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Original Article

Malaria Parasitaemia And Abo Blood Group Among Patients Attending Madonna University Teaching Hospital (Muth), Elele, Rivers State, Nigeria.

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A R T I C L E I N F O

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A B S T R A C T

There are different reports on the increasing evidence about the relationship between *Plasmodium falciparum* malaria and ABO blood group, but the range is still under various investigations. This study was carried out to investigate the prevalence of malaria parasite and its relationship with ABO blood grouping among patients studied at MUTH, Rivers State.Two milliliters (2ml) of venous blood samples were collected from a total of 200 symptomatic and asymptomatic malaria patients. The blood samples were analyzed using field stained thick and thin films for identification of malaria parasite.ABO Blood typing using monoclonal Antisera A, B and D was also carried out on all the samples to determine blood group. Outof the 200 samples analyzed,178(89%) were rhesus positivewhile 22 (11%) were rhesus negative. From the 200 blood samplesexamined, an overall malaria prevalence of 160 (80%) was obtained in the study area while 40 (20%) where not infected.Male patients had the highest prevalence rate of 101(90.99%) compared to 59(66.29%) in female. Patients within the age group 16-20 years had the highest prevalence rate of 102(100%) while patients within the ages 31-35 years had the lowest prevalence 2(25%). Patients with blood group O+ were the most infected 56(96.55%) while patients with B- and AB- had no infection 0(0%). Malaria parasitemiawas found to be statistically significant (P<0.05) in patients with blood group O Rhesus positive and O Rhesus negative. Malaria prophylactic treatment should be intensified to reduce the burden of malaria in the country.

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Introduction

Malaria is recognized globally as a serious public health challenge that is mostly prevalent in tropical and sub-tropical regions and countries of the world, including Nigeria. (Ejike et al., 2022).

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Malaria is a serious infection that is transmitted through the bite of the female Anopheles mosquito that deposit infective sporozoites via its proboscis directly into the blood stream of unsuspecting hosts during its blood meal.

The parasite belongs to the phylum Apicomplexa, class Haematozoea and genus *Plasmodium* (Arora and Arora, 2014). Malaria which is caused by the *Plasmodium* parasite is the first leading cause of death in Nigeria and the second cause of death in Africa after HIV/AIDS (Chukwu etal., 2019; Murray et al., 2014). The medical significance of malaria is as a result of its high morbidity and mortality as well heavy economic burden on households and nations.

About 90% cases of malaria and deaths occur in sub-Saharan Africa with most of the cases being infections due to *Plasmodium falciparum* (Onyido et al., 2015). *Plasmodium falciparum* is the commonest and most deadly of four malaria parasites species contributing

significantly to hospitalization in Nigeria and sub-Saharan Africa as a whole.Approximately 80% of malaria cases and 90% of the deaths occur in Africa while the remaining cases and deaths occur mainly in the Eastern Mediterranean regions and South-East Asia. It is reported that annually, approximately 30,000 visitors to endemic areas develop malaria and 1% of them die due to lack of protective immunity(WHO 2012).

Nigeria is a frontline malaria endemic country, contributing significantly to the world's total malaria infection cases.In 2020, Nigeria accounted for 26.8% and 31.9% of global malaria cases and deaths, far above all other countries (WHO, 2021). The incidence of malaria is increasing due to resistance of its mosquito vectors to insecticides and drug resistance. Four blood groups namely A, B, AB and O exist in nature with specific antigens and antibodies.

The ABO blood groups are the most medically important blood types that are very vital in ensuring safe human blood transfusions. The Rhesus system which is another vital component in consideration prior to blood transfusion usually induce immune system response in humans (Onanuga and Lamikanra, 2016).

Appropriate matching of the Rhesus factor is particularly significant in prevention of Rhesus haemolytic disease condition which is a common occurrence in feto-maternal blood transfusion between a Rhesus D positive foetus and Rhesus D negative mother (Varghese et al., 2013).

