



## **ABO Blood Groups and Malaria Parasitaemia in Outpatients of BMSH Port Harcourt, Rivers State**

**M. N. Wogu<sup>1\*</sup>, F. O. Nduka<sup>1</sup> and S. O. Nzeako<sup>1</sup>**

<sup>1</sup>*Department of Animal and Environmental Biology, Faculty of Science, University of Port Harcourt, Rivers State, Nigeria.*

### **Authors' contributions**

*This work was carried out in collaboration between all authors. Authors MNW and FON designed the study, wrote the protocol, interpreted the data, anchored the field study, gathered the initial data and performed preliminary data analysis. Author SON managed the literature searches and produced the initial draft. All authors read and approved the final manuscript.*

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### **ABSTRACT**

A cross – sectional study was conducted to investigate the relationship between ABO blood groups and malaria parasitaemia in Port Harcourt, Rivers State, Nigeria. Thick and thin films made from venous blood samples collected from 1000 consenting outpatient study subjects, were stained with 10% Giemsa stains and viewed microscopically using oil immersion objective to detect malaria parasites following standard parasitological techniques. ABO blood group typing with monoclonal Antisera A, B and D was carried out using agglutination technique. An overall malaria prevalence of 32% was observed among the study subjects irrespective of blood groups. Blood groups A and O had higher malaria prevalence rates of 38% and 33% respectively while blood group AB had the least malaria prevalence rate of 13% ( $P<0.05$ ). Malaria parasite density levels  $>1000$  parasites/ $\mu$ L in relation to ABO blood groups showed a higher prevalence in blood group A and least prevalence in blood group O with rates of 29% and 3% respectively ( $P<0.05$ ). This study showed that individuals with blood group O were susceptible to contracting uncomplicated malaria infections but had a high resistance to developing severe malaria parasitemia compared to individuals with blood

\*Corresponding author: E-mail: [michael.wogu@yahoo.com](mailto:michael.wogu@yahoo.com);

groups A, B and AB. Malaria control strategies should be directed equally at individuals with the different ABO blood groups because more research is required to fully understand the relationship between ABO blood groups and malaria parasitemia.

*Keywords: Malaria; ABO; prevalence; Rivers State.*

## 1. INTRODUCTION

Malaria is responsible for high mortality and morbidity rates in tropical Africa where it is highly endemic in most countries and Nigeria has reported more mortality cases compared to other countries [1]. Despite the mortality and morbidity rates, some people in malaria – endemic regions are less susceptible to malaria infection than others who experience frequent bouts. This less susceptibility maybe due to the development of some levels of immune response by the host through some innate characteristics such as sickle cell trait, ABO blood groups and G – 6 – P – Dehydrogenase activity level [2]. All humans possess ABO blood groups with different frequencies which are transferred from one generation to another but these different frequencies depend on several factors such as the socio – economic status, alleles, distribution, ethnic groups, race and sexual relationship among people [3]. Understanding the relationship between ABO blood groups and malaria parasitemia (uncomplicated and severe) would aid in developing new malaria control strategies to effectively combat malaria especially in endemic regions. This study was conducted to investigate the relationship between ABO blood groups and malaria parasitaemia among randomly selected outpatient study subjects in Braithwaite Memorial Specialist Hospital (BMSH), Port Harcourt Rivers State, Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Area and Study Population

The study was conducted in the Outpatient Department of Braithwaite Memorial Specialist Hospital (BMSH), Rivers State, Nigeria. A total of 1000 randomly selected study subjects were recruited for this study after giving their consent. The Rivers State Ministry of Health issued an ethical clearance before the commencement of this study.

### 2.2 Data Collection and Analysis

Venous blood (5 mls) was collected from each study subject for malaria diagnosis using Giemsa

microscopy and ABO blood group. For malaria diagnosis, thick and thin blood films were made, air dried, stained with 10% Giemsa stains for 10 minutes and then observed microscopically using oil immersion objective [4]. ABO blood grouping was done with monoclonal Antisera A, B and D (Agappe Diagnostics Ltd, India) and each blood group was determined by agglutination [4]. The data generated in this study was analyzed using statistical package for social sciences (SPSS) version 17. Parasite density per microliter ( $\mu\text{L}$ ) was gotten by counting the number of parasites per 200 white blood cells on a thick blood film assuming a total standard WBC count of  $8000/\mu\text{L}$ . The degree of parasite intensity was graded as uncomplicated (1 – 999 parasites/ $\mu\text{L}$ ) and severe ( $\geq 1000$  parasites/ $\mu\text{L}$ ) [5]. Analysis of variance (ANOVA) and Chi – square test were used to analyze paired and unpaired comparisons. A 95% confidence interval was used and a p – value less than 0.05 was considered significant.

## 3. RESULTS

An overall malaria prevalence of 32% was reported in this study, ABO blood groups A and O had higher malaria prevalence rates of 38% and 33% respectively while blood group AB had the least malaria prevalence rate of 13% ( $P < 0.05$ ) (Table 1). Among study subjects examined, individuals with blood group O had the highest population while those with blood group AB had the least population (Tables 1 and 2). Malaria parasite density levels  $> 1000$  parasites/ $\mu\text{L}$  in relation to ABO blood groups showed an overall prevalence of 6% with high parasitemia in blood group A and least prevalence in blood group O with rates of 29% and 3% respectively ( $P < 0.05$ ) (Table 2).

**Table 1. Malaria prevalence in relation to ABO blood groups**

ABO blood group	NE	NI (%)
A	87	33 (38)
B	76	19 (25)
AB	15	2 (13)
O	822	268 (33)
<b>Total</b>	<b>1000</b>	<b>322 (32)</b>

*NE = Number Examined; NI = Number Infected*

**Table 2. Malaria parasite density levels >1000 parasites/ $\mu$ L in relation to ABO blood groups**

ABO blood group	NE	NI (%)
A	87	25 (29)
B	76	11 (14)
AB	15	1 (7)
O	822	27 (3)
<b>Total</b>	<b>1000</b>	<b>64 (6)</b>

NE = Number Examined; NI = Number Infected

#### 4. DISCUSSION

Results from this study showed that study subjects with blood groups O and AB had the highest and lowest population. This finding is comparable to other related research which reported higher study populations in blood group O and least population in blood group AB [2,6,7]. Malaria prevalence rates was higher in blood groups A (38%), followed by blood groups O (33%) and B (25%) while the least rate was reported in blood group AB (13%). This finding is comparable to similar studies that reported higher rates in blood groups A and O compared to blood groups B and AB [8,9,10]. Malaria parasite density levels >1000 parasites / $\mu$ L showed significant higher prevalence rates in blood groups A and B compared to blood groups AB and O with blood group O having the least rate. This is comparable to findings in some other similar research [7,11,12,13,14]. The ABO locus is linked with serum levels of molecules which bind to *Plasmodium falciparum* infected erythrocytes that are markers of damage to inflammatory processes and vascular endothelial cells [15,16]. Parasitized erythrocytes form a stronger and large rosette with uninfected erythrocytes in blood groups A, B and AB but smaller and weaker rosettes in blood group O [17]. Blood groups A and B antigens are rosetting receptors on the surface of uninfected erythrocytes [17] and these antigens are held by PfEMP1 which is expressed on the surface of *P. falciparum* infected erythrocytes [18].

#### 5. CONCLUSION

Although individuals with blood group O had the least level of malaria parasite density compared to other blood groups (A, B and AB), available malaria prophylactic and therapeutic strategies should be equally directed at individuals belonging to all blood groups. More detailed research are still required to fully understand the relationship between ABO blood groups and malaria parasitemia.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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