NEXUS OF MEDICINE AND LABORATORY SCIENCE JOURNAL **ISSN (ONLINE): 3027-2998**

Association of Blood Group Antigens with Human Immunodeficiency Virus Infection in River State University Teaching Hospital, Port Harcourt, Nigeria

Hart Dabota Walter*, Stella ken–Ezihuo, Beauty E. Echonwere-Uwikor

Department of Medical Laboratory Science, Rivers State University, Port Harcourt, Rivers State, Nigeria

*Corresponding Author's email: hdabota@yahoo.com; Tel: +2348065832228

Article type: Original research

Cite as: Walter HD, Ken-Ezihuo S, Echonwere BE. Association of Blood Group Antigens with Human Immunodeficiency Virus Infection in River State University Teaching Hospital, Port Harcourt, Nigeria. Nexus Med. Lab. Sci. J. 2024;1(4):10-22

Received on 31st August, 2024; Accepted on 9th September, 2024; Published on 8th September, 2024
Publisher: ScholarlyFeed

ABSTRACT

Background: Blood group antigens have been implicated in the susceptibility to various infections, including Human immunodeficiency virus (HIV). Understanding the relationship between these antigens and HIV susceptibility can offer insights for better clinical management and potential therapeutic interventions. This study aimed to investigate the association between blood group antigens and the susceptibility to HIV infection in Port Harcourt**,** River State, Nigeria.

Method: A cross-sectional observational study was conducted involving 250 residual blood samples made up of 150 HIV-positive and 100 HIV-negative individuals from the Rivers State University Teaching Hospital. The presence of various blood group antigens was determined using standard serological methods. Statistical analysis was performed using statistical Package for social science (SPSS) version 29 and graphpad prism version 10.

Result: The results show association between blood group A antigen with HIV infection (P-value: 0.019), and **Rhc**(P<0.001). The RhE antigen exhibits an association with HIV infection (, P<0.001) and Rhe antigen (P<0.001). The RhD positive antigen exhibits an association with HIV infection (P<0.015) while RhD negative antigen association with HIV infection (P<0.015). The P value (P<0.001) was observed in the association between HIV infection and blood group **M antigen** (P<0.001) , **O** (P<0.010), s antigen (P<0.001) and **Fya** (P< 0.001), S antigen (P<0.001), RhC antigen (P: <0.001), and Fya-b- (P< 0.001) . Conversely, a significant association with HIV infection was observed in S antigen (P<0.001), RhC antigen (P: <0.001) and Fya-b- (P< 0.001) antigens which were validated by a logistic regression ..

Conclusion: The study concluded that certain blood group antigens, particularly Fya-b- and s antigens may be significantly associated with HIV susceptibility. Whereas, antigens such as RhC seem to confer protection against HIV infection. Additionally, consideration should be given to these antigens in the development of new therapeutic strategies.

Key words: *Antigens, Blood Group, Human Immunodeficiency Virus*

INTRODUCTION

There are currently 45 recognized blood group systems containing 360 red cell antigens [1]. Some have been cloned and sequenced and have diverse functions, including structural and cellular transport [2,3]. Most of these surface antigens can affect the susceptibility to disease, by acting as receptors for pathogens, or by manipulating the immune response [4]. The specificity of most blood group antigens is commonly established either by the oligosaccharide or amino acid sequence. Natural selection, disease and control of environmental factor can modify the expression of blood group antigens in human populations and geographical regions [5]. Subject to the expression of the Fucosyltransferase 2 (FUT2) enzyme, individuals are termed as secretors. Secretors expresses Fucosyltransferase 2 (FUT2) enzyme which results to possession of ABO antigens on other cells and tissue types, including epithelium and body fluids which predispose individuals to many conditions including cardiovascular disease, venous thrombosis, malignancy [6].

The human immunodeficiency virus (HIV) is an enveloped retrovirus and the etiologic agent of acquired immunodeficiency syndrome (AIDS), and it is an acquired defect of the cellular immunity associated with infection by HIV, it is mainly characterized by a CD4 positive lymphocyte count of less than 200 cells/microliter, opportunistic infections, and tumors, which are usually fatal without treatment [7-9]. There are two variants of HIV; HIV-1 and HIV-2. The variant of HIV that is the cause for almost all infections is HIV-1. Two to four weeks after HIV enters the body, the patient may complain of symptoms of primary infection [10]. After that, a long chronic HIV infection occurs, which can last for decades [11].

