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Antigenic Expression of Duffy Blood Group amongst the People of Zaakpon in Ogoni, Rivers State, Nigeria

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Abstract
The aim of the study was to determine the pattern of antigenic expression of Duffy blood group amongst the people of Zaakpon in Ogoni, Rivers State, Nigeria. This study was a cross-sectional study among Zaakpon indigenes whose origin of their first-generation parents are Ogonis. The study aimed at evaluating the prevalence of Duffy blood group antigen among the Ogonis, specifically Zaakpon indigenes. A total number of one hundred and twenty (120) apparently healthy human subjects consisting of twenty-five males and ninety- five female aged 12 -75 years were recruited for the study. The study was carried out in December 2021. Ogoni land is in an area along the Niger Delta Eastern edge, to the northeast of the Imo River and Port Harcourt City. Ogoni land covers about 1036 Sq Km and borders the Bay of Guinea. All participants were recruited in Zaakpon, Khana Local Government Area, Rivers State. Zaakpon is a village in Bori. Bori is the traditional headquarter of Ogoni. Bori is located on latitude $4^0$40′34.64′N and longitude $7^0$21′54.68′E. Analysis was carried out at the Haematology Laboratory, Department of Medical Laboratory Science, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt. Port Harcourt is the capital of Rivers State. Laboratory identification of Duffy blood group antigens was carried out using the Anti-Fya monoclonal and Anti- Fyb polyclonal reagent produced by Lorne Laboratory Ltd, UK with lot numbers: 77435-A1 and 317793-A3 respectively. Indirect Antiglobulin Techniques was used to phenotype the red cells as described by Lorne Laboratory Ltd. The result showed zero frequency occurrence and percentage distribution of Duffy blood group antigens in the studied population. There is absence of Duffy (Fya and Fyb) blood group antigens amongst the studied population that are natives of Zaakpon in Ogoni. The Fy (a-b-) phenotype amongst the people of Zaakpon in Ogoni, is therefore of clinical advantage in the protection and resistance against malaria infection caused by *Plasmodium vivax.*

Keywords: Antigenic Expression, Duffy Blood Group, Zaakpon, Ogoni, Rivers State, Nigeria.

Introduction

A blood group system is defined as a group of antigens encoded by alleles at a single gene locus or at gene loci so closely linked that cross over is very rare (Daniels and Reid, 2010). The International Society of Blood Transfusion recently recognize thirty-three blood group systems. Apart from ABO and Rh system, other blood group antigens have also been found on the red cell membrane of which Duffy blood group antigen is one of them (Mitra *et al.*, 2014). The Duffy group system has six known antigens that reside on a glycoprotein found on the red blood cell membrane and act as receptor for chemokines (Aldarweesh, 2019).

The Duffy blood group system with ISBT number 008 and symbol FY or Fy, was published for the first time in 1950 when anti-Fya was identified in a suspected haemolytic transfusion reaction in a 43year old patient with haemophilia who received three packed red blood cell units for treatment of spontaneous bleeding and who developed jaundice one day after transfusion (Aldarweesh, 2019).

Anti-Fya and Anti-Fyb are clinically significant RBC alloantibodies which can cause immediate and delayed haemolytic transfusion reactions (HTRs) as well as haemolytic disease of the foetus and new-born (HDFN). There are six known antigens with four main phenotypes: Fy(a+b+), Fy(a- b+), Fy(a+b-), and Fy(a- b-) (Pogo and Chaudhuri, 2000).

The FY-DARC (Duffy blood group, chemokine receptor) gene located in chromosome 1 has both FY and RH gene loci. The FY locus is located on the long arm at position 1q22-q23 where it consists of two exons distributed over 1.5 kb of genomic DNA (gDNA), exon 1 encoding only the first seven amino acids of the Duffy glycoprotein (Castilho, 2013).

The Duffy glycoprotein is encoded by the FY gene, of which there are two main alleles, FYA and FYB. They are codominant, meaning FYA is inherited from one parent and FYB allele is inherited from the other parent. Both gene product, Duffy Fy^a and Fy^b antigens, will then be expressed on the RBCs (Castilho, 2013).

The Fy^a and Fy^b antigens are found relatively frequently in Caucasians (Fy^a 66% and Fy^b 83%) and Asians (Fy^a 99% and Fy^b 18.5%) but are far less common in Blacks (Fy^a 10% and Fy^b 23%). In fact, the Fy (a- b-) phenotype is present in two-thirds of African American Blacks but is very rare in Caucasians (Reid and Lomas-Francis, 2004). Jamoh *et al.* (2018) reported absence of Duffy blood group antigens in their study population in Kano, Nigeria. Erhabor *et al.* (2014) reported 4.3% for Fya and 5.6% for Fyb in their study population.

