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# The risk of transfusion transmitted malaria and the need for malaria screening of blood donors in Abuja, Nigeria

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## Abstract:

**Background:** Blood transfusion saves life but it is also a major risk factor in the transmission of certain infections such as malaria, which remains a public health problem in tropical and sub-Saharan Africa.

**Methodology:** This study investigated the prevalence of malaria among 550 blood donors aged 18 to 60 years from blood bank units of some selected hospitals in Federal Capital Territory (FCT), Abuja, using gold standard microscopy for malaria parasite detection.

**Results:** Two hundred and fifty two (45.8%) donors were positive for malaria parasites. Replacement donors had higher prevalence rate of malaria compared to voluntary donors. The distribution of infection on the basis of age revealed the highest prevalence rate of malaria among the 20- 29yrs age group. The rate of infection among the males and the females was not significantly different ( $p > 0.05$ ). No association was observed between the blood group types and the rate of malaria infection ( $p > 0.05$ ).

**Conclusion:** A high prevalence of malaria parasitaemia was observed among blood donors in FCT, Abuja, Nigeria in this study. The introduction of malaria screening as part of routine screening for blood donation and the provision of modern blood screening equipment within healthcare facilities are highly advocated.

**Keywords:** Blood, Malaria, Microscopy, ABO Blood group

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## Risque de paludisme transmis par transfusion et nécessité d'un dépistage du paludisme chez les donneurs de sang à Abuja, Nigéria

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## Abstrait:

**Contexte:** La transfusion sanguine sauve des vies, mais elle constitue également un facteur de risque majeur dans la transmission de certaines infections, telles que le paludisme, qui reste un problème de santé publique en Afrique tropicale et en Afrique subsaharienne.

**Méthodologie:** Cette étude a examiné la prévalence du paludisme chez 550 donneurs de sang âgés de 18 à 60 ans appartenant aux banques de sang de certains hôpitaux sélectionnés du Territoire de la capitale fédérale (FCT), à Abuja, en utilisant la microscopie de référence pour la détection des parasites du paludisme.

**Résultats:** Deux cent cinquante deux (45,8%) donneurs étaient positifs pour les parasites du paludisme. Le taux de prévalence du paludisme était plus élevé chez les donneurs de remplacement que chez les donneurs volontaires. La répartition de l'infection sur la base de l'âge a révélé le taux de prévalence du paludisme le plus élevé parmi le groupe d'âge des 20-29 ans. Le taux d'infection chez les hommes et les femmes n'était pas significativement différent ( $p > 0,05$ ). Aucune association n'a été observée entre les types de groupes sanguins et le taux d'infection palustre ( $p > 0,05$ ).

**Conclusion:** Une prévalence élevée de parasitémie paludéenne a été observée chez les donneurs de sang à FCT, à Abuja, au Nigeria, dans cette étude. L'introduction du dépistage du paludisme dans le cadre du dépistage systématique des dons de sang et la fourniture d'équipements modernes de dépistage du sang dans les

**Mots-clés:** Sang, Paludisme, Microscopie, Groupe sanguin ABO

## Introduction:

Blood is a unique type of organic liquid that is produced within a living body which is indispensable for normal bodily function and even survival. In spite of the advances made in medicine, man has not been able to produce a functional substitute for human blood as a result of which blood transfusion will remain a clinically important medical procedure for a long time to come (1). Every second someone somewhere in the world needs blood as trauma, surgery, anaemia and complications of pregnancy in every countries of the world makes the need inevitable (2). Blood transfusion is an age-long important life-saving clinical intervention which unfortunately has also played a role in the transmission of infectious diseases when proper screening of donated blood is not carried out (World Health Organization (3, 4).

Blood donation occurs when a healthy person referred to as a blood donor voluntarily has his or her blood drawn for the purpose of saving another person's life. A blood donor may fall into any of three categories namely; voluntary (or allogeneic) donor, family (or replacement or directed) donor and

commercial (or paid) donors (5, 6, 7). Blood transfusion is safer today than it has ever been. However, any blood borne pathogen has the potential to be transmitted by blood transfusion if adequate vigilance is not maintained (8). It has been suggested that the safest source of blood supply is from voluntary non-remunerated donors usually seen as a population at low risk for transfusion-transmissible infections (3). Since blood safety is a major concern all over the world, certain factors such as the prevalence of asymptomatic carriers in the case of transmission transfusion malaria (TTM) should not be neglected.