Nigeria, the most populous country in Africa [12] has the second largest HIV epidemic in the world [13]. The national HIV prevalence in Nigeria is 1.4%, with 1.9 million people living with HIV between the ages of 15 – 49 years with the highest in Akwa Ibom State (5.6%); Benue State (4.9%) and Rivers state (3.8%). The South-South zone of Nigeria has the highest HIV prevalence, at 3.1% among adults aged 15–49 years [14].

Key vulnerable populations at a higher risk of acquiring HIV and thus developing AIDS continued to be pregnant women, infants, prison inmates, injecting drug users (IDU) and men who have sex with men (MSM) [15]. Recent research on blood groups and SARS-COV-2 infection have reported interactions between ABO incompatibility and decreased risk of COVID-19 transmission, suggesting neutralization by naturally occurring anti-ABO antibodies [16].

The secretor status of individuals has been shown to influence other viral infections, such as the norovirus, which binds to antigens expressed on mucosal surfaces of the gastrointestinal tract [17]. This association of FUT2 and disease has led to the hypothesis that non-secretors could be protected against HIV infection [18]. The ABO is the most significant blood group system in transfusion, followed by the Rhesus (Rh) and Kell systems [19]. Accordingly, ABO and Rh are the most extensively researched blood group antigens [20]. The ABO blood group status has been linked to a variety of conditions, including cardiovascular disease, cancer, and some infectious diseases [20-22]. Indeed, studies have demonstrated an association between ABO blood group and host susceptibility to pathogens such as *Helicobacter pylori, Escherichia coli, Plasmodium falciparum*, HIV, and SARS-CoV-2 [19-21]. Several studies have likewise examined the relationship of ABO and Rh status with transmissible transfusion infections (TTIs) in blood donors. Legese *et al* [20] reported HBV to be the most frequent TTI among Ethiopian donors, but found no significant association of either ABO or Rh blood group with TTIs.

The aim of this study is to determine the Association of Blood Group Antigens with

Human Immunodeficiency Virus Infection in River State University Teaching Hospital, Port Harcourt, Nigeria.

Materials and Methods

Study Design

The study was a cross-sectional observational study.

Study Population

Two hundred and fifty (250) blood samples from subjects within the ages of 20 to 80 years were obtained from the Blood Transfusion Service center and the HIV reference laboratory, River State University Teaching Hospital as residual samples. One hundred and fifty (150) were individuals who were confirmed sero-positive for Human Immunodeficiency Virus infection and the other one hundred (100) were individuals who were seronegative for Human Immunodeficiency Virus infection. HIV-positive samples included both new cases and those from patients already on anti-retroviral therapy.

Study Area

Port Harcourt is the capital of Rivers State, Nigeria. It lies along the Bonny River in the Niger Delta. Coordinates: 4°53'23" N 6°54'18" E and located in a city 360 km2 (139 sq mi). From the Nigeria census in 2006, Port Harcourt had a population of 1,382,592 (National Population Commission (NPC), author *Census of the Federal Republic of Nigeria.* 2006). Port Harcourt city is in the Port Harcourt City Local Government Area, consisting of the former European quarters now called old Government Reservation Area (GRA) and new layout areas. The Port Harcourt Urban Area (Port Harcourt metropolis) is made up of the city itself and parts of Obio/Akpor Local Government Area [23]. It also has a tropical climate with very short dry seasons and lengthy and heavy rainy seasons. Only the months of December and January truly qualify as dry season months in the city. The harmattan, which climatically influences many cities in West Africa, is less pronounced in Port Harcourt.

Sample Collection

Two millilitres (2ml) of blood sample was aliquoted from residual samples of patients and Clients of HIV reference and blood transfusion center Rivers State University Teaching Hospital (RSUTH) into ethylenediaminetetraacetic acid (EDTA) without identifiers respectively and later assigned study numbers.

