
The Influence of Abo Blood Group On Malaria Parasites Infection in Obudu Local Government Area of Cross River State

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ABSTRACT: *Malaria has been reported to cause a huge burden in Africa, crippling the economic development in the continent. There are also contradictory reports on the influence of the ABO blood group on the severity of the infection. This study sought to find out the prevalence of malaria in Obudu Local Government Area of Cross River State, Nigeria, and if malaria parasites have any preference for a particular blood group in infection. The survey design was employed in which the purposive sampling technique was used to select 240 subjects from people who reported in the Sacred Heart Hospital, Obudu with complaints of ailments and were referred to the laboratory for malaria parasite test. The laboratory unit assisted in the collection of data on whether malaria was positive or not, identifying the parasite to species level, as well as determining the ABO blood group of the patient. The data obtained were entered accordingly in a template developed by the researchers and analysed using percentages and chi-square. Results obtained indicated that 34 % of the people who visited the hospital were positive for malaria, which had no significant relationship with ABO blood group type, and no Plasmodium species significantly prefers any ABO blood group type. It is recommended that whatever efforts put in place to “rollback malaria” should be sustained and intensified to further reduce the incidence. The efforts should also be applied in the same way to individuals of all ABO blood groups. More work should also be carried out on the severity of malaria infection and ABO blood group*

KEY WORDS: Malaria, Plasmodium, ABO blood group, prevalence, parasite.

INTRODUCTION

Malaria remains a devastating global health problem, with an estimated population of 300-500 million people contracting malaria each year, resulting in 1.5-2.7 million deaths annually (Tampuz, Jereb, Muzlovic and Prabhu, 2003). More than 90% of all the malaria cases are in sub-saharan Africa, especially in remote rural areas with poor access to health services (Lambert, 2003). According to Appiah-Darkwah and Badu-Nyarko (2011), Malaria is a global disease and exists in over 100 countries with higher incidence in the tropical areas of Africa, Asia and Latin America. In Sub-Saharan Africa, the situation has actually deteriorated and there have been resurgences of the disease in several countries in Asia. In Ethiopia, more than 75% of the total area is malarious, making malaria the leading public health problem in Ethiopia (Ayele, Zewotir and Mwambi, 2012).

According to Roll Back Malaria in Nigeria (2010), Malaria presents a huge burden to Africa and continues to cripple the economic development of the continent. In Nigeria, the disease is responsible for 60 per cent of outpatient visits to health facilities, 30 per cent of childhood deaths, 25 per cent of deaths under one year, and 11 per cent of maternal deaths. In financial terms, the disease is estimated to cost the country about 132 billion naira (US\$862.4 million) every year, taking into account the treatment and prevention costs, and loss of working hours. In fact, Malaria is by far the world's most important tropical parasitic disease, and it kills more people than any other communicable disease, except tuberculosis. In many developing countries and in Africa especially, malaria exacts an enormous toll on lives, in terms of medical costs, and in days of labor lost (Lambert, 2003).

Malaria is caused by an obligate, intracellular protozoan parasite of the genus *Plasmodium*. The four species that infect humans are *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium ovale* and *Plasmodium malariae* (Tekeste, 2010). It is characterized by chills, fever and in the most severe cases, coma leading to death. Lucas and Gilles (1990) aver that “clinically, malaria is characterized by *hepatomegaly*, *splenomegaly*, varying degrees of *anemia* and various syndromes resulting from the involvement of individual organs. According to Werner, Thuman, Maxwell, and Pearson (1993), the signs and symptoms of malaria can be classified into three main stages as follows:

- It begins with chills and often headache and weakness. The person shivers or shakes for 15 minutes to an hour.
 - Chills are followed by fever, often 40⁰C or more. The person is weak and at times delirious (not in his right mind). The fever lasts several hours or days.
 - Finally, the person begins to sweat, and his temperature goes down.
- Werner *et al* (1993) add that

usually malaria causes fevers every 2 or 3 days (depending on the kind of malaria), but in the beginning it may cause fever daily. Also, the fever pattern may not be regular or typical. For this reason, anyone who suffers from unexplained fevers should have his blood tested for malaria.

In children, anemia and paleness can set in within 1-2 days. Cerebral malaria may result in fits followed by periods of unconsciousness. Breathing may get rapid and deep with palms showing blue-gray color (Werner *et al*, 1993).

Of the four species that infect humans, *P. falciparum* is responsible for virtually all deaths, its virulence being associated with the capacity of the infected Red Blood Cells (IRBC) to adhere to uninfected Red Blood Cells (RBC), leading to **rosetting** of cells (Tekeste and Petros, 2010). Rosetting has been linked to the occurrence of severe malaria. Tekeste and Petros (2010) investigated the relationship between blood group type and severe disease in falciparum malaria. They discovered that a case of severe malaria was almost twice as likely to be of type A as to be of type O, and more than twice as likely to be of type B as to be of type O.