Malaria is a protozoan parasitic infection caused by *Plasmodium* species; *Plasmodium falciparum*, *Plasmodium ovale*, *Plasmodium vivax*, *Plasmodium malariae* and *Plasmodium knowlesi* (9). The species differ widely in morphology, geographical distribution, characteristics and clinical presentation (10). In addition to being transmitted through the bite of an infected female Anopheles mosquito, malaria can also be transmitted by transfusion of blood from infected donors (11).

Transfusion Transmitted Malaria (TTM) was first reported in 1911 (12). But

due to high interest in human immunodeficiency virus (HIV), hepatitis B virus (HBV) and syphilis safety in blood transfusion, TTM has been a neglected topic until the year 2010 (13). Even with the interest in TTM leading to its inclusion by the World Health Organization among the diseases for which blood must be screened before transfusion, blood transfusion is still done without regard for TTM screening in Nigeria. This is despite the consequences for a substantial segment of the Nigerian populace among who are sickle cell disease patients for whom malaria is very dangerous. It is against this background that this study was designed to assess the danger associated with the non-inclusion of malaria screening for blood donors in the Federal Capital Territory, Abuja, Nigeria.

## **Materials and method:**

### **Study area**

Blood samples were collected at the blood bank units of Asokoro, Maitama, Wuse District hospitals, National Blood Transfusion Services, Federal Medical Center at Jabi and Karishi, and General Hospital, Nyanya. The choice of the hospitals reflects the level of patronage by most residents of Abuja especially in emergency cases. The donors were individuals without symptoms of malaria.

### **Ethical clearance**

The study was approved by the Health Research Ethics Committee of the Federal Capital Territory, Abuja.

### **Study population**

A total of 550 apparently healthy blood donors who came to the blood bank units of the hospitals to donate blood participated in this study based on informed consent. All the donors who satisfied the qualifying criteria of age (18-60 years), body weight (above 50 kg depending on the BMI), haemoglobin requirement (more than 12.5 gm/dl) and who had no significant medical or surgical history were qualified for the donation

process. All donors were offered pre and post donation counseling. Lactating mothers, pregnant, or menstruating women, and those who have donated more than the prescribed 3 times in the last 12 months were excluded from the study. The study was also designed to include different types of blood donors namely; voluntary, family/replacement donors and commercial/paid donors which were absent. The data obtained were analyzed to determine significant relationship between different socio-demographic characteristics of the blood donors.

### **Sample collection**

Five milli-liters of whole blood were obtained via venipuncture from the donors using 5 ml syringe (14). To ensure confidentiality of the donors, numbers were used. Two milli-liters of these were placed in ethylene diamine tetra acetic acid (EDTA) for parasitological (malaria) screening.

### **Screening tests for malaria parasites**

Thick and thin films were prepared following the procedure described by Cheesbrough (14) within 1-2 hours of collection. A drop of each blood sample was placed in grease-free clean slide and smeared with micro-pipette and cover slip to give a thick and thin film respectively. Slides were air-dried and thin films were fixed with methanol. All the films were stained with 1% Giemsa stain diluted with 9 ml of distilled water for 15 minutes and rinsed. The slides were dried at room temperature. Prepared slides were viewed under 100x objective lens of microscope with the aid of immersion oil and were reconfirmed by a medical laboratory scientist.

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 along these sites (14). The process of searching was characterized by continuous adjustment of the stage of the microscope to get different fields of each slide. A positive slide of malaria parasite

showing the different stages of the parasite was used as a guide in the identification of the parasite. Film was considered positive (p+) when any of the erythrocytic stage was observed and negative (p-) when absent (14).

### ABO blood grouping

The ABO/Rhesus blood groupings were performed for all subjects using the slide method. Blood from each sample were placed separately on a clean tile. To each drop of blood, one of the antisera; anti A, anti B or anti D was added and then mixed with the aid of a glass rod. The blood groups were determined on the basis of agglutination.

### Statistical analysis

Data was analyzed using Statistical

Package for the Social Sciences (SPSS) version 20.0, and Chi square ( $X^2$ ) was used to test significant association between malaria prevalence and different socio-demographic characteristics of the blood donors at 95% confidence level.

### Results:

#### Prevalence of malaria

Out of the 550 blood donors sampled and analyzed for ABO Rhesus blood group and malaria, 521 (94.7%) were males while 29 (5.3%) were females. Malaria parasite was detected in 252 (45.8%) blood samples comprising 237 (45.5%) from males and 15 (51.7%) from females (Table 1).