Laboratory Procedures

Patients and donors red cells were phenotyped with Ortho Bio Vue typing technique from (Ortho- Clinical Diagnostics United Kingdom) using TD5K –G Blood card type centrifuge apart from Jk^a and Jk^b, that used the test tube method. The strength of the reaction was graded from 0–4 where4+ Reaction**:** Agglutinated red blood cells form a band at the top of the bead column,3+ Reaction: Most agglutinated red blood cells are retained or trapped in the upper half of the bead column,2+ Reaction: Agglutinated red blood cells are observed throughout the length of the bead column. A small button of cells may also be visible at the bottom of the bead column.1+ reaction: Most agglutinated red blood cells are retained or trapped in the lower half of the bead column. A button of cells will also be visible at the bottom of the bead column, 0.5+ Reaction: Most agglutinated red blood cells pass through and form a disrupted (not smooth) button at the bottom of the bead column. Small agglutinates are visible above the bottom.

A total of 16 antigens were analyzed A, B, AB, D, E, C, c, e, K, Jk^a, Jk^b, fy^a, fy^b, M, S, and s including blood group O , Rhesus D negative and Fy-b- (Duffy null).

The detection of HIV was done using Immunochromatographic assay method. The antibody to HIV in the blood of the intending population is tested using Determine HIV- 1 /2 from Alere Medical Company Ltd. Japan. Alere Determine HIV- 1 / 2 is an immunochromatographic test for the qualitative detection of antibodies to HIV-1 and HIV-2. Sample is added to the sample pad. As

the sample migrates through the conjugates pad, it reconstitutes and mixes with selenium colloid- antigen conjugate. This mixture continues to migrate through the solid phase to the immobilized recombinant antigens and synthetic peptides at the patient window site. If the antibodies to HIV- 1 and/or HIV-2 are present in the sample, the antibodies bind to the antigen – selenium colloid and to the antigen at the patient window, forming a red line at the patient window site. If antibodies to HIV -1 and/or HIV-2 are absent, the antigen-selenium colloid flows past the patient window, and no red line is formed at the patient window site. To ensure assay validity, a procedural control bar is incorporated in the assay devise that also forms a red line. The specificity is 99.87% and the sensitivity is 100%.

The Determination Method of Antigens A, B D, E, e C, c & K was done by Ortho Bio Vue typing techniques. The Principle of the procedure is based on the agglutination. Normal human red cells, possessing antigens will form agglutination in the presence of antibody directed towards the antigen. The ortho Bio Vue systems utilizes column agglutination technology, comprised of glass beads and reagents contain in the column (cassette). Upon addition of the red blood cells and subsequent centrifugation of the cassette, agglutinated red blood cells are trapped by the glass beads and non – agglutinated red blood cells travel to the bottom of the column.

Red cells were washed with normal saline and 4% cell suspension was prepared with low ionic strength solution (LISS).The Ortho Bio vue cassette and test sample were allowed to come to room temperature. The cassette was oriented with the back label (barcode side) and labeled appropriately. The foil strip on the top of the cassette was peeled off to expose the reacting chamber. 10ul of the 4% red cell suspension was added to the appropriate reaction chamber of the cassette and centrifuged using TD5K-G blood card type centrifuge at 1000g for 5 minutes. The individual columns were read for agglutination and /or hemolysis upon test completion. **Positive results** demonstrate agglutination represented by red blood cells retained in or on top of the glass bead column.**4+ Reaction showed** agglutinated red blood cells form a band at the top of the bead column. **3+ Reaction showed** most agglutinated red blood cells are retained or trapped in the upper half of the bead column. **2+ Reaction showed a**gglutinated red blood cells are observed throughout the length of the bead column. A small button of cells may also be visible at the bottom of the bead column.**1+ reaction showed mo**st agglutinated red blood cells are retained or trapped in the lower half of the bead column. A button of cells will also be visible at the bottom of the bead column while at **0.5+ Reaction, m**ost agglutinated red blood cells pass through and form a disrupted (not smooth) button at the bottom of the bead column. Small agglutinates are visible above the bottom. **Negative results** demonstrate no agglutination of the red blood cell represented by a button of packed cell at the bottom of the column.

