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MALARIA PARASITAEMIA AMONG BLOOD DONORS IN ILORIN, NIGERIA.

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Abstract

Background: The prevalence of malaria parasitaemia among blood donors in Ilorin has not been documented. In this study, we determined the prevalence of malaria parasitaemia among blood donors in Ilorin, as well as, the sociodemographic and other factors associated with it.

Method: This was a hospital- based cross sectional study involving 308 consenting blood donors. The sociodemographic characteristics of participants as well as blood donation history were obtained using structured questionnaires specifically designed for this purpose. Giemsa-stained thick and thin blood films to identify malaria parasites were performed using standard method. ABO blood grouping and haemoglobin electrophoresis tests were also done using standard methods.

Results: The prevalence of malaria parasitaemia among blood donors in Ilorin was 27.3%. The parasite species found were more of *Plasmodium falciparum*(85.7%) than *Plasmodium malariae*(14.3%) . There was no age or sex difference in malaria parasitaemia. (*p-value* of 0.8 and 0.32 respectively). A greater proportion of blood group O individuals had malaria parasitaemia than groups A and B but this difference was not significant (*p-value* = 0.13). There was also no significant difference among haemoglobin genotypes.

Conclusion: The prevalence of malaria parasites among blood donors in Ilorin is considerably high and lack of routine screening of blood puts recipients at risk. We recommend that routine screening for malaria parasites be commenced in our blood banks. Treatment of donor blood with riboflavin and UV light to inactivate malaria parasites and other infectious pathogens before they are transfused to patients may also be considered in our blood banks.

Key words: malaria, parasitaemia, blood donors, Nigeria

Introduction

Malaria parasite was one of the first reported organisms transmissible by blood transfusion, the first case was reported in 1911. Even though many more different organisms have been reported to be transmissible since then, malaria remains one of the most common transmissible infections worldwide. (Kitchen *et al*, 2006). Organisms that are commonly screened for worldwide include Human Immunodeficiency Virus (HIV), Hepatitis B and C viruses. Blood parasites such as *plasmodium species*, *trypanosome cruzi*, *Toxoplasma gondi* and *Babasia microti* are not routinely screened for especially in Africa. (Barbara, 1998).

Malaria is endemic in Africa and remains the most complex and overwhelming health problem facing humanity in the tropical and sub-tropical regions of the world. It accounts for most deaths in these regions especially in children below the age of 5 years. (WHO, 2000; Baye *et al*, 2007) In countries where malaria is not endemic travel history and serological test are used to exclude donor at risk of transmitting malaria parasites. But in malaria endemic counties including Nigeria, serological tests are not appropriate for screening donors because most residents have anti-malaria antibodies. Malaria antigen test which is much cheaper than malaria antibody test is more appropriate for donor screening in malaria endemic regions.

Even in countries where screening is done routinely a risk of transmission of malaria parasites still exist. Consequently pathogen reduction using riboflavin and UV light, which is a method by which infectious pathogens, including plasmodium in blood for transfusion are inactivated by adding riboflavin and irradiating with UV light , is another effort in transfusion medicine to ensure blood safety. (Hardwick *et al*, 2004; Reddy *et al*, 2008; Sullivan *et al*, 2008). This lack of routine screening poses a particular risk to vulnerable blood recipients who include visitors to the region, little children who have not acquired partial immunity, pregnant women who are not on routine malaria prophylaxis, probably HIV/AIDS patients and other people with low immune status. (Chandramohan *et al*,1998; Migot *et al*,1996)

Different strains of malaria species such as *Plasmodium falciparum* (*P.falciparum*), *Plasmodium vivax*, *Plasmodium malariae*(*P. malariae*) and *plasmodium ovale* can be responsible for transmission associated malaria infections. (Baye *et al*, 2007). Most studies in Africa put the prevalence of malaria parasitaemia in blood donors between 6.0% to 40.0% with the predominant causative agent being *P. falciparum* . (Baye *et al*, 2007 ; Mohamed *et al*, 2004 ; Nmor *et al*, 2004 ; Akinboye *et al*, 1982).

In Ilorin, like in most other parts of the country and other endemic regions blood is not routinely screened for malaria and so there is no documentation on the prevalence of malaria parasitaemia among blood donors. The aim of this study was therefore to determine the prevalence of malaria parasites among blood donors in Ilorin as well as the sociodemographic, donor type, blood group and other factors associated with malaria parasitaemia.

Patients and Methods

This was a hospital based cross sectional study. The minimum sample size calculated for the study was 300. (Araoye, 2003) Three hundred and eight blood donors who consented to participate in this study were recruited consecutively at the blood bank of the University of Ilorin Teaching Hospital (UITH), Ilorin, Nigeria from 1st of July and 31st of August 2011.

