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Frequency of Blood Donation and Malaria Occurrence among Blood Donors in a Tertiary Hospital, Nigeria

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Abstract

Context: Malaria is a significant cause of morbidity and mortality in Sub-Saharan Africa (SSA). Transfusion transmitted malaria contributes significantly to the burden of malaria in SSA. The safety of blood transfusion as it relates to frequency of blood donation and malaria occurrence on the part of donors is an aspect that has not been properly investigated hence this study.
Objectives: This study was conducted to assess the frequency of blood donation and occurrence of malaria among blood donors at OAUTHC, Ile-Ife.
Materials and methods: This was a cross-sectional study. Ethical approval was obtained. One hundred and thirty-three consenting blood donors aged between 18-50 years were recruited for the study. Two millilitres of blood were collected from each study participant and immediately transported to the laboratory for processing. Giemsa-stained films of the samples were viewed under the oil immersion objective of the microscope. Questionnaires were administered to the study participants to obtain relevant information. Data generated were analysed using descriptive and inferential statistics with SPSS software version 20. The level of significance was set at $p < 0.05$.
Results: The prevalence of malaria among the blood donors was 21.1% with the highest rate among commercial donors (33.3%) followed by family donors (12.9%) then voluntary donors (11.9%). Evaluation of the frequency of donation showed that malaria occurred more in recurring donors (77.78%) than first time donors (22.22%).
Conclusion: Malaria is highly prevalent among blood donors and occurs more in recurring blood donors than first time donors.

Keywords: Malaria, Blood donor, Frequency

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Introduction

Malaria is a disease that is endemic in Sub-Saharan Africa (SSA) and it is a cause of significant morbidity and mortality particularly among children under 5 years of age, pregnant women, immigrants from non-endemic regions and immunocompromised individuals.[1,2] The recent World Health Organization (WHO) report on

Malaria reveals an estimated 247 million malaria cases in 2021 in 84 malaria endemic countries with most of this increase coming from countries in the WHO African Region.[3] Nigeria is among the four countries that accounted for almost half of all cases globally.[3] The greatest malaria burden globally occurs in Nigeria, with approximately 51 million cases and 207,000 deaths reported annually which is equivalent to approximately 30 % of the total malaria burden in Africa, while 97 % of the total population (approximately 173 million) is at risk of infection.[4] In addition, malaria accounts for 60 % of outpatient visits to hospitals and resulted to approximately 11% maternal mortality and 30 % child mortality.[5] Malaria is mainly transmitted by the bite of female anopheles' mosquito of which Anopheles gambiae, Anopheles funestus, Anopheles arabiensis, and Anopheles moucheti are the major vectors that result in all year transmission.[6] Malaria transmission occurs through other routes such as transfusion of infected blood, vertical transmission and needle stick injury.[6] Transfusion transmitted malaria occurs when whole blood or components of blood is transfused from an infected person or donor to a recipient who is in need at that point in time which can result in severe life-threatening infections in persons from non-endemic regions who get transfused with blood infected with *Plasmodium* species. Malaria acquired by non-immune individuals has been reported to be fatal.[8] Malaria is caused by 5 species of *Plasmodium* which are *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale*, *Plasmodium malariae* and *Plasmodium knowlesi* with *Plasmodium falciparum* being the deadliest of all. However, transfusion transmitted malaria is commonly associated with *Plasmodium falciparum*, *Plasmodium vivax* and *Plasmodium malariae*.

In comparison with other transfusion-transmitted infections, Malaria is one of the most significant transfusion transmitted infections in SSA.[7] Blood transfusion is an established form of management for several health conditions which is lifesaving. Standard practice in health care facilities ensure safety of blood or any blood product that is to be transfused to patients in need through screening for various infective agents to prevent transfusion transmittable infections like Syphilis, Hepatitis B, C viruses and Human Immunodeficiency Virus (HIV). However, screening of blood for malaria is not routinely carried out in most blood banks in SSA despite the recommendation by WHO.[8] This may be because of asymptomatic parasitaemia which is a common occurrence among blood donors but however a major risk for acquiring transfusion transmitted malaria. Donors are usually sourced from family or volunteers and those who donate for remuneration. The commercial blood donors have continued to increase in Nigeria due to the financial gratification and the deficit in blood supply.[8]

Studies carried out on blood donors in Nigeria show that blood transfusion still carries a risk of transmitting malaria to recipients.[9-12] Transfusion transmitted malaria if not curbed will continue to dampen efforts being made to reduce Malaria burden in SSA. The safety of blood transfusion especially as it relates to frequency of blood donation and malaria occurrence on the part of donors is an aspect that has not been properly investigated hence this study.

Materials and methods

Study site, period, and population: A cross sectional study was carried out at Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife a tertiary hospital in Osun State, Nigeria among one hundred and thirty-three randomly selected blood donors at the hospital's blood bank between January and April 2019.

Ethical approval: Ethical Approval was obtained from the Ethics and Research Committee of OAUTHC, Ile-Ife and informed consent was obtained from the study participants.

Blood collection and Processing: Two millilitres of venous blood samples were collected into an Ethylene diamine tetra acetic acid (EDTA) bottle for the study. The blood donors were tested for malaria parasites through microscopic examination of Giemsa-stained blood films and examined under the oil immersion objective. Rapid diagnostic test (RDT) was also carried out on all the blood samples using the SD Bioline RDT antigen kit which detects Histidine rich protein II (HRPII) of *Plasmodium falciparum*; The manufacturer's instructions were followed in performing the tests.

