



Association of Falciparum Malaria and ABO Blood Group in Awka, Anambra State, Nigeria

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ABSTRACT

A cross-sectional randomized study was carried out to evaluate the association of falciparum malaria and ABO Blood group in Awka, Anambra State, Nigeria from the months of June to August 2018. Blood samples were collected from all study participants. Thick films were made from each blood sample, stained with 10% Giemsa using standard parasitological techniques. Agglutination technique using monoclonal Anti-sera A, B, and D were used to determine the ABO blood groups. Data generated were statistically analyzed using ANOVA test and the significance level was set at $P < 0.05$. An overall malaria prevalence of 62% was observed among study participants. Blood groups O positive and A positive had higher malaria prevalence of 48.38% and 19.35% respectively of the total population size of patients infected, while blood groups B negative and AB negative had a lower prevalence of 0% respectively. There was no statistical significance ($P > 0.05$). 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). To this end, therefore, malaria interventions and control strategies should be directed equally among individuals irrespective of their blood groups.

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1. INTRODUCTION

Malaria is a disease due to blood infection caused by protozoan parasites of the genus *Plasmodium*, which is transmitted through the bite of infected female *Anopheles* mosquito (Ani *et al.*, 2015; Ikeh and Nwaorgu, 2004). There are four (4) species of the *Plasmodium* parasite that affect humans, namely; *Plasmodium falciparum*, *Plasmodium ovale*, *Plasmodium malariae*, and *Plasmodium vivax*. *Plasmodium falciparum* is the most deadly of the four and highly entrenched in the tropics (WHO, 2015; Vaughan *et al.*, 2017). The global incidence of malaria is estimated to be nearly 120 million clinical cases each year, with nearly 300 million carrying the parasite (WHO, 2014). It is one of the leading causes of mortality and morbidity in the tropics, affecting more than 200 children under 5 years of age and pregnant women (Ani *et al.*, 2015). The ABO grouping system is a system used for classification of human blood in a lay man's definition. Cell surface glycans such as ABO blood groups and related antigens could modulate some of these specific cell interactions (Cserti and Dzik, 2007). Since the discovery of the ABO blood group, numerous associations between the groups and disease have been reported (Bremant, 2001; Ikeh and Njoku, 2003). Postulations have been put up that certain antigens on erythrocyte surfaces which enable the

classification of blood groups into ABO grouping system are involved in the susceptibility of Red Blood Cell (RBCs) to species of *Plasmodium falciparum* (Ani *et al.*, 2015).

There have been various studies on the association of ABO antigens with infection since their discovery as the most functional genetic polymorphism in humans (Onanuga and Lamikanra, 2016). Their association with malaria has been the subject of numerous investigations, since the sickle-cell haemoglobin was discovered to afford protection against *Plasmodium falciparum* malaria infection (WHO, 1990).

Several researches, including some from Nigeria, have reported different views on the origin, distribution and relative proportion of ABO blood groups in humans including their relationship to *Plasmodium falciparum* infection. This report is a similar study but among the very few that were carried out using patients in hospitals in the South Eastern part of Nigeria, Awka, Anambra State to be precise.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out at Chukwuemaka Odumegwu Ojukwu, University Teaching Hospital Amaku, Awka South Local Government Area of Anambra State within the period of June, July and August 2018. Awka is the capital of Anambra State, Nigeria and is located at the geographical coordinates of 6 12' 25" N and 7 04' 04" E with estimated population of 301,657 as of the 2006 Nigerian census. Awka, being a commercial city, have drainage systems, which are poorly maintained and nonexistent in some areas, thus, serve as a breeding site for the Anopheles mosquito. Also, the presence of rivers like the Amansea River, ponds and streams within Awka metropolis also constitute the breeding site for mosquitoes. Two seasons of rainy and dry which occur respectively between April and July, followed by a short period in August lasting two to three weeks with the rain resuming in September and October. This is followed by five months of dryness between November and March marked by harmattan wind. The temperature is between 27c to 30C between June and December but rises to 32C to 34C between January and April.

2.2 Study Population

This study included One hundred persons of all ages which comprises of civil servants, farmers, lecturers, businessmen, students and pupils, many of which are residents of Awka and its environs.

2.3 Ethical clearance

Ethical clearance was obtained from the Ethical Review Committee of the Chukwuemaka Odumegwu Ojukwu University Teaching Hospital and informed consent of the participating patients.

2.4 Sample Collection

Venous blood was collected by venepuncture from randomly selected patients at Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Amaku, Awka, Anambra State. Three milliliters (3ml) of blood was collected from each randomly selected patient and was dispensed into an Ethylene Diamine Tetra-acetic Acid (EDTA) bottle, gently and properly mixed and transported to the Haematology section of the hospital's laboratory.

2.5 Laboratory Analysis

Thick blood films was prepared, stained and examined following the method described by Cheesbrough (Cheesbrough, 2005). Thick films were made and labeled on a clean glass slide as recommended by the World Health Organization (WHO) for *Plasmodium falciparum* species detection. The thick smears were then stained with 10% Giemsa stain for 10 minutes and then observed microscopically using oil immersion objective (Cheesbrough, 2005). The blood was also diagnosed of *Plasmodium falciparum* infection using the antigen-based Malaria Rapid Diagnostic Test (RDT) cassette. The ABO blood grouping test was done using the slide method as described by Dacie and Lewis (2002). A drop of the monoclonal antisera A, B and D was also added to each of the monoclonal antisera and gently mixed and swirled for about 2 minutes and observed to check for agglutination.