Studies have demonstrated a cytoadherence property of IRBC, ie, binding of IRBC with uninfected RBC. Rosetting of uninfected RBC around IRBC has been reported for *P. falciparum* and *P. fragile*, both of which are known to sequester in the microcirculation. Furthermore, rosetting of uninfected cells occurs around IRBC that contain mature parasites (i.e. late trophozoite/schizont) but is absent when IRBC contain early stages of the parasite (i.e. ring ~stage). Rosetting of uninfected cells with IRBC could potentially contribute to the microvascular obstruction and pathology of *P. falciparum* malaria (Tekeste and Petros, 2010).

On the preference of *Plasmodium* species for any particular blood group, Rowe, Opi and Williams (2010) aver that reports are contradictory. They however report that blood group O confers resistance to severe malaria, which is largely due to rosetting of the red blood cells as a result of infection with *P. falciparum*.

This may explain why most malaria drugs are designed to target *P. falciparum*. For instance, the literature of Artesunate tablets C. P. states that it “has effect on chloroquine-resistant *falciparum* malaria” and should be “used in the treatment of falciparum and vivax malaria” (CUSNAT, 2012). Hence, the need for this study.

Statement of the problem:

Malaria kills one child every 30 seconds. This disease, which is preventable, has reached epidemic proportions in many regions of the world. The prevalence and severity of the disease have been associated with species of *Plasmodium* that is causing the disease. *P. falciparum* is reported to be the most prevalent, also causing the most severe symptoms, and most malaria drugs are targeted at it. Is this the case also in Obudu? Tekeste and Petros (2010) assert that previous studies have also implicated the ABO blood group type in the prevalence and severity of the disease. So, is there any significant influence of ABO blood group type on malaria infection? Do *Plasmodium* parasites significantly differ in preference of ABO blood types? These are the questions motivating this study.

Purpose of the study: This study aims at finding out the prevalence of malaria in obudu Local Government area of Cross River State and if there is any relationship between ABO blood group type and malaria parasites infection. In specific terms, the study sought to:

- Find out the prevalence of malaria in Obudu Local Government Area of Cross River State
- Determine if there is any significant relationship between malaria infection and ABO blood group types;
- Find out if *Plasmodium* species differ in their preference of ABO bood group type;

Research Questions:

The following questions were raised to guide the study:

- What is the prevalence of malria in Obudu Local Government of Cross River State?
- Is there any significant relationship between malaria infection and ABO blood group type?
- Do *Plasmodium* species significantly differ in their preference of ABO bood group type?

Significance of the study:

The findings of this study shall be useful in many ways to the people of Obudu, Cross River, Nigeria, and the world at large. It will bring to bear the status of malaria in Obudu and reflect the impact of the various interventions in prevention of malaria incidence.

Individuals with a given blood group that is more predisposed to malaria infection may be warned to take more precautions to prevent malaria or treat it as soon as they are infected. Even government and non-governmental organizations may also begin to pay special attention to individuals with such blood group(s). Government as well as non-governmental agencies involved in the rollback malaria programme may use the findings from this study to re-focus their attention in terms of indices for determining who is more at risk as well as choice of drugs for treatment.

MATERIALS AND METHODS

This study was carried out in Obudu Local Government Area of Cross River State. The descriptive survey design was employed since no variables were manipulated by the researchers. The population comprised all the people of Obudu, including people of all occupations, gender, and ages.

To get the sample for the study, the criteria sampling technique was used. All patients who visited the Sacred Heart Catholic Hospital, Obudu, and were referred to the laboratory unit to screen for malaria parasites from 10th to 24th of February 2018 (totaling 232 individuals) formed the sample. Two tests were performed on the patients: ABO blood group and malaria parasite determination (to the species level). The tests were carried out by the laboratory technicians, who were staff of the hospital. The ABO blood group was determined using the antisera for red blood cell surface antigen A and B as well as that for the Rhesus factor. The malaria parasite determination was carried out by making a smear of the patient's blood on a micro slide and allowed to air-dry. The slides were then stained with **Giemsa** stain and observed under the microscope using low power and 100x oil immersion objective. The results of all the tests were entered in a "Prevalence of malaria parasite by blood group" pro forma developed by the researchers for entering patient's blood group and malaria parasite by species (see attached appendix).

The data obtained were analyzed using percentages and chi square.

RESULTS

The results of the data analysis are hereby presented according to the research questions.

Research question I: What is the prevalence of malaria in Obudu Local Government of Cross River State? This question was answered using percentages and the result is as shown in table I.

Table I: The Prevalence of Malaria Parasite Infection in Obudu Local Government Area of Cross River State, Nigeria.