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Standard ethical procedure was complied with in accordance with Helsinki declaration. (World Medical Association , 2008). University of Ilorin Teaching Hospital Ethical Review Committee which is a member of the National Health Research Ethics Council approved the study protocol. Written Informed consent of the participants was equally obtained. Donors that did not consent to participate in the study were excluded.

The sociodemographic characteristics of participants, the nature of donation, as well as blood donation history were collected using structured questionnaires specifically designed for this purpose. Giemsa-stained thick and thin blood films to identify malaria parasites were performed using standard method. (Cheesbrough, 1998) The ABO blood grouping test was performed using standard method with commercial reagents which produced strong agglutination within 1-2 minutes (Murex Diagnostics, Inc. Dartford,UK). Haemoglobin electrophoresis was done using standard method. (Dacie *et al*,1994)

Data was analysed using Epi Info version 3.5.1. Statistical analysis of mean and standard deviation were used for the numeric variables. Blood group, genotype, type of donor and other parameters of donors who were positive or negative for blood parasites were compared by the Chi-square and Fisher exact tests. Difference in mean age of donors positive and negative for malaria parasite was done using Kruskal-Wallis test. Differences were regarded as significant when $p \leq 0.05$.

Results

Three hundred and eight blood donors (296 males and 12 females) aged 31 ± 9 years (mean \pm SD) were recruited for this study. Most of the donors were students (32.8%), 24.7% were civil servants and 21.8% were skilled artisan. (Table 1) About 60% were first time donors and majority (57.1%) of those who had donated before had donated only once before. Only 7.3% were voluntary donors while 92.7% were family replacement/ paid donors. One hundred and sixty eight (54.5%) of the blood donors were blood group O, 77(25.0%) blood group B, 59(19.2%) blood group A while 4(1.3%) were blood group AB. The haemoglobin genotype of most of the donors (68.8%) was AA, 23.1% were AS while 8.1% were AC. (Table 2)

The prevalence of malaria parasites among the blood donors was 27.3%. The parasite species found were *P. falciparum* (85.7%) and *P. malariae* (14.3%). There was no significant difference in the mean age of donors whose MP was positive (31.0 ± 8.2 years) and those whose MP was negative (31.3 ± 9.5 years) ($p = 0.8$). There was no significant difference in malaria parasitaemia between male (27.7 %) and female (16.7%) blood donors ($p = 0.32$). Among the blood donors malaria parasitaemia was found in 31.5%, 20.3% and 22.1% of groups O, A and B respectively (Table 2). The Chi-square test however indicated no significant difference in the trend (p value of 0.133). Blood group AB donors were excluded from this analysis because they were very few.

Malaria parasitaemia was not influenced by donor types, voluntary versus family replacement donors: 28.6% versus 26.6 % (p value 0.509), first time donors versus repeat donors: 27.5% versus 27.8% (p value 0.531) and haemoglobin genotypes (p value 0.709). (Table 2)

Table 1: Malaria parasitaemia in relation to sociodemographic factors

Factors		Positive	Negative	total	<i>p</i> -value
Mean age		31.3 \pm 9.5	31.0 \pm 8.2	31.0 \pm 9.0	0.779
sex	Male	82(27.7%)	214(72.3%)	296(96.1%)	0.319
	Female	2(16.7%)	10(83.3%)	12(3.9%)	
Marital status	Married	48(29.7%)	115(70.3%)	163(52.9%)	0.205
	Single	36(24.8%)	109(75.2%)	145(47.1%)	
Occupation	Business	16(32.0%)	34(68.0%)	50(16.2%)	0.491
	Civil servants	19(25.0%)	57(75.0%)	76(24.7%)	
	Professionals	6(42.8%)	8(57.2%)	14(4.5%)	
	Skilled artisans	18(26.9%)	49(73.1%)	67(21.8%)	
	Students	25(24.8%)	76(75.2%)	101(32.8%)	

Table 2: Malaria parasitaemia in relation to blood group, haemoglobin genotype, and donor type

		Positive	Negative	Total	<i>P</i> -value
Blood group	A	12(20.3%)	47(79.7%)	59(19.4%)	0.133
	B	17(22.1%)	60(77.9%)	77(25.3%)	
	O	53(31.5%)	115(68.5%)	168(55.3%)	
Genotype	AA	55(25.9%)	157(74.1%)	212(68.8%)	0.709
	AC	7(28.0%)	18(72.0%)	25(8.1%)	
	AS	22(31.0%)	49(69.0%)	71(23.1%)	
Type of donor	Family	76(26.6%)	210(73.4%)	286(92.7%)	0.509
	Voluntary	6(28.6%)	16(71.4%)	22(7.3%)	
Ever donated blood?	No	50(27.5%)	130(72.5%)	180(58.4%)	0.531
	Yes	36(27.8%)	92(72.2%)	128(41.6%)	