The association of ABO blood group with malaria has been widely investigated since the sickle cell hemoglobin was discovered to afford protection against *falciparum* malaria infection (Ikeh et al., 2021). Conflicting reports have been published by different scholars worldwide in respect to malaria infection and its possible connection to ABO blood group. Similarly high prevalence of malaria infection is being constantly reported in different parts of Nigeria as well as other tropical and sub-tropical regions of the world.

Severe morbidity and mortality rates revealed annually are a further testimony of the impact of malaria on public health. It is pertinent to carry out epidemiological surveys at local scales to obtain actual pictures of malaria infection in Nigeria.

This will help to improve the current approaches, strategies and policies to better control and manage the disease. Therefore, this study assessed malaria prevalence in a tertiary healthcare facility in Rivers State, Nigeria. The study also set out to determine association between ABO blood group and malaria parasitemia, ABO blood group distribution within the study area as well as age and sex-specific malaria prevalence, in Rivers State, southern Nigeria.

MATERIALS AND METHOD

Study Area

The study was conducted in Madonna University Teaching Hospital Elele, Rivers State, Nigeria. Elele is a hyper-endemic area for malaria and is one of the major towns in Ikwerre local government area in Rivers State, South-South Nigeria.

The town lies on latitude 5°06'03.2''N and longitude 6°48'50.8''E and has an estimated population of about 20,620 inhabitants. The area experiences warm climate with an average temperature and heavy downpour during rainy season (Chukwu et al., 2019). Elele is located in the tropical rainforest zone with a thick forest vegetation.

The hydrographic network is fairly developed with many swamps, streams, rivers and lakes, all of which serve as breeding ground for the mosquito vector. The economy thrives mainly on agriculture, fishing and artisan business.

Madonna university teaching hospital is a highly advanced tertiary health care facility that serves the health needs of Elele populace and neighboring towns.

Informed Consent

Patients were approached during their visits to the hospital and detailed explanation of the aim and objectives of the study was given to them. Only those who willingly gave their consent were then included in the study.

Sample Collection

Using 5ml sterile needle and syringes, 2ml of venous blood samples were collected from the patients with the assistance of the medical laboratory scientists by vein puncture technique.

The blood samples collected was dispensed into an EDTA tube, gently mixed to avoid clotting and labelled appropriately. Relevant demographic data such as age and gender were obtained from the patients at the end of collection to aid the epidemiological studies.

Determination of Malaria Parasite

Thick and thin blood films were prepared on clean, grease free, glass microscope slides and were allowed to air dry. The glass film slides were then stained with field stain A and B which was then washed with distilled water and air dried. The slides were then viewed under the microscope using oil immersion and x100 objective lens for presence or absence of *Plasmodium* parasites.

The parasite number on each slide was calculated per 200 WBC assuming 8000 WBC/µl of blood (Onanuga and Lamikanra, 2016). The level of malaria parasitemia was designated as single (+) when 1-10 parasites were counted per 100 microscopic fields (scanty/mild parasitemia); or double (++) when 11-100 parasites were counted per 100 fields or triple (+++) when the count per 100 fields was between 101-1000 (Cheesbrough, 2002).

Determination of ABO Blood Group

The ABO blood group of each patient was determined by agglutination using anti-sera A, B and D (Atlas Medical GmbH Germany). Two drops of whole blood from the EDTA tube were placed in three different spots on a clean, grease free white tile and two drops of blood group A, B and rhesus factor D anti-sera was added to each of the three different blood spots.

The blood cells and antigens were mixed thoroughly with an applicator stick to homogenize. The white tile was rocked gently to observe any agglutination and the results were recorded appropriately (Cheesbrough, 2009).

Statistical Analysis

The data obtained from the study was subjected to statistical analysis using SPSS version 20. Chi-square test was used to determine the relationship among the different variables studied and Pvalue less than or equal to 0.05 was considereded significant.

