level of Parasitaemia in Relation to Frequency of Blood Donation

Frequency	No. Examined	No. Positive	% Positive
New donors	129	92	92
Previous donors	71	23	20
Total	200	115	100 %

$\chi^{2=}$ 0.29 DF =1

Table 3: Prevalence of Malaria Parasitaemia in Donors, Based on Blood Groups

Blood Group	No. Negative	No. Positive	% Infected
O	44	67	58.26
A	22	30	26.09
B	11	14	12.17
AB	5	4	3.48
Total	82	115	100 %

$\chi^{2=}$ 0.804. D.F =3. p>0.05

Table 4: Prevalence of Malaria Parasite in Relation to Age among Male Donors

Age Groups	No. Not Positive	No. Positive	% Positive
≤25	16	22	30.14
26-30	17	25	34.25
31-35	7	13	17.81
36-40	10	10	13.69
≥41	3	3	4.11
Total	53	73	100%

χ^2=0.0025 DF=4 p>0.05

Table 5: Prevalence of Malaria Parasite in Relation to Age among Female Donors

Age Groups	No. Negative	No. Positive	% Positive
≤25	17	20	47.62
26-30	8	17	40.5
31-35	1	1	2.38
36-40	2	3	7.14
≥41	4	1	2.38
Total	32	42	100%

$\chi^{2=}$ =0.237 D.F=4 p>0.05

CONCLUSIONS

The prevalence of infected donors by malaria parasite as seen in the present study is significantly high, therefore the transmission of malaria through the donation of blood remains a major public health problem. As the world searches for ways to curtail the spread and mortality due to malaria, there is the urgent need to screen blood donors for Plasmodium parasite, prior to donation. This is a neglected but important public health issue.

ACKNOWLEDGEMENTS

The authors thank all blood Donors who agreed to be part of the study.

Author Disclosure Statement

No conflicting interests. The research did not receive any financial assistance.

REFERENCES

1. **Agboola, T. F., Ajayi, M. B., Adeleke, M. A. and Gyang, P. V.,** (2010). Prevalence of malaria parasite among blood donors in Lagos University teaching hospital, Lagos Nigeria *Annals of Biological Research; 1 (3):72-75*.
2. **Adewuyi, J. O**. (2001). The challenge of blood safety in Africa. *Africa Sanguine* 2001; *4*(2): 1–5.
3. **Bronner, U., Divis, P. C. S., Färnert, A. and Singh, B**. (2009). Swedish traveller with *Plasmodium knowlesi* Malaria after Visiting Malaysian Borneo. *Malaria J*. **8**:15.
4. **Cheesebrough, M**. (2004). District laboratory practice in tropical countries. Part 2. Cambridge University Press. p 357.
5. **Epidi, T. T., Nwani, C. D., Ugorji, N. P.,** (2008). Prevalence of malaria in blood donors in Abakaliki Metropolis, Nigeria. *Scientific Research and Assay*, 3(4): 162-164.
6. **Ekwunife, C. A., Ozumba, N. A., Eneanya, C. I., and Nwaorgu, O. C.** (2011). Malaria infection among blood donors in Onitsha Urban, Southeast Nigeria. *Sierra Leone Journal of Biomedical Research*. 3(1): 21-26.

7. **Daneshvar, C., Davis, T. M. E., Janet Cox-Singh, J., Rafa'ee, M.Z., Zakaria, S. K., Divis, P. C. S. and Singh B.** (2010). Clinical and Parasitological Response to Oral Chloroquine and Primaquine in Uncomplicated Human *Plasmodium knowlesi* Infections. *Malaria J.* **9:** 238.

8. **Dubey, A., Elhence, P., Ghoshal, U., Verma, A.** (2012). Seroprevalence of malaria in blood donors and multi-transfused patients in Northern India: Relevance to prevention of transfusion-transmissible malaria. *Asian J Transfus Sci.* 6: 174-178.

9. **Ghimire, P., Dhungyel, B. B., Tiwari, B. R.** (2007). Hepatitis B and Malaria among Nepalese Blood donors. *Scientific World* 5: 81-4.

10. **Guiguemide, T. R., Sanou, M. A., Ouedraogo, J. B., Coulibaly, N., Gbary, A. R., Coulibaly, S. O.,** (1999). Malaria and Transfusion. *Version Francaise*, 1999; 2: 2-9.

11. **Ibhanasebhor, S. E., Otobo, C. S, Ladipo, O. A**., (1996). Prevalence of malaria parasitaemia in transfused donor blood in Benin City, Nigeria. Ann. Trop. Paediatr. 16(2): 93-95.

12. **Jackson, H.** Aids: Africa continent in crisis. SAFAIDS. 2002.

13. **Kitchen, A. D., Chiodini, P. L.,** Malaria and blood transfusion. (2006). Blackwell Publishing Ltd. *Vox Sanguinis* 90: 77–84.

14. **Kinde –Gazard, D., Oke, J., Gnahoui, I., Massougbodji, A.** (2000). The risk of malaria transmission by blood transfusion at Coutonu, *Benin Sante*. 10: 389 – 392.

15. **Marlies, H. C., Brian, L. S.,** (1997). Comparative evaluation of four techniques for the diagnosis of *Plasmodium falciparum* infections. *Trans R Soc Trop. Med. Hyg. 91*: 279-82.

16. **Okocha, E. C., Ibeh, C. C., Ele, P. U. and Ibeh N. C.,** (2005). The Prevalence of Malaria in Blood Donors in Nigerian Teaching Hospital. *J Vector Borne Dis*. **42:** 21-24.

17. **Olaiya, M. A., Alakija, W., Ajala, A., Olatunji, R. O.** (2004). Knowledge, attitude, beliefs and motivations towards blood donation among blood donors in Lagos, Nigeria. *Transfus. Med.* 14(1):13-7.

18. **Tagny, C. T., Mbanya, D., Tapko, J., Lefre're, J**. (2008). Blood safety in sub-Saharan Africa: a multi-factorial problem. *Transfusion* 48(6):1256-1261.

19. **Uneke, C. J, Ogbu, O and Nwojiji, V.** (2006). Potential Risk of Induced Malaria by Blood Transfusion in South-eastern Nigeria. *McGill J Med.* **9: 8**-13.

20. **Van Hellemond, J. J., Rutten, M., Koelewijn, R., Zeeman, A. M., et al.,** (2009). Human *Plasmodium knowlesi* infection detected by rapid diagnostic tests for malaria. *Emerg Infect Dis*. 2009; **15:**1478-1480.

21. **World Health Organization**. (2010). World Malaria Report. Geneva: *World Health Organization*.

22. **World Health Organisation**. (2002). Diagnosis and Management of Severe *falciparum* Malaria 2002. *Tutor's Guide*. Geneva.