The people of Ogoni are among one of the minority tribes in the South-South geopolitical zone (Niger Delta) of Nigeria. Early 1970s, the Ogoni tribe became part of Rivers State. The Ogoni tribe is approximately five hundred thousand in population which represents 0.5% of about one hundred and thirty million Nigerians. The Ogoni region has a population density that is equal 1,233 people/square miles, and therefore, one of the densely populated regions (Oyinlade and Vincent, 2020).

Zaakpon is a community found in Khana local government area and for political administrative purpose is represented by a counsellor as ward 2. Zaakpon is the host community for Kenule Saro Wiwa Polytechnic. Majority of the indigens are farmers.

There is a dearth in published research information on percentage distribution and frequency occurrence of Duffy blood group antigens amongst the Ogonis. It is therefore necessary to carry out serological identification of Fya and Fyb antigens to identify how dominant these antigens are.

Materials and Method

Study Design

This study was a cross-sectional study among Zaakpon indigenes whose origin of their first-generation parents are Ogonis. The study aimed at evaluating the prevalence of Duffy blood group antigen among the Ogonis, specifically Zaakpon indigenes. The study was carried out in December 2021.

Study Area

Ogoni land is in an area along the Niger Delta Eastern edge, to the northeast of the Imo River and Port Harcourt City. Ogoni land covers about 1036 Sq Km and borders the Bay of Guinea. All participants were recruited in Zaakpon, Khana Local Government Area, Rivers State. Zaakpon is a village in Bori. Bori is the traditional headquarter of Ogoni. Bori is located on latitude $4^0 40' 34.64'' N$ and longitude $7^0 21' 54.68'' E$. Analysis was carried out at the Haematology Laboratory, Department of Medical Laboratory Science, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt. Port Harcourt is the capital of Rivers State.

Study Population

Based on convenient sampling, A total number of one hundred and twenty (120) apparently healthy human subjects consisting of twenty-five males and ninety-five females were recruited for the study. The study subjects were adult varying between 12 -75 years of age.

Sample Collection, Storage and Transportation

After pre-test counselling, venous blood sample was collected with the use of conventional needle and syringe for each subject, of which 3. 0 ml of collected blood from each subject was added into individualized tube containing 0.5mL of 1.2mg/mL ethylene diamine tetra-acetic acid (EDTA) as described by Cheesebrough (2010). It was properly mixed to obtain homogeneity between the blood and anticoagulant. The samples were preserved using ice pack in an airtight thermo cool container at temperature of 2- 8^{O}Cand then transported from Zaakpon village (site of sample collection) to the Haematology Laboratory, Department of Medical Laboratory Science, Rivers State University, Port Harcourt, where they were analysed for Duffy blood group. Blood samples collected in ethylene diamine tetra-acetic were analysed within 24 hours of collection.

Methodology

Determination of Duffy-a Blood Group Using Anti-Fy^{a} Monoclonal, Lorne Laboratories Ltd, UK. Lot Number: 77435-A1, Expiry Date: 2023-04-27

Method: Indirect Antiglobulin Techniques

Indirect Antiglobulin Technique was used to phenotype red cells as describe by Lorne laboratory. Three percent (3%) of red cell suspension was prepared using isotonic saline. One volume of Lorne Anti-Fy^{a} reagent was added to one volume of the prepared 3% red cell suspension, thoroughly mixed and incubated for 15 minutes at room temperature (37^{O}C), two volume of Anti-human globulin was added before it was centrifuge at 20 seconds at 1000rpm. The red cell button was gently re-suspended before it was read macroscopically for agglutination.

Presence of agglutination was indicative of a positive result while on the contrary, absence of agglutination was indicative of a negative result.

Determination of Duffy-b Blood Group Using Anti-Fy^{b} Polyclonal, Lorne Laboratories Ltd, UK. Lot Number: 31793-A3, Expiry Date: 2023-07-07

Method: Indirect Antiglobulin Techniques

Indirect Antiglobulin Technique was used to phenotype red cells as describe by Lorne laboratory. Three percent (3%) of red cell suspension was prepared using isotonic saline. One volume Lorne Anti-Fy^{b} reagent was added to one volume of the prepared 3% red cell suspension, thoroughly mixed and incubated for 15 minutes at room temperature (37^{O}C), two volume of Anti-human globulin was added before it is centrifuge at 20 seconds at 1000 rpm. The red cell button was gently re-suspended before it was read macroscopically for agglutination (Lorne Laboratories, 2020).

Interpretation of Results

Positive: Agglutination of red cells indicative of a positive test result.

Negative: No agglutination of red cells indicative of a negative test result.

Statistical Analysis

Data collected was statistically analysed by simple percentage calculation. Data were represented in Tables.