Table 1: Gender Distribution of Malaria among Donors

Gender	Number examined	Number infected (%)
Male	521	237 (45.5)
Female	29	15 (51.7)
Total	550	252 (45.8)
$X^2$		0.430
<i>p</i> value		0.512

Table 2: Frequency distribution of malaria with respect to types of blood donors

Types of blood donors	Gender			
	Male		Female	
	Number Examined	Number infected	Number Examined	Number infected (%)
Voluntary	60	19 (31.6)	3	1(0.3)
Family/Replacement	461	218 (47.2)	26	14 (53.8)
Commercial/Paid	0	0 (0.0)	0	0 (0.0)
		$X^2$		5.675
		<i>p</i> value		0.017*

Statistical analysis of the result showed that there was no significant relationship between the gender and the prevalence of malaria ( $p=0.512$ ). It was observed that there were 63 (11.5%) voluntary donors, 487 (88.5%) family/replacement donors, with no record of commercial/paid donors. In Table 2, replacement donors 218 (47.2%) had significantly higher rate of malaria than voluntary donors 19 (31.6%) ( $p= 0.017$ ).

### Age group and malaria

The age distribution ranges from 18 to 60 years with the majority of the donors 335 (60.9%) aged 30-39 years

(Table 3). The age group with the highest prevalence of malaria was the <20 years (100%). There was no significant difference in the age groups in relation to malaria ( $p> 0.05$ ).

### Blood group and malaria

Table 4 shows the distribution of malaria on the basis of blood group which revealed that O- blood group (58.3%) had the highest prevalence of malaria, followed by A- (55.6%), AB+ (53.3%), B- (50.0%), B+ (47.1%), A+ (47.0%), O+ (43.7%), and AB- (25.0%). However, there is no significant association between the prevalence of malaria and ABO blood groups ( $p= 0.507$ ).

Table 3: Frequency distribution of malaria with respect to age

Age (18-60 years)	Number examined	Number infected (%)
< 20	1	1 (100.0)
20 – 29	83	36 (43.4)
30 – 39	335	158 (47.2)
≥40	131	57 (43.5)
	$\chi^2$	1.908
	p-value	0.592

Table 4: Predisposition to malaria with relation to blood group

Blood Group	Number examined	Number infected (%)
A+	117	55 (47.0)
A-	9	5 (55.6)
B+	85	40 (47.1)
B-	10	5 (50.0)
AB+	15	8 (53.3)
AB-	4	1 (25.0)
O+	286	125 (43.7)
O-	24	14 (58.3)
	$\chi^2$	6.286
	p value	0.507

## Discussion:

This risk associated with malaria is worsened by the fact that absence of symptoms even for a long period does not necessarily mean lack of infectivity and malaria parasites survive well in stored blood. In this study, malaria prevalence rate of 45.8 % was recorded among blood donors in F.C.T, Abuja. This is higher than the 6.0% among blood donors in Maiduguri (15). This rate appears to be lower when compared to 77.4% obtained from blood donors in Owerri (16) and 93.4% obtained in Odoakpu, Onitsha South (17). A study in Sudan reported a figure lower than this study, 13% (18). These differences in the prevalence rate of malaria documented above are suggestive of local variations in the prevalence of plasmodia infection. A high prevalence of the malaria parasite in blood already screened for transfusion should be a cause for concern since majority of blood recipients are usually sickle cell disease patients, pregnant women, children and those with already compromised immune systems.

It was observed that female blood donors (51.7%) had higher infection rate with malaria than their male counterparts, though no significant difference was obtained ( $p > 0.05$ ). The reason for this difference may be due to higher number of male donors than the female donors. Generally, males donate blood more often than females, particularly in developing countries (19). The reason has been attributed to socio-cultural influences and beliefs (20).

Blood group O+ was the dominant blood group type in this study with O- highly predisposed to malaria. There was no significant relationship between the ABO blood groups and malaria infections however. This finding contradicts the earlier reports of Migot-Nabias *et al.* (21) and Pathirana *et al.* (22) who observed low malaria parasitaemia among blood group O individuals. In their reports, they concluded that blood group O seems to confer a certain degree of protection

against severe course of malaria because of the absence of either A or B triglyceride antigen believed to enhance plasmodial cyto-adherence and rosette formation which in turn increases pathogenicity. However the even distribution of malaria observed among blood groups and their rhesus factor showed that any of the ABO blood groups may be equally predisposed to malaria. This observation is consistent with the findings of Fischer and Boone (23), Uneke (24), and Otajevwo (25).

In conclusion, the prevalence rate of 45.8% asymptomatic carriage of malaria among blood donors in F.C.T Abuja poses a serious threat to certain categories of recipients of the blood such as pregnant women and sickle cell disease patients. This finding underscores an urgent need to review the policy on the safety of blood for transfusion in Nigeria towards the inclusion of malaria as part of routine screening for donors. Awareness campaign to educate the public on the benefits of maintaining environmental practices which reduces the breeding of mosquitoes is strongly recommended.

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