RESULTS

A total of 200 patients comprising 111(55.5%) male and 89(44.5%) female were recruited into this study. The prevalence of malaria parasitemia among the patients on gender basis was 101(90.99%) and 59(66.29%) for male and female respectively.
The observed difference was statistically significant (P=0.004) (Table 1).

Table 1: Malaria parasitemia among patients according to gender

Risk factor	Number examined	Number positive (%)	Number Negative (%)	P-value
Gender				
Male	111	101 (90.99)	10(9.00)	0.004
Female	89	59 (66.29)	27(33.71)	
Total	200	160(80.00)	40(20.00)	

The distribution of malaria parasitemia among patients according to the different age groups showed patients within the age bracket of 16-20 years had the highest infection prevalence 102(100%) while the least infection prevalence of 2(25.00%) was seen in the 31-35years age bracket. The observed difference was not statistically significant (P=0.352)(Table 2).

Table 2: Malaria prevalence among patients according to age

Risk factor	Number examined	Number positive (%)	Number Negative (%)	P-value
Age group (years)				
16-20	102	102(100)	0(0.00)	0.352
21-25	80	53(66.25)	27(33.75)	
26-30	10	3(30.0)	7(70.00)	
31-35	8	2(15.2)	6(75.00)	
Total	200	160(80.00)	40(20.00)	

Table 3: Distribution of ABO blood groups among patients

Blood group	Frequency (n=200)	Rhesus positive (%)	Rhesus negative (%)
A+	56(28)	178 (89)	22 (11)
B+	41(20.5)		
AB+	23(11.5)		
O+	58(29)		
A-	8(4)		
B-	4(2)		
AB-	2(1)		
O-	8(4)		

The frequency of malaria parasitemia among the patients with ABO blood group system revealed group O+ to be the highest (96.55%) and both group B- and AB- to be the lowest (0%) each but the observed differences among the various blood groups were not statistically significant (P>0.05) (Table 4).

Table 4: Distribution of malaria parasitemia among patients according to ABO blood groups

Blood groups	Total number of samples	Number infected	Percentage (%)	P-value
A+	56	44	78.57	0.120
B+	41	36	87.80	
AB+	23	12	52.17	
O+	58	56	96.55	
A-	8	6	75.00	
B-	4	0	0.00	
AB-	2	0	0.00	
O-	8	6	75.00	

However, the frequency of higher malaria parasitemia among patients with blood group A+, B+, AB+, O+ and O- was significantly higher (P<0.05) when compared with the other blood group types (Table 5).

Table 5: Relationship between the Rhesus +ve and Rhesus -ve blood groups

Blood groups	Total number of samples	Number infected	P-value
A+	56	44	<0.05*
A-	8	6	>0.05
B+	41	36	<0.05*
B-	4	0	>0.05
AB+	23	12	<0.05*
AB-	2	0	>0.05
O+	58	56	<0.05*
O-	8	6	<0.05

Figures with (*)are statistically significant

DISCUSSION

When it comes to blood transfusion, the ABO and Rhesus blood group systems are the key conditions that comes into play. Over the years, certain types of blood groups reportedly confer protection to individuals on common diseases such as malaria while others have been shown to be particularly susceptible to certain infections (Guven et al., 2014).

The results of the prevalence of malaria parasitemia in the study revealed an overall prevalence of 80.0% in the study area. This rather very high prevalence is an indication of the endemicity of malaria infection in Nigeria and thus calls for continued and sustained efforts geared towards elimination of malaria within the region.

This result is much higher than the studies conducted by Wogu et al. (2017) and Ejike etal. (2022) that reported lower malaria prevalence of 43.1% and 46.4% in Rivers State and Abia State in Nigeria respectively. On the other hand, the result of our study is similar to the findings of Wokem et al. (2020) that also, reported high malaria prevalence of 87%.