Discussion

The prevalence of malaria parasitaemia among blood donors in this study is 27.3%; this is very close to the prevalence rate in other parts of the country which ranged between 30.0 -40.0%. (Akinboye et al, 1982; Uneke et al, 2006; Okocha et al , 2005) . The most prevalent

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malaria parasite specie found among the donors was *P. falciparum*, this is the most dangerous of the four human malaria parasites and most effectively transmitted by *Anopheles gambiae*. (WHO, 2003). *P. falciparum* predominated because *Anopheles gambiae* is the most widespread and the most difficult to control of all vectors of malaria parasites (Kuliya-Gwarzo et al, 2007). Because of the high degree of virulence of *P. falciparum*, it may be necessary to screen blood routinely for malaria parasites most especially for the transfusion of immunocompromised patients as well as expatriates and tourists from countries where malaria is not endemic.

In a study conducted in the South Eastern part of the country, the prevalence of malaria parasitaemia decreased with increasing age, and individuals aged 20-25 years were most infected. (Uneke et al, 2006) However there was no difference in the mean age of donor with and without malaria parasitaemia in this study. This may be due to the fact that more than three quarters of donors recruited in this study were within the age bracket of 20-40years. Very small proportion of donors (3.9%) were females and this is also consistent with findings in other parts of Nigeria where the percentage of female donors ranges from 0.2-5 % (Kuliya-Gwarzo et al, 2007; Emeribe et al, 1993) In a study done in India, the percentage of female donors is even as low as 0.1%. (Chaudhary et al, 2008) The low number of female donors in developing countries has been attributed to negative culture and wrong beliefs. (Barbara, 1998; WHO, 2000) There was a higher percentage of malaria parasitaemia among male compared to female blood donors although no significant difference was observed statistically. This is consistent with previous studies carried out in Nigeria. (Uneke et al, 2006) However, in the Caribbean and Ghana reports, females were reported to be more parasitized. (Vlassoff et al, 1994)

More than half of the donors were of blood group O and a greater proportion of blood group O donors were positive for malaria parasites although the difference was not statistically significant. This finding is likely to be attributed to chance because in a similar study done in the south eastern part of the country blood group B individuals were found to be slightly more parasitized than the other blood groups and the difference was also not statistically significant. (Uneke et al, 2006) Earlier studies carried out to determine the relationship between blood group and susceptibility to malaria also showed no relationship between ABO blood group and malaria parasitaemia (Facer et al, 1979; Martin et al, 1979; Montoya et al, 1994; Fischer et al, 1998). However more recent studies are in support of the view that blood group O provides a selective advantage against severe malaria (Cserti et al, 2007; Loscertales et al, 2007; Loscertales et al, 2009; Cserti-Gazdewich et al, 2011). In another recent case-control study carried out in India there was a significant association of blood group B, but not A and AB, with severe malaria. (Panda et al, 2011)

This study shows clearly that family replacement donation was the major source of blood for transfusion in our hospital when compared with voluntary donors. This is consistent with findings of previous studies carried out in Ilorin and other parts of the country. (Kuliya-Gwarzo et al, 2007; Emeribe et al, 1993; Kotila et al, 2008; Olawumi et al, 2012) It appears that most Nigerians are unwilling to donate blood voluntarily because of certain beliefs and misconceptions regarding blood donation. (Olawumi et al, 2007; Adewuyi et al, 2008) They are however coerced to donate when they have a sick relative that needs blood. Majority of the donors were first time donors and majority of the repeat donors had donated only once before. More effort needs to be put into blood donation drive in the country in order to have voluntary donors who will be willing to donate blood regularly so as to improve the safety of donor blood that is transfused to patients.

The haemoglobin genotype of about two thirds of the donors was AA, others were AS and AC. Malaria has been known to be responsible for sustaining the sickle cell gene in developing countries where malaria is endemic. (Luzzattee, 1979) There was no relationship between malaria parasitaemia and haemoglobin genotype in this study.

In conclusion, the prevalence of malaria parasites among blood donors in Ilorin is considerably high and lack of routine screening of blood puts recipients especially immunocompromised patients, expatriates and tourists from countries where malaria is not endemic at risk. We recommend that routine screening for malaria parasites be commenced in our blood bank and donors that are positive for malaria parasite should be deferred from blood donation until after they are MP negative following treatment. Treatment of donor blood with riboflavin and UV light to inactivate malaria parasites and other infectious pathogens before they are transfused to patients may also be considered in our blood banks.

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