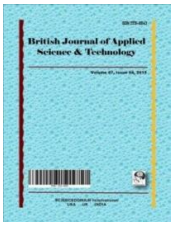

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The Susceptibility of ABO Blood Groups to Malaria Parasitaemia among Residents of Awka, Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

The investigation was carried out to determine the susceptibility of ABO blood groups to malaria parasiteamia among residents of Awka, Awka South L.G.A, Anambra State Nigeria. The research revealed that out of 309 samples analyzed for ABO blood groups susceptibility for malaria in various classes, 265 (85.8%) was observed to have patent parasiteamia with malaria. Among the sexes, males recorded higher susceptibility than females, with blood group B recording highest (94.5%) susceptibility of infection than other blood groups. The ABO and Rhesus blood group phenotype sample were determined by agglutination method using commercially provided antisera suitable for the detection of blood rhesus positivity and negativity.

Keywords: Malaria; plasmodium; parasitaemia; ABO; susceptibility.

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1. INTRODUCTION

Malaria is a disease due to blood infection by protozoan parasites of the genus *Plasmodium* which is transmitted through the bite of infected female *Anopheles* mosquitoes [1,2]. The four species of the parasite that infect humans are *Plasmodium falciparium, Plasmodium vivax, Plasmodium malaria and Plasmodium ovale. Plasmodium falciparium i*s the most deadly of the four and highly entrenched in the tropics [3]. The global incidence of malaria is estimated to be nearly 120 million clinical cases each year with nearly 300 million people carrying the parasites [4]. It is one of the leading causes of mortality and morbidity in the tropics affecting more than 200 children under five years of age and pregnant women. The complex life cycle of the parasite involving human and mosquito vector as well as its allelic diversity and antigenic variations make the development and implementation of effective malaria control intervention problematic [5]. Host genetic factors also modulate the risk and severity of infection through specific mediators, which can be different in various epidemiological settings. Cell adhesion also plays a fundamental role in placental malaria pathophysiology [6]. Cell surface glycans such as ABO blood groups and related antigens could modulate some of specific cell interactions [7]. Since the discovery of the ABO blood groups, numerous associations between the groups and diseases have been reported [8]. There has been postulation that certain antigens on erythrocyte surfaces which enable the classification of blood groups into ABO system are involved in the susceptibility of red blood cells to species of *Plasmodium* – the malaria parasite. The objectives of this research are therefore to investigate if such relationship exists and at the same time find out the blood group that stands the highest risk of malaria infection.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out at Glancing Laboratory Awka, Awka South Local Government Area of Anambra State Nigeria. Awka is located in the tropical rain forest zone of the country and the climate is characterized by dry period which stretches from November to April while rainy season occurs from May to October.

2.1.1 Study population

This includes persons of all ages which comprises of civil servants, farmers, lecturers, businessmen, students and pupils, many of which were residents of Awka and its environs.

2.2 Methods

A total of 309 blood samples were collected through venopuncture and appropriate investigation were carried out. Thick films of the blood were made on the slides which were marked with the patient's number, age and sex. The films were air dried and Giemsa stained. Identification of parasites was then made microscopically using oil immersion objective lens, [9]. The ABO and Rhesus blood group phenotype of the blood samples were determined by agglutination method using commercially available Anti- sera A, B and D. Anti sera D- was used to determine rhesus positivity and negativity of the blood samples. Agglutination showed rhesus positive while no agglutination showed rhesus negative.

2.3 Statistical Analysis

Differences were evaluated using chi-square test and statistical significance was achieved if $P < 0.05$).

3. RESULTS

Out of three hundred and nine (309) blood samples investigated, 265(85.8%) were positive and found to have patent parasitaemia. Among the sexes, prevalence was higher in females 149 (87.1%) than in males 116 (84.1%) (Table1). However, the difference was not statistically significant (X^2=4.11, df=1; P=0.05). The distribution of malaria parasitaemia among the ABO blood groups showed that of the 265 positive samples, 62(87.32%), 35(94.59%), 9(90%), and 59(83.25%) belonged to blood groups A, B, AB and O respectively (Table 2). Prevalence of parasitaemia was therefore highest in blood group O individuals and least in blood group A. The differences were statistically significant. (X^2=194.33, df=3, p=0.05).

