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***Original Research Article***

# ABO BLOOD GROUPS AND MALARIA PARASITAEMIA USING DIFFERENT DIAGNOSTIC METHODS IN A REFERRAL HOSPITAL


## ABSTRACT

A cross-sectional randomized study was carried out to evaluate the relationship between malaria parasitaemia and ABO blood groups in a referral hospital in Rivers State, Nigeria. Venous blood samples were collected from all consenting study participants, films (thick and thin) were made from each blood sample, stained with 10% Giemsa stains and viewed microscopically with oil immersion objective to detect *Plasmodium* species using standard parasitological techniques. Agglutination technique using monoclonal Antisera A, B and D was used to determine the ABO blood groups. Data generated were statistically analyzed using Chi-square test and significance level was set at $P<0.05$. An overall malaria prevalence of 43.1% was observed among study subjects. Blood groups A and O had higher malaria prevalence of 61.1% and 42.6% respectively while blood groups B and AB had lower prevalence of 28.0% and 0% respectively ($P<0.05$). Malaria parasite density levels >1000 parasites/µL in relation to ABO blood groups showed a higher prevalence of 46.7% and 22.7% in blood groups A and B respectively while lower prevalence of 0% and 15.7% occurred in blood groups AB and O respectively ($P<0.05$). The findings of this study showed that individuals with blood group O were susceptible to contracting uncomplicated malaria but had a higher resistance to developing severe malaria compared to non – O blood groups (A and B). More detailed molecular researches are needed to fully establish the relationship between malaria parasitaemia and ABO blood groups, therefore malaria interventions and control strategies should be directed equally among individuals irrespective of their blood groups.


**Keywords**: Malaria, ABO, Prevalence, Rivers State

## 1. INTRODUCTION

Malaria is a parasitic disease caused by *Plasmodium* species, it is transmitted mainly via the bites of an infected female *Anopheles* during a blood meal and this disease has plagued man for centuries [1]. Malaria is a serious public health concern in sub-Saharan Africa, causing high morbidity and mortality rates [2,3].

UNDER PEER REVIEW

Some individuals in malaria-endemic zones are less susceptible to *Plasmodium* species infection despite the prevailing high morbidity and mortality rates compared to others who experience frequent malaria bouts. Some factors such as G-6-P-Dehydrogenase activity levels, sickle cell trait, host immune response and ABO blood groups have been linked to individuals with less malaria susceptibility [4]. ABO blood groups are physiological traits with different frequencies possessed by humans and are transferred from one generation to the next but some factors such as sexual relationship, race, ethnic group, socio-economic status and alleles affect the frequencies of the ABO blood groups among people [5]. In developing new malaria control strategies and scaling up existing ones, understanding the relationship between ABO blood groups and malaria parasitaemia could aid in effectively combating malaria especially in endemic regions of sub-Saharan Africa. This study was conducted to evaluate the relationship between ABO blood groups and malaria prevalence among randomly selected consenting study subjects in University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria.

## 2. MATERIALS AND METHODS

### 2.1 Study Area and Population

A cross-sectional study was carried out in UPTH using 1000 randomly selected consenting study participants. Ethical clearance was obtained from the Rivers State Ministry of Health and UPTH Ethics Committee before the commencement of the study.

### 2.2 Data Collection and Analysis

Venous blood was collected from each consenting study participant for *Plasmodium* species detection using Giemsa microscopy technique and ABO blood grouping by Agglutination technique [6]. For *Plasmodium* species detection, blood films (thick and thin) were made, air dried, stained with 10% Giemsa stains for 10 minutes and then observed microscopically using oil immersion objective [6]. ABO blood grouping was done with monoclonal Antisera A, B and D (Agappe Diagnostics Ltd, India) and each blood group was determined by agglutination technique [6]. The degree of *Plasmodium* species density was graded as uncomplicated (1 – 999 parasites/µL) and severe (>1000 parasites/µL) [7]. All data generated were statistically analyzed using Chi-square test and a p-value less than 0.05 was considered significant.