3. RESULTS AND DISCUSSION

A total of one hundred (100) blood samples were examined for *Plasmodium falciparum* malaria. Among which were 39 (39%) males and 61 (61%) females. Out of the 100 samples, 62 (62%) were positive to *P. falciparum* malaria, of

which 21 (33.9%) were males and 41 (66.1%) were females. Prevalence of *P. falciparum* among sexes showed a high prevalence in females with 67.2% and 53.8% for males (Table 1).

Table 1: Prevalence of *P. falciparum* malaria parasite in relation to sex in Awka

Sex	No examined (%)	No infected	% infected
Male	39(39)	21	53.84%
Female	61 (61)	41	67.21%
Total	100 (100)	62	62%

Among the males (Table 2), it was noticed that the prevalence of *P. falciparum* malaria was highest among patients with blood group A negative with a percentage of 100% representing 1 out of the 1 A negative male patient examined. In respect to the total population size of males infected, patients with blood group O positive had the highest prevalence 33.33% of *P. falciparum* malaria, followed by those in blood group A positive with 28.57%. In females, prevalence was highest amongst blood group AB with 100%, but within the total population size of females infected, blood group O positive (56.10%) showed the highest prevalence followed by group A positive (14.63%). There was therefore least prevalence in blood groups B negative and AB negative due to zero patients with these blood groups (Table 3). Infection based on blood group was not statistically significant ($P > 0.05$).

Table 2: Blood group distribution among sexes

Blood group	Male (% prevalence)	Female (% prevalence)	% occurrence
A positive	11 (28.2%)	9 (14.75%)	20%
A negative	1 (2.56%)	2 (3.28%)	3%
B positive	6 (15.38%)	6 (9.84%)	12%
B negative	0 (0%)	0 (0%)	0%
AB positive	3 (7.69%)	2 (3.28%)	5%
AB negative	0 (0%)	0 (0%)	0%
O positive	18 (46.15%)	36 (59.02%)	54%
O negative	0 (0%)	6 (9.84%)	6%
TOTAL	39 (39%)	61 (61%)	100%

Table 3: Blood group distribution in males in relation to *P. falciparum* parasitaemia

Blood group	No examined	No infected	%infected	% in population size infected
A Positive	11	6	54.54%	28.57%
A negative	1	1	100%	4.76%
B Positive	6	5	83.33%	23.81%
B negative	0	0	0	0
AB positive	3	2	66.66%	9.52%
AB negative	0	0	0	0
O positive	18	7	38.88%	33.33%
O negative	0	0	0	0
TOTAL	39	21	53.84%	100%

$Df = 6; P\text{-value} = 0.335 (P > 0.05)$

This study was carried out to investigate the Association of *Falciparum* malaria and ABO Blood group in Awka, Anambra state. Individuals with different blood groups have varying susceptibility to malaria infection. Adebisi *et al.* (1993), reported that protein of *P. falciparum* merozoites recognize and attach to cluster of carbohydrates on the surface of host's red blood cells by means of lectin-like bonds and lectins are known to show specificity for different blood groups.

In the present study, 62% of the total samples of 100 patients were positive for *P. falciparum* malaria parasite. This showed high prevalent rate of parasitaemia in the study area as it is in other sub-Saharan areas of the world. This agreed with the research findings of Ani *et al.* (2015); Wogu *et al.* (2017), and this can be caused by low preventive measure towards the malaria vector (i.e Anopheles mosquito) and its breeding site. The prevailing blood group among the studied population showed that blood group O+ (O positive) had the highest prevalence with 54%. This finding agrees with Abah *et al.* (2016) who reported 47.6% in Yenagoa, Bayelsa State. This supports the universal knowledge that blood group O is the commonest of all the blood groups. The study equally revealed the females have higher susceptibility to *P. falciparum* malaria parasites than males because some of the females examined were pregnant, and pregnancy makes them lose the acquired semi-immunity of adulthood, making them more prone to malaria than males as stated by Jenkins *et al.* (2015). Findings from this study suggests that individuals with different blood groups have varying susceptibility to malaria parasitaemia. It was recorded that prevalence was highest in blood group O positive (48.3%) and least in patients with blood group AB- and B- negative. This result agreed with that of Abah *et al.* (2016) that reported a high prevalence amongst donors with blood group O. This variation might be due to geographical location and the reason for the high prevalence may be due to the prevailing environmental conditions such as high rainfall high relative humidity and luxuriant vegetation that collectively enhance breeding of the malaria vector. It has long been known that people with blood group O are protected of dying from severe malaria as it offers protection against severe malaria attack. Nonetheless, the exact causes of these variations remain to be identified.

CONCLUSION

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). To this end, therefore, malaria interventions and control strategies should be directed equally among individuals irrespective of their blood groups.

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