Antigens Fy^{a}, Fyb, S, s, M were determined with Ortho Bio Vue typing technique with neutral cassette. The Principle of the procedure showed that the Monoclonal blood grouping reagents for Anti-Fy^{a}, Fyb,S,s and the Polyclonal blood grouping reagent for Anti-M will cause agglutination of the red cells that carry the Fy^{a}, Fy^{b}, S,s and M antigens respectively after centrifugation. No agglutination generally indicates the absence the antigens. Red cells were washed with normal saline and 4% cell suspension was prepared with low ionic strength solution (LISS).The Ortho Biovue cassette (neutral) and test sample were allowed to come to room temperature before use and the cassette labelled appropriately, the foil covering the cassette was peeled off and 50ul of the 4% cell suspension and 40ul of the appropriate blood grouping reagents added to the appropriate

reaction chamber and incubate for 15 minutes and later centrifuged at 1000g for 5 minutes. The individual columns were read for agglutination and /or hemolysis upon test completion. **Positive results** demonstrate agglutination represented by red blood cells retained in or on top of the glass bead column.**4+ Reaction showed** agglutinated red blood cells form a band at the top of the bead column. **3+ Reaction showed** most agglutinated red blood cells are retained or trapped in the upper half of the bead column. **2+ Reaction showed a**gglutinated red blood cells are observed throughout the length of the bead column. A small button of cells may also be visible at the bottom of the bead column.**1+ reaction showed mo**st agglutinated red blood cells are retained or trapped in the lower half of the bead column. A button of cells will also be visible at the bottom of the bead column while at **0.5+ Reaction, m**ost agglutinated red blood cells pass through and form a disrupted (not smooth) button at the bottom of the bead column. Small agglutinates are visible above the bottom. **Negative results** demonstrate no agglutination of the red blood cell represented by a button of packed cell at the bottom of the column.

Antigens Jka & Jkb were determined using test tube method. The procedure is based on the principle of agglutination. The Kidd monoclonal antibody reagent will cause direct agglutination of test red cells that carry the corresponding Kidd antigen. No agglutination generally indicates the absence of Kidd antigen. Red cells were washed with normal saline and 4% cell suspension was prepared with normal saline.10ul of Lorne reagent and 10ul of red cell suspension was added in a test tube mixed and incubated for 5 minutes at room temperature. The tubes were then centrifuged at 1000rpm for 20 seconds, supernatant decanted and cell button resuspended. The individual tubes were visually and microscopically read for agglutination and /or hemolysis. Agglutination of the test red cells constitutes a positive test result while No agglutination of the test red cells constitute a negative result.

Data Analysis: The data were analysed with Statistical Package for Social Sciences (SPSS) version 29 and graph pad prism version 10 using the Pearson Chi-Square (X^2) test to evaluate the significance of the association between blood group antigens and HIV status and significant associations was validated using logistic regression to determine the odds ratios (OR) and 95% confidence intervals (CI) for the likelihood of HIV infection based on the presence of specific antigens using $p<0.05$ as level of significance.

Results

Table 1 below presents the social demographic characteristics of the study population. The sex distribution shows that 138(55.2%) of the participants are female while 112(44.8%) are male. The results reveal that 100 (40.0%) of the participants are HIV negative while 150 (60.0%) are HIV positive. The age group distribution of the participants' shows that 102(41.6%) individuals was 30-39 years, followed by participants aged 20-29 years, 65(26.0%). Participants in the age group of 40-49 years constitute 55 (21.68%) while those aged 50-59 years' account for 17 (6.4%) subjects. The age group of 60-69 years includes 7(2.8%) participants age group is those aged 70 and above had 4(1.6%) subjects.

Table 1: Social Demographic Characteristics of Study Population

CHARACTERISTICS	FREQUENCY	PERCENTAGE (%)
SEX	**N= 250**	100
FEMALE	138	55.2
MALE	112	44.8
HIV STATUS	**N=250**	100
NEGATIVE	100	40.0
POSITIVE	150	60.0
AGE RANGE(years)	**N=250**	100
20-29	65	26.0
30-39	104	41.6
40-49	54	21.6
50-59	16	6.4
60-69	7	2.8
70 AND ABOVE	4	1.6

Subjects with antigen A was 39(15.6%), antigen B 30(12%), antigen AB 9 (3.6%) and antigen O 170 (68.8%). In the Rhesus blood group system RhD positive subjects were 234 (93.60%) while RhD negatives were 16 (6.4%). The RhC antigen was 62 (24.8%) while Rhc was 188(75.2%). The prevalence of RhE was 82 (32.8%) while Rhe was 168 (67.2%). In the Kidd antigen system, JKa was 172 (68.8%) while JKb was 78 (31.2%). In the Duffy antigens system Fya was 63(25.2%), Fyb was 73(29.2%) while Fya-b- was 114 (45.6%). The M antigen had prevalence of 59 (23.6%), S antigen was 69(27.6%) and s was 122 (48.8%) in the MNS blood group system. In the Kell Blood group system, KELL had 2 (0.8%) as shown in table 2.