## 3. RESULTS

An overall prevalence of 43.1% was recorded in the study and *Plasmodium falciparum* was the only malaria parasite species identified (Table 1). Among

UNDER PEER REVIEW

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). Individuals with ABO blood groups B and AB had lower malaria prevalence of 28.0% and 0% respectively while those with blood groups A and O had higher malaria prevalence of 61.1% and 42.6% respectively (P<0.05) (Table 1). Malaria parasite density levels >1000 parasites/µL in relation to ABO blood groups showed an overall prevalence of 19.0% with higher parasitaemia of 46.7% and 22.7% in individuals with blood groups A and B respectively compared to 0% and 15.7% in individuals with blood groups AB and O respectively (P<0.05) (Table 2).

Table 1: Malaria parasitaemia in relation to ABO blood groups

| ABO BLOOD GROUPS | NUMBER EXAMINED | NUMBER INFECTED (%) |
|---|---|---|
| A | 90 | 55 (61.1) |
| B | 75 | 21 (28.0) |
| AB | 1 | 0 (0) |
| O | 834 | 355 (42.6) |
| **TOTAL** | **1000** | **431 (43.1)** |

*$X^2$ = 18.970, Df = 2, P – value = 0.000 (P<0.05)*

Table 2: Malaria parasite density levels >1000 parasites/µL in relation to ABO blood groups

| ABO BLOOD GROUPS | NUMBER EXAMINED | NUMBER INFECTED (%) |
|---|---|---|
| A | 90 | 42 (46.7) |
| B | 75 | 17 (22.7) |
| AB | 1 | 0 (0) |
| O | 834 | 131 (15.7) |
| **TOTAL** | **1000** | **190 (19.0)** |

*$X^2$ = 51.253, Df = 2, P – value = 0.000 (P<0.05)*

## 4. DISCUSSION

Data obtained in this study showed that study subjects with blood groups AB and O had the least and highest population respectively. This observation is comparable to some other similar researches conducted in Nigeria and Ethiopia [4,8,9]. Malaria prevalence was highest in blood groups A (61.1%) and O (42.6%) but lower in blood groups AB (0%) and B (28.0%). This finding is comparable to similar studies that reported higher malaria parasitaemia among individuals with blood groups A and O when compared to those with blood groups B and AB [10,11,12]. Malaria parasite density levels >1000 parasites/µL showed significant higher prevalence in blood groups A and B compared to blood groups AB and O. This finding agrees with the reports of similar

UNDER PEER REVIEW

researches [9,13,14,15,16]. *Plasmodium falciparum* infected erythrocytes bind with some serum molecules whose levels are linked with the ABO locus and these are used as biomarkers for inflammatory processes and damaged vascular endothelial cells [17,18]. *Plasmodium falciparum* – infected erythrocytes form stronger and larger rosette (clustering of cells) with uninfected erythrocytes in non – O blood groups (A and B) but weaker and smaller rosettes in blood group O [19]. Also, blood groups A and B antigens are good rosetting receptors on the surface of *Plasmodium falciparum* – uninfected erythrocytes [19] and these antigens are held by PfEMP1 which is expressed on the surface of *P. falciparum* infected erythrocytes [20]. Therefore, the high severe malaria observed among individuals with blood groups A and B could be attributed to the presence of more cellular factors (e.g. complement receptor 1 and glycoproteins) in their erythrocytes which aid invasion by *P. falciparum* and rosetting.

## 5. CONCLUSION

More detailed molecular researches are needed to completely establish the relationship between malaria parasitaemia and ABO blood groups. Therefore, malaria therapeutic interventions and control measures should be directed equally at all individuals irrespective of their blood groups in malaria endemic regions.

## COMPETING INTEREST

Authors have declared that no competing interests exists.

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UNDER PEER REVIEW

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UNDER PEER REVIEW

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