According to Arora and Arora, (2014), a situation such as the presence of duffy factor on red blood cells increases the susceptibility to malaria. It is believed that duffy factor present on red blood cells acts as receptor for attachment of malaria parasite. This might probably be the case among the sampled patients in this study which resulted to such high malaria prevalence.Gender related prevalence showed that malaria infection is most prevalent among male patients (90.99%) compared to the 66.29% observed in female patients.

This is in contrast with the findings of Egbom et al. (2022), Ikeh etal. (2021) and Okonko et al. (2021) who reported higher prevalence among females than males. However, the result agrees with the work of Onanuga and Lamikanra (2016) and Abah et al. (2017) that also reported higher prevalence in male subjects.

This male prevalence could be due to the habit of men spending most times outdoor and shirtless especially during heat period, thereby exposing themselves to mosquito bites.With respect to age, malaria infection was highest (100%) among patients within the 16-20 years age bracket. This observation is in-line with the findings of Ejike et al. (2022) that reported the highest prevalence of (50.3%) within the similar age bracket of 15-24 years.

Our result however, contradicts the work of Wogu et al. (2017) that documented highest malaria infection prevalence of 49.5% within the 0-10 years age bracket and also, Egbom et al. (2022) that reported highest infection prevalence of 59.09% among the 31-40 years age bracket. According to O'Neil (2011), the distribution of ABO blood groups varies from region to region globally and the ratio of group O to A is highest in geographical areas with a past or present history of malaria endemicity.

Reports suggest that, blood group A is more predominant in colder regions of the world which usually have little or no malaria endemicity while sub-Saharan Africa where *Plasmodium falciparum* persist has a higher prevalence of blood group O (Onanuga and Lamikanra, 2016).

The ABO blood group distribution in our study showed group O to be the predominant blood group occurring in 66 (33%) of all studied patients while the AB blood group 25(12.5%) was the least frequently encountered blood group. This result agrees with Ikeh et al. (2021) and Abah et al. (2016)that documented similar findings in a tertiary hospital in Awka, southeastern Nigeria and Yenagoa in South-south Nigeria.

This thus suggests that blood group O is the most predominant blood group in Nigeria. Our study showed a significant difference between Rhesus A+, B+, AB+, O+ and O- while none existed between A -ve, B -ve and AB -ve. This scenario had no overall influence on malaria parasitemia.

The frequency of Rhesus D positive antigen was found in 89% of all the patients. The low prevalence of Rhesus negativity blood groups among the study population (11%) suggests a low probability of the development of haemolytic disease in infants that is usually associated with Rhesus factor mismatch among married couples.This finding is in-line with previous studies in Nigeria which reported 94-98.4% of Rhesus D positive antigen in adult individuals (Onanuga and Lamikanra, 2016; Pennap et al., 2011).Furthermore, studies postulates that there is low occurrence of Rhesus negative blood group in different regions of the world where malaria parasitemia is endemic.

The results of this study on the relationship between ABO blood groups and malaria infection showed patients with blood group O positive suffered malaria attacks more frequently than those in the other blood groups. However, the observed differences in the prevalence of malaria infection among the patients of the different blood groups were not significant (P>0.05).

This thus is an indication that there exist no association between malaria infection and ABO blood groups. This is especially so considering the similarly high malaria prevalence seen in the other different blood groups. The findings of the present study is a reminder of the endemicity of malaria in Nigeria and thus, sustained efforts towards total malaria elimination in the region.

CONCLUSION

A very high prevalence of malaria parasitemia has been revealed in the study which shows that malaria infection is highly endemic the study area. The result of this study also shows that blood group O+ is the most prevalent blood group type in the area and there is no significant association between ABO blood group and malaria infection, although patients with blood group O appeared to be more susceptible to higher levels of malaria.

Therefore, while the masses must take measures to reduce malaria vectors around their residential area, relevant health stakeholders should ensure appropriate intervention, control and prevention and management of malaria in the region.

CONFLICT OF INTEREST

The authors declare that no conflict of interest exists

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