Table 2: Distribution of Blood Group Antigens among Study Population.

Blood group system	BLOOD GROUP ANTIGEN	FREQUENCY N=250	PERCENTAGE (%) 100
ABO blood group	**A**	39	15.6
	B	30	12
	AB	9	3.6
	O	172	68.8
RhD antigen	**RhD**	234	93.6
	RhDneg	16	6.4
RhC antigen	**RhC**	62	24.8
	Rhc	188	75.2
RhE antigen	**RhE**	82	32.8
	Rhe	168	67.2
Kidd antigens	**JKa**	172	68.8
	JKb	78	31.2
Duffy antigens	**Fya**	63	25.2
	Fyb	73	29.2
	Fya-b-	114	45.6
M antigen	**M**	59	23.6
S antigen	**S**	69	27.6
	s	122	48.8
Kell	**KELL**	2	0.8

In the HIV Positive subjects (n=150), Subjects with antigen A was 31(20.67%), antigen B 20(13.33%), antigen AB 5(3.33%) and antigen O 94(62.67%). In the Rhesus blood group system antigen RhD positive subjects were 145(96.67%) while RhD negatives were 5(3.33%). The RhC antigen was 9(6.0%) while Rhc was 141(94.0%). The prevalence of RhE was 25(16.7%) while Rhe was 127(84.7%). In the Kidd antigen system, JKa was 106(70.7%) while JKb was 42(28.0%). In the Duffy antigens system Fya was 23(15.33%), Fyb was 37(24.7%) while Fya-b- was 101(67.3%). The M antigen had prevalence of 49(35.4%), while in S antigen was 19(12.7%) and s was 113(75.3%)in the MNS blood group system. In the Kell Blood group system, KELL had 1(0. 7%) as shown in table 3.

In the HIV Negative subjects (n=100), Subjects with antigen A was 9(9.0%), antigen B 10(10.0%), antigen 4(4.0%) and antigen O 76(76.0%). The RhD positive subjects were 89(89.0%) while RhD negatives were 11(11.0%). The RhC antigen was 53(53.0%) while Rhc was 47(47.0%). The prevalence of RhE was 57(57.0%) while Rhe was 41(41.0%). In the Kidd antigen system, JKa was 66(66.0%) while JKb was 36(36.0%). In the Duffy antigens system Fya was 40(40.0%), Fyb was 36(36.0%) while Fya-b- was 13(13.0%). The M antigen had prevalence of 10(10.0%), while in S antigen was 50(50.0%) and s was 9(9.0%)in the MNS blood group system. In the Kell Blood group system, KELL had 1(1.0%) as shown in table 3.

Table 3: Distribution of Blood Group Antigens among HIV Positive and HIV Negative Subjects in Port-Harcourt, Nigeria.

		HIV Positive Subjects	**HIV Negative Subjects**			
Blood group system	**Blood group antigen**	**Frequency (%) N=150**	**Frequency (%) N=100**	**X^2**	**P**	**Remark**
ABO blood group	**A**	31(20.67)	9(9.0)	5.514	0.019	S
	B	20(13.33)	10(10.0)	0.631	0.427	NS
	AB	5(3.33)	4(4.0)	0.077	0.782	NS
	O	94(62.67)	78(78.0)	6.572	0.010	S
RhD antigen	**RhD**	145(96.67)	89(89.0)	5.887	0015	S
	RhDneg	5(3.33)	11(11.0)	5.887	0.015	S
RhC antigen	**RhC**	9	53(53.0)	71.069	<0.001	S
	Rhc	141	47(47.0)	71.069	<0.001	S
RhE antigen	**RhE**	27(18)	57(57.0)	44.283	<0.001	S
	Rh_e	123(82)	41(41.0)	51.905	0.001	S
Kidd antigens	**JKa**	88(58.67)	66(66.0)	0.609	0.435	NS
	JKb	62(41.33)	36(36.0)	1.789	0.181	NS
Duffy antigens	**Fya**	23(15.33)	40(40.0)	19.367	<0.001	S
	Fyb	27(18.00)	36(36.0)	3.728	0.054	NS
	Fya-b-	100(66.67)	13(13.0)	71.404	<0.001	S
M antigen	**M**	49(32.67)	10(10.0)	17.097	<0.001	S
S antigen	**S**	54(36)	50(50.0)	41.850	<0.001	S
	s	96(64)	9(9.0)	105.664	<0.001	S
Kell	**KELL**	1(0.007)	1(1.0)	0.084	0.772	NS