Demographic Information: A well-structured questionnaire was used to obtain relevant demographic information.

Data Analysis: The data were analysed using Statistical Software for Social Sciences (SPSS) version 20. Data generated were analysed using descriptive and inferential statistics with SPSS software version 20. The level of significance was set at $p < 0.05$.

Results

A total of 133 blood donors participated in the study. One hundred and twenty-five (94%) were males and 8(6%) were females. Twenty-seven males (20.8%) were positive for malaria parasite while 1(12.5%) of females was positive for malaria parasite. Sixty-six (49.6%) were married and 67 (50.4%) were single. Most of the blood donors were in the age group of 20-29 years while 4(3%) were less than 20 years of age and 10 (7.5%) were greater than 40 years in age. The mean age is 29.6(± 6.88) years. Most of the blood donors had secondary education, 79(59.4%) and 2(1.5%) had no formal education. Fifty-two (39.1%) of the donors were artisans while the rest were involved in occupations such as driving, teaching, civil service, schooling, business owners and unskilled work. One hundred and eighteen (88.7%) were urban dwellers who resided in non-bushy areas with no environmental stagnant water collection while 15(11.3%) were rural dwellers that resided in bushy areas with stagnant water collection in their environments. One hundred and seven (80.5%) used protection against malaria in the form of net on window, insecticide treated nets, insecticides, or coils while 26 (19.5%) used none. *Plasmodium falciparum* was the only species of malaria parasite detected among the study participants.

Table 1: Prevalence of Malaria among the blood donors

Laboratory Test for malaria (N=133)	Microscopy	RDT
Positive	28 (21.1%)	20 (15.0%)
Negative	105 (78.9%)	113 (85.0%)

Table 2: Types of blood donor and occurrence of Malaria

Type of donor	Malaria Parasite (MP)		Total	Statistics
	Negative	Positive		
Voluntary n= 17	15 (88.2%)	2(11.8%)	17	Likelihood ratio=
Family n= 62	54(87.1%)	8(12.9%)	62	8.156
Commercial n= 54	36(66.7%)	18(33.3%)	54	p= 0.017
	105	28	133	
	78.9%	21.1%	100.0%	

Table 3: Frequency of donation and occurrence of Malaria

Frequency of donation	Negative MP	Positive MP	Statistics	p-value
Recurring donor	55(51.89%)	21(77.78%)	Chi-square = 5.891	0.015
First time donor	51(48.11%)	6 (22.22%)		

Discussion

Standard practice ensures that blood is screened before it is administered to a patient in need to prevent transfusion transmitted infections of which malaria is one but routinely malaria is not usually screened for in most blood banks in SSA.[5] In this study, the overall prevalence of malaria in the study participants is 21.1% which is quite high, and which implies increased risk of malaria parasite transmission during transfusion. The rate obtained in this study is much higher than that obtained in Kaduna Nigeria,[13] Tanzania[14] and Ethiopia[15] where prevalence rates of 7.5%, 5.3%, and 4.1% were reported respectively. A much lower prevalence of 2.5% was also reported among blood donors in Ghana.[16] This may be due to differences in environmental factors, levels of endemicity and prevention modalities for malaria. However there had been reports of higher prevalence rates in Lagos[17] and Nnewi,[18] Nigeria. *Plasmodium falciparum* was the only species of malaria parasite seen in this study, which is similar to studies[5,13,16] carried out in SSA among blood donors. This is not surprising as *Plasmodium falciparum* is endemic in SSA. However, prevalence of malaria was higher in males (20.8%) than females (12.5%). This finding is in line with two studies[5,19] where males had a higher malaria parasite infection rate than females but contrasts with the report by Inyang-Etoh et al[20] and Otajevwo et al[21] that reported a higher infection rate in females than males. The low rate of infection among female donors in this study may be because of the low number of female participants.

Blood donation is now seen as a survival measure in this environment; This is because of the high

poverty level and unemployment in addition to reduction in supply of blood for transfusion purposes and because of these reasons there has been an increase in commercial blood donors. However, in this study most of the donors (46.6%) were family donors, (40.6%) were commercial donors while (12.7%) were voluntary donors. This pattern of donation can be explained by the fact that family members are the closest to a patient when health care is been administered. However, malaria occurred more in the commercial donors and occurred least in voluntary donors. Increased malaria occurrence among commercial donors in this study could be because of the possibility of asymptomatic infection in the blood donors and also lack of screening for malaria of blood donors. This finding is in keeping with a study done in Benin City,[19] Nigeria where malaria occurred more among commercial blood donors. In this study, malaria occurred significantly more in recurring blood donors than first time donors. The finding of increased occurrence of malaria in this study suggests a reduced immune response to malaria in recurring blood donors with possible loss of protective antibodies. Protective antibodies against malaria include IgG which protect against asexual and sexual stages of malaria parasites. Frequent exposure to *Plasmodium falciparum* results in immunity that is transient.[22] A limitation of this study is that protective antibodies against Malaria were not looked for.

Conclusion

The results of this study reveal a high prevalence of malaria among blood donors, increased malaria occurrence among commercial donors and recurring donors. These findings suggest there is a high risk of transfusion transmitted malaria to recipients. Recommendations from this study include mandating routine screening of blood donors for malaria parasites in all health care facilities. Another recommendation is that regulations must be put in place to prevent frequent donation of blood from donors as this makes them more susceptible to malaria and such blood carries the risk of transmission of malaria to the recipient.

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