Out of 62 positive malaria cases in blood group A, 18 were males and 44 were females while in blood group B, 19 of 35 positive individuals were males and 17 were females. Among the 9 positive samples of AB blood group, 4 individuals

Table 1. Sex distribution of parasitaemia

Sex	No: examined	No: positive	% occurence
Male	138	116	84.1
Female	171	149	87.13
Total	309	265	85.8

Table 2. Distribution of ABO blood groups and parasitaemia

Blood group	No examined	No positive	% occurrence
A	71	62	87.32%
B	37	35	94.59%
AB	10	09	90.0%
O	191	159	83.25%
Total	309	265	85.76%

were males and 5 were females while 75 of 159 positive samples of blood group O were males and 84 were females (Table 3).

4. DISCUSSION

Malaria has been a serious health problem in many parts of the world especially in the tropics. It is the most important cause of mortality and morbidity in tropical and sub- tropical areas of the world particularly in children under five and pregnant women [10]. In Nigeria, it is highly endemic and one of the major causes of ill-health and death [11]. It therefore becomes imperative to identify the factors that contribute to susceptibility of hosts to the infection. This study was therefore carried out to investigate the incidence of ABO blood groups and their susceptibility to malaria parasitaemia in humans. Individuals with different blood groups have varying susceptibility to malaria infection. [12] reported that protein of *Plasmodium falciparium* merozoites recognize and attach to cluster of carbohydrates on the surface of host's red blood cells by means lactin-like bonds and lactins are known to show specificity for different blood groups. In the present study, 85.8% of the total sample of 309 individuals was positive for malaria parasite. This shows high prevalent rate of parasitaemia in the study area as it is in other sub-Saharan areas of the world. This agreed with the findings of other researchers [13,14]. The study equally revealed higher susceptibility of males to malaria parasites than females. [1,15] also reported the same trend in their respective findings. It also agreed with [16]. Although no explanatory factor can be ascribed at present to this observation, one is inclined to agree with the suggestion of [17] that genetic factors could play a role by endowing females with immune-regulatory potentials to cope better with some disease conditions. It may equally be attributed to the fact that males due to their occupation are exposed more to constant attack with malaria vector, the mosquito than their female counterparts. Findings from this study suggest that individuals with different blood groups have varying susceptibility to malaria parasitaemia. It was recorded with highest percentage of infection in the blood group B and lowest in the O group. This agreed with [16] who observed that individuals with blood group B were slightly more likely to become infected than those of other groups. However, it contrasted those of [11,14], who reported that blood group O was the most susceptible while blood group AB was the least. It also disagreed with the findings of [18] that the blood group A was the most susceptible to malaria parasites. However, the exact causes of these variations remain to be identified. [19,5] suggested that the genetic makeup of individuals may be responsible for a considerable variable in their relation to malaria infection. Secondly, qualitative and quantitative variation in structure and chemical composition of the receptor sites on the erythrocyte membrane of the various groups may play an important role in determining susceptibility in relation to Duffy blood groups, [20]. Some strains of *Plasmodium falciparum* readily trigger rosette formation in infected red blood cells depending on the cell group. Blood groups A and B are more likely to form rosette than other groups. Therefore, the individual that possesses former groups seem to be at greater risk of developing severe malaria more than others.

Table 3. Sex distribution of malaria parasitaemia in relation to ABO blood groups

Blood Grp	No examined	No: infected	%	No examined	No infected	%	Total No examined	Total No infected	%
A	24	18	75	47	44	93.62	71	62	87.32
B	20	19	95	17	16	94.12	37	35	94.59
AB	04	4	100	6	5	83.33	10	9	90.00
O	90	75	83.33	101	84	83.17	191	159	83.25
Total	138	116	84.10	171	149	87.13	309	265	85.76

5. CONCLUSION

It is concluded that there is a form of association or relationship between ABO blood groups and malaria parasitaemia. Blood group B had the highest incidence followed by group A and AB while group O had the least. It is expected that these findings will serve as background information for future studies on the ABO status and its susceptibility to malaria in this part of the country. The information will also help authorities and agencies involved in management or control of malaria in the sub-Saharan region to achieve reduction in the rate, morbidity and mortality of the infection.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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