KEY: $X^{2=}$ Pearson Chi Square, S= Significant, NS= Not Significant

The result of the logistic regression model used to determine the association between HIV infection and blood group antigen show the blood group antigens Fya-b-(OR:10.537; 95%CI: 2.439- 45.522, P-value: 0.002); blood group antigen s (OR:24.983; 95%CI: 6.766 - 92.243, P-value: <0.001) and blood group antigen RhC (OR: 0.017; 95%CI: 0.003 - 0.091, P-value: <0.001). The s antigen shows a significant association with HIV infection. The RhC antigen shows a significant protective effect against HIV infection.

Table 4: Logistic Regression Model to Determine the association of HIV and Blood Group Antigens with Odd ratio using the Significant Blood Group Antigens.

SIGNIFICANT BLOOD GROUP ANTIGEN	ODD RATIO	95% C. I	P-VALUE
s	24. 983	6. 766 -92.243	<0.001
RhC	0.017	0.003 -0. 091	<0.001
Fya-b-	10.537	2.439- 45.522	0.002
A	0.902	0.175 – 7.125	1.125
O	2.465	0.664 – 9.145	0.178
RhD	0.429	0.000-247534.764	0.901
RhDneg	12.270	0.000-7143422.391	0.711
RhE	2.951	0.342-25.487	0.325
Rhe	0.990	0.121-8.088	0.992
Fya	1.540	0.498-4.766	0.453
M	0.292	0.074-1.152	0.079
S	0.720	0.225-2.307	0.581

KEY: 95% C. I= 95% Confidence Interval

Discussion

The demographic characteristics of this study revealed a predominance of females compared to males, which is consistent with general demographic trends observed in similar studies. This distribution underscores the importance of considering gender disparities in HIV research, as highlighted by studies such as Motswaledi *et al*. [6], Siransy *et al*. [24] and the National Bureau of Statistics that submitted that 56.03% of women have HIV compared to men which are 43.9% and that 1.9% of women aged 15 to 49 years are more likely to be living with HIV compared with 0.9% of men of the same age range in 2019 (14). This is because women are more biologically vulnerable to HIV, their reproductive tract lining is larger than that of the male and has been shown to be easily bruised , therefore increasing the chances of transmission of the virus through sexual contact. Women also have a higher risk of HIV infection because of the increased incidents of rape in Nigeria especially through abduction which highlights varying susceptibility to HIV infection based on gender and blood group antigens. Age distribution among the participants in this study revealed that individuals aged 30-39 years constitute the largest group, followed by those aged 20-29 years. This demographic profile is consistent with studies focusing on age-related trends in HIV prevalence.

In the ABO blood group system, blood group O emerged as the most prevalent among HIV-positive individuals in the sample. This aligns with broader observations where individuals with blood group O have been associated with varying susceptibility to HIV infection across different populations. For instance, studies such as Siransy *et al*. [24] and Davison *et al*. [25] have reported higher infection rates among O-

group individuals, highlighting potential vulnerabilities.

Regarding the Rhesus blood group system, the prevalence of RhD antigen among HIV-positive subjects in Port-Harcourt is notably high with RhD negative observed lesser. This aligns with findings from studies emphasizing the role of Rh antigens in modulating HIV susceptibility, although variations exist in the specific antigens influencing infection rates across different populations [2,6]. The systematic review and meta-analysis by Noori *et al.* [26] emphasized that blood group AB carriers are more susceptible to HIV infection compared to non-AB groups, suggesting that certain ABO antigens, including B, could influence HIV susceptibility. Shaikh *et al.,* [27] reported significant associations between HIV and blood group A, HBsAg and group AB , HBV-DNA and group AB. Anyiam *et al*., [28] in their study reported that HIV is strongly associated with RhD positive blood groups.

The distribution of Kidd antigens (JKa