

Plasmodium Malaria and ABO Blood Group among Blood Donors in Yenegoa, Bayelsa State, Nigeria

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Abstract

Background: Transmission of Malaria by blood transfusion remains a significant public health problem in the malaria endemic regions like Nigeria. This study therefore was to investigate *Plasmodium* malaria and ABO blood group among blood donors in Yenegoa, Bayelsa State, Nigeria.

Materials and methods: Prevalence of malaria infection was determined on 250 randomly selected blood donors (201 males and 49 females) using standard parasitological method and ABO blood group was done using the monoclonal antisera A, B, and D (murex Diagnostic, inc, Dartford, UK) on a slide and observing for agglutination.

Results: The overall prevalence was 91(36.4%) out of which 84(41.8%) were males and 7(14.3%) were females. Prevalence of infection in relation to age showed that subjects within age's 24-29 years were more infected with 48.6%. Followed by those within ages 30-35 years with 42.9%, and those within 42-47 years with 30.4% while the least infected age group were those within the ages 18-24 years with 23.7% rate of infections. ABO blood group of the population sampled showed that Blood group O+ was the most prevalent with 119(47.6%) followed by blood group B+ with 62(24.8%) and A+ with 31(12.4%) while the least prevalent was AB- with 0 prevalence. The prevalence of infection in relation to ABO blood group showed that blood group O+ had the highest prevalence with 42.9% followed by blood group A+ with 41.9% and groups AB+ and A- both tied with 33.3% while the least prevalence was recorded in blood group AB- with zero prevalence. The difference was not statistically significant ($P>0.05$).

Conclusion: The prevalence of malaria infection among blood donors is high and blood group O harbours more parasite than any other blood group in Bayelsa State.

Keywords: Malaria infection; ABO blood group; Donors; Bayelsa state; Nigeria

Introduction

Blood transfusion is a lifesaving procedure and has greatly increased over the years. According to the World Health Organization (WHO), every second, someone in the world needs blood and in every country. Surgery, trauma, severe anaemia and complications of pregnancy are among clinical conditions that demand blood transfusion [1]. Transmission of Malaria by blood transfusion is a significant public health problem especially in the malaria endemic regions of the world [2]. Malaria is endemic in Nigeria where it accounts for more cases and death than any other country in the world, and where high prevalence has been reported by many researchers [3-6].

Some studies have suggested that ABO blood groups have an impact on the infection status of an individual [7-10]. Pizzorno and Murray stated that malaria infected RBCs sometimes bind to uninfected RBCs to form clumps called rosettes [11]. The rosettes can obstruct flow in small blood vessel and lead to tissue damage and severe malaria disease. The virulence of *Plasmodium falciparum* has been associated with the capacity of the infected RBCs to adhere to uninfected RBCs, leading to rosetting of cells [12,13]. The ABO blood group types have been implicated in rosetting [14]. In Ethiopia, Tekeste and Petros reported 25(35.7%), 15(21.4%), 14(20%) and 16(22.9%) to belong to blood group A, B, AB and O patients, respectively in a study using only severe malaria cases. Prevalence of malaria parasitemia and its possible association with ABO blood groups was investigated among inhabitants of Odakpu of Anambra State, Nigeria by Ilozumba and Uzozie [15,16]. They reported ABO blood group prevalence of 2.63%, 12.05%, 21.05% and 63.83% for groups AB, B, A and O respectively. Otajewwo reported a total prevalence of 138 (79.3%) in a study associating malaria parasitaemia with ABO blood groups among residents of Warri, Nigeria [17]. He observed that 6.9%, 19.0%, 20.7%

and 53.3% of 174 blood samples analyzed belonged to blood groups AB, B, A and O respectively.

Few studies have been undertaken in to ascertain the prevalence of Malaria among blood donors in Nigeria. Falade et al. [18] reported 20.2% by microscopic method. Erhabor et al. [19] reported 10.2% among donors in the Niger Delta of Nigeria also Pondei et al. [20] reported 12.5% in screened blood in a tertiary health Centre in Niger Delta. Abah and Joe-Cliff [21] reported 28% among blood donors in Port Harcourt. Chikwem et al. [22] reported 4.1% in Maiduguri, Northern Nigeria. Akinboye and Ogunrinade [23] reported 7.8% at Ibadan, Nigeria. Uneke et al. [24] reported 40.9% in south-Eastern Nigeria. Epidi et al. [25] reported 51.5% in Abakaliki. Oladeinde et al. [26] reported 27.5% and 13.8% among commercial and volunteer donors respectively.

It is difficult to completely avoid the risk of transfusion-transmitted malaria without the exclusion of blood donation, hence asymptomatic carriers of *Plasmodium* species are still qualified to donate blood for transfusion purposes. The aim of this study therefore was to investigate *Plasmodium* malaria and ABO blood group among blood donors in Yenegoa, Bayelsa State, Nigeria.