Malaria status	Number	Percentage
Negative	151	81.6
Positive	34	18.4
Total	185	100

From the table above, of a total of 185 subjects investigated, 34 (18.4 %) were positive for malaria while 151 (81.6 %) tested negative for malaria.

Research Question II: Is the ABO blood group type significantly associated with malaria infection?

This question was answered using chi-square and the result is as shown in table II below.

Table II: Relationship between malaria parasites infection and ABO blood group in Obudu Local Government Area.

Malaria Status	BLOOD GROUP				Total	X ²	Sign. at
	A	B	AB	O			
Negative	30 (32.6)	28 (27.8)	3 (3.3)	90 (87.3)	151	1.74	0.63
Positive	10 (7.4)	6 (6.2)	1 (07)	17 (19.7)	34		
Total	40	34	4	107	185		

From the table, 10 persons out of the 40 who were blood group “A” (25 %); 6 out of 34 (17.6 %) who were group “B”; one out of the 4 group “AB” persons (25 %); and 17 out of 107 (15.9 %) group “O” person tested positive for malaria parasite. These differences, when tested using chi-square were found not to be significant ($P > 0.05$). In other words, there is no significant relationship between ABO blood group type and infection of malaria parasites.

Question III: Do *Plasmodium* species significantly differ in their preference of ABO blood group types?

This hypothesis was tested using the chi-square statistics and the result is as shown in table II.

Table II: Chi-square of relationship preference of *Plasmodium sp* for ABO blood group tyupes.

PLASMODIUM	BLOOD GROUP				Total	X ²	Sign. at
	A	B	AB	O			
<i>Falciparum</i>	9 (7.1)	6 (6.1)	1 (0.7)	17(19.1)	33	4.77	0.57
<i>Vivax</i>	1 (.02)	0 (.02)	0 (0.0)	0 (0.0)	1		
Nil	30 (32.6)	28 (27.8)	3 (3.3)	90 (87.3)	151		
TOTAL	40	34	4	107	185		

From the table, 34 people were positive for malaria parasite out of which 33 cases were *Plasmodium falciparum* and only one case was *Plasmodium vivax*. The other species of *Plasmodium* were not observed. Out of the 33 falciparum cases, 9 were associated with blood group “A” (out of a total of 40 group A patients); 6 with group “B” (out of a total of 34 group B patients); 1 out of 4 (25 %) were group “AB” and 17 out of 107 (15.9 %) were group “O”. The only case of *Plasmodium vivax* was associated with blood group “A”. Other species of *Plasmodium* (*malariae* and *ovale*) were not detected in any of the patients. This distribution of *Plasmodium* species among people of different ABO blood groups was found not to be significant when compared with the expected frequencies. In other words, *Plasmodium* species do not significantly differ in their preference of ABO blood group type ($P>0.05$).

DISCUSSION

The results obtained indicated that 18.4 % of the people of Obudu are infected with malaria. This is far less than the report of Roll Back Malaria in Nigeria (2010) that the disease is responsible for 60 % of outpatient visits to health facilities. It is also for less than the 75 % reported by Ayele, Zewotir and Mwambi, (2012) for Ethiopia. The significant reduction in prevalence of malaria in Obudu can likely be attributed to the various intervention efforts of Government and non-governmental organizations towards malaria eradication.

The result also showed that there was no significant relationship between ABO blood group type and infection of malaria parasites ($P>0.05$). In other words, an individual’s infection with malaria parasite is not associated with his/her blood group. This however is at variance with Tekeste and Petros’s report (2010) that previous studies have implicated the ABO blood group type in the prevalence and severity of the disease. This study however did not study the severity of the infection cases in terms of blood group type as in the case of Tekeste and Petros (2010). It is possible therefore, that while ABO blood group may not be implicated in infection, it may play a role in the severity of the infection due to rosetting.

On whether *Plasmodium* species prefer a certain blood group to another, the result showed that the various species do not prefer any particular blood group for infection. This agrees with Rowe et al. (2010) that there are contradictory reports concerning the association of ABO blood group with malaria infection. While the species may not prefer a particular blood group for infection, the severity is strongly associated with blood group (with the non-O individuals being more susceptible) due to rosetting (in individuals infected with *P. falciparum*) (Tekeste & Petros, 2010 and Rowe et al., 2010).

CONCLUSION AND RECOMMENDATIONS

From the findings of this study, it can be concluded that the prevalence of malaria in Obudu is 18.4 % and an individual’s infection with malaria parasite is not significantly associated with his ABO blood group, nor does any *Plasmodium* species significantly prefer a given ABO blood group.

Following the findings of this study, it is recommended that whatever efforts put in place to “rollback malaria” should be sustained and intensified to further reduce the incidence. The efforts should also be applied in the same way to individuals of all ABO blood groups. More work should also be carried out on the severity of malaria infection and ABO blood group

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