Results

Demographic Details of Studied Population

A total number of 120 subject (twenty- five (25) males and ninety-five (95) females, within the age of 12 and 75years were recruited for the study. Details are shown in Table 1.

Frequency Occurrence and Percentage Distribution of the Studied Blood Group

Frequency occurrence and percentage distribution of Duffy blood group antigens were analysed and reported. Details are shown in Table 2.

Frequency and Percentage Distribution of Studied blood Group System based on Gender

The frequency distribution and percentage distribution of Duffy blood group system based on gender were analysed and recorded. Details shown in table 3.

Table 1: Demographic Details of the Studied Population

Parameter	Frequency	Percentage
Total number of subjects	120	100
Total number of males	25	20.8
Total number of females	95	79.2
Age range (years)	12 – 75	_

Table 2: Frequency Occurrence and Percentage Distribution of the Studied Blood Group

Blood Group	Frequency	Percentage distribution (%)
For Duffy: Fy^a	0	0
Fy^b	0	0
Total	0	0

Table 4.3: Frequency and Percentage Distribution of Studied blood Group System based on Gender

Blood Group	Frequency Occurrence	Percentage Distribution (%)
Duffy: Fy^a	M - 0	M - 0
	F – 0	F – 0
Fy^b	M - 0	M - 0
	F – 0	F – 0
Total	0	0

Discussion

The Ogonis are not related to any other tribe in Nigeria and not one of the major tribes in Nigeria. Duffy blood group system is yet to be studied extensively in Rivers State, Nigeria and specifically amongst the Ogonis.

The Duffy (Fy-a and Fy-b) blood group is one of the clinically significant blood group systems. Antibodies of this blood group system could cause HTR (Haemolytic Transfusion Reaction) as well as cross the placenta barrier into the foetal circulation and cause HDFN (Haemolytic disease of the foetus and New-born). Some literatures have also associated Duffy blood group to cytokines against malaria parasitaemia. From the study, it was observed that the presence of Duffy blood group antigen in subjects recruited for the study were rare which by implication means that Duffy blood group and its associated antigens were not found amongst the study population and therefore it is rare.

The frequency occurrence of Duffy blood group amongst the Ogonis and the percentage distribution of Duffy blood group antigen was zero. This finding is consistent with that of Jamoh *et al.* (2018) who reported absence of Duffy blood group antigens in their study population in Kano, Nigeria. Uwen (2011) reported in his studies carried out in Lagos that Fya and Fyb were unlikely to cause transfusion reactions (HTR and HDN) as sampled subjects tested negative to the antigens, and Kuikarni *et al.,* (1985) in their study of antigens among the Hausa population of the Northern Nigeria reported that great majority of the subjects were 98.8% negative (Kulkarni *et al.,* 1985; Uwen,

2011), the findings from these researchers closely agrees with the findings of this study. In comparison, Erhabor *et al.* (2014) in their study of red cell phenotypes among pregnant women of Sokoto, Northwestern Nigeria (which was an ethnic based studies) reported 4.3 % for Fya and 5.6% for Fyb in their study population; and based on ethnic distribution, Hausa (Fya: 4.87%; Fyb: 4.87%); Yoruba (Fya: 0%; Fyb: 0%); Fulani (Fya: 4.34%; Fyb: 8.69%); and Igbo (Fya: 3.85%; Fyb: 7.69%) that the lowest prevalence (0%) of the antigen was found amongst the Yoruba ethnic group. These findings are not consistent with the finding from this study.

Previous report indicated that Fy-a and Fy-b antigens are found relatively among the Caucasians (66% and 83%) respectively and Asians (99% and 18.5%) but far less in the blacks (10% and 23%) (Reid and Lomas-Francis,2004).

The reason for the low or absence prevalence of duffy (fya and fyb) phenotypes among people of Zaakpon village in Ogoni, Rivers State Nigeria agrees with the findings from literatures that Duffy antigens are rare amongst blacks (Lepers *et al.,* 1986).

Duffy negative status is suggested to play a major role in resistance to malaria infection caused by *Plasmodium vivax* (Langhi & Bordin, 2006). The Duffy negative status – Fy (a-b-) in Zaakpon, Ogoni is therefore of clinical advantage in the war against malaria.

Conclusion

The study has revealed an absence of Duffy (Fy-a and Fy-b) blood group antigens amongst natives of Zaakpon, in Ogoniland, recruited for the study. The Fy (a-b-) phenotype amongst the people of Zaakpon in Ogoni, is therefore of clinical advantage in the protection and resistance against malaria infection caused by *Plasmodium vivax.*

Consent

Informed consent was obtained from the ostensibly healthy subjects before these samples were collected.

Competing Interest

No competing interest exist as declared by the authors.

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