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Materials and Methods

Study area

Bayelsa State is located in the Niger Delta region, Southern Nigeria. Its capital is Yenagoa and it is bordered on the west by Rivers State, on the East and South by the Atlantic Ocean and on the North by Delta State. Rainfall in Bayelsa State varies in quantity from one area to another, the state experiences equatorial type of climate in the southern part and tropical rain towards the northern parts. Rain occurs generally every month of the year with heavy downpour. The mean monthly temperature is in the range of 25°C to 31°C. Mean maximum monthly temperatures range from 26°C to 31°C. The mean annual temperature is uniform for the entire Bayelsa State. The hottest months are December to April. The difference between the wet season and dry season temperatures is about 2°C at the most. Relative humidity is high in the state throughout the year and decreases slightly in the dry season. The Vegetation of the state is composed of four ecological zones. These include: Coastal barrier island forests, mangrove forests, freshwater swamp e.g. forests and lowland rain forests. These vegetation types are associated with the various soil units in the area. Bayelsa State has a population of about 1.5 million inhabitants and because of the favourable environment for vector breeding, malaria is the main cause of illness and death [27].

Ethical clearance

Permission was sought and obtained from Bayelsa State Ministry of Health. Verbal consent was obtained from the participants.

Sample collection

Venous blood was collected from 250 randomly selected blood donors (201 males and 49 females) at the Diète Koki Memorial Hospital Yenagoa, Bayelsa State, Nigeria. The donors were within the age of 18-60 years. Five milliliters of blood was collected from each participant and was dispensed into Ethylene Diamine Tetra-acetic Acid (EDTA) bottle, gently and properly mixed and transported to the parasitology laboratory of the Department of Animal and Environmental Biology.

Laboratory analyses

Both thick and thin blood films were prepared, stained and examined following the method described by Cheesbrough [28]. Thick and thin blood films were made and labeled on a clean glass slide as recommended by World Health Organization (WHO). The thin films were fixed with methanol and all films were stained with 3% Giemsa stain at pH 7.0 for 30 minutes. The blood films were examined under the microscope using the oil immersion (100x) objectives as described by Cheesbrough [28]. The thick films were used to determine the parasite density while the thin film was used to differentiate the species of the parasites.

Determination of blood group

The ABO blood grouping test was done using the slide method as described by Dacie et al. [29]. A drop of the monoclonal antisera A, B, AB and D (murex Diagnostic, Inc, Dartford, UK), was placed on a clean white tile respectively. A drop of the blood sample was added to each and with the help of a glass rod it was mixed properly, swirled for 2 minutes and observed for agglutination. Agglutination reaction signified the presence of the natural antigens A, B, AB or D and confirms ABO/Rhesus phenotypes.

Results

Out of the 250 blood samples analyzed, 91(36.4%) were positive for malaria parasites. Among them were 201 males out of which 84(41.8%) were positive and 49 females out of which 7(14.3%) were positive (Table 1). Prevalence of infection in relation to age showed that subjects within age's 24-29 years were more infected with 48.6%. Followed by those within age's 30-35 years with 42.9%, and those within 42-47 years with 30.4% while the least infected age group were those within the ages 18-24 years with 23.7% rate of infections (Table 2). ABO blood group of the population sampled showed that Blood group O+ was the most prevalent with 119(47.6%) followed by blood group B+ with 62(24.8%) and A+ with 31(12.4%) while the least prevalent was AB- with 0 prevalence. The prevalence of infection in relation to ABO blood group showed that blood group O+ had the highest prevalence with 42.9% followed by blood group A+ with 41.9% and groups AB+ and A- both tied with 33.3% while the least prevalence was recorded in blood group AB- with zero prevalence (Table 3). Though the difference in prevalence of infection in relation to ABO blood group was not statistically significant ($P>0.05$).

Discussion

The prevalence of 36.4% recorded among blood donors in this study is relatively high. The high prevalence buttresses the fact that malaria is endemic in Nigeria where it accounts for more cases and death than any other country in the world [2]. Though high malaria prevalence has been reported by many researchers in Nigeria and blood donors are not isolated from other Nigerians, the high prevalence in the present study is worrisome due to the fact that the recipients of these blood are those that are vulnerable; mostly pregnant women, children under 5 years, accident victims and other immuno-suppressive patients

Sex	Number Examined	Number Infected	% infected
Male	201(80.4%)	84	41.80%
Female	49(19.6%)	7	14.30%
Total	250(100%)	91	36.40%

Table 1: Prevalence of malaria parasite among blood donors and in relation to sex in yenegoa.

Age-Group	Number Examined	Number Infected	% Infected
18-23	38	9	23.70%
24-29	72	35	48.60%
30-35	56	24	42.90%
36-41	47	13	27.70%
42-47	23	7	30.40%
48-53	14	3	28.60%
Total	250	91	36.40%

Table 2: Prevalence of parasite in relation to age group in yenegoa.

ABO Blood Group	Number Examiner	Number Infected	% Infected
O positive	119(47.6%)	51	42.90%
O Negative	11(4.4%)	3	27.30%
AB positive	12(4.8%)	4	33.30%
AB Negative	0(0%)	0	0.00%
A positive	31(12.4%)	13	41.90%
A Negative	6(2.4%)	2	33.30%
B positive	62(24.8%)	16	25.80%
B Negative	9(3.6%)	1	11.10%
Total	250	91	36.40%

Table 3: Prevalence of parasite in relations with blood group abo in yenegoa.

as reported elsewhere [4-6,21]. The prevalence of 36.4% is actually high when compared with results of Falade et al. [18] that reported 20.2% by microscopic method, Erhabor et al. [19] who reported 10.2% among donors in the Niger Delta of Nigeria, Pondei et al. [20] who also reported 12.5% in screened blood in a tertiary health Centre in Niger Delta. The 36.4% prevalence is still higher than results of Abah and Joe-Cliff, who reported 28% among blood donors in Port Harcourt, Chikwem et al. who reported 4.1% in Maiduguri, Northern Nigeria [21,22]. Akinboye and Ogunrinade that reported 7.8% at Ibadan and Oladeinde et al. that reported 13.8% among volunteer donors [23,26]. It is suggestive of the fact that rather than decrease, malaria prevalence among blood donors is on the increase and this trend was also established by the WHO report in which there were 214 million cases of malaria in 2015 as against an estimated 198 million cases of malaria worldwide in 2013 [30,31]. However, the prevalence recorded in this study is lower than reports of Uneke et al., who reported 40.9% in south-Eastern Nigeria and Epidi et al. who reported 51.5% among blood donors in Abakaliki [24,25]. The reason for the high prevalence of malaria infection in the area may be due to the prevailing environmental conditions such as high rainfall, high relative humidity and good vegetation which collectively enhance malaria vector breeding and consequently high transmission of infections.

Sex related prevalence showed that more males (41.8%) were infected than females (14.3%). This finding agrees with Muntaka and Opoku-Okrah but at variance with Otajevwo who reported that more females were infected than males among students of Igbinedion University Okada, Nigeria [32,33]. The fact that more male subjects 80.4% presented as donors than females (19.6%) and the reason for this discrepancy which had been explained by Bani and Giussani's who stated that gender plays key role in the motivation to give blood may explain the reason for the variation in the prevalence of infection among this population [34].

Prevalence of infection in relation to age showed that subjects within age's 24-29 years were more infected with 48.6%. This finding seems to agree with Muntaka and Opoku-Okrah who observed that individuals with age between 21-25 years had the highest infection among blood donors in a Ghanaian hospital [32]. The reason for this difference observed in terms of age was not actually clear and needs further investigation. It was, however, clear that the majority of the infected individuals were the young adults and the adolescence. Since these groups of people are the principal blood donors [35].

The prevailing blood group among the studied population showed that blood group O+ had the highest prevalence with 53.3%. This finding agrees with Enosolease and Bazuaye who reported 53.2% in Benin area of Niger-Delta, Abah and Joe-Cliff who reported that people in Blood group O were more than those of the other blood groups among blood donors in Port Harcourt and Odokuma et al. who also reported blood group O as the most common among students of the Abraka campus of Delta State University in Nigeria [21,36,37]. This supports the universal knowledge that blood group O is the commonest of all the blood groups.

The prevalence of infection in relation to ABO blood group showed that blood group O+ had the highest prevalence with 42.9% followed by blood group A+ with 41.9% and groups AB+ and A- both tied with 33.3% while the least prevalence was recorded in blood group AB- with zero prevalence. Similar findings were reported by Ilozumba and Uozie and Otajevwo [16,17]. It has long been known that people with blood type O are protected from dying of severe malaria and that blood group O provides protection against severe malaria and that may explains why blood type O seems to be the commonest blood type in malaria

endemic countries and in the present study [38]. Goel et al. reported that because of endemicity of malaria in Nigeria, more than half of the population belongs to blood group O which protects against malaria [39]. That again may buttress the finding in this study where Blood group O has the highest prevalence of infection. Though Gupta and Rai chowdhuri had observed that people in blood group types A and other blood group types were more susceptible to malaria infections such observations may be for people who presented with symptoms as the present study was undertaken on subjects that were apparently healthy and could donate blood [38].

Conclusion

The prevalence of malaria infection among blood donors is high and blood group O harbours more parasite than any other blood group in Bayelsa State. However, severe blood shortages are widespread and would be exacerbated by rejecting blood that contained malaria parasites. This study confirms a high prevalence of transfusion-transmissible malaria among blood donors. Therefore, one would only align with earlier researchers that suggested that it would be of benefit to include screening for malaria parasitaemia in the routine investigation of potential blood donors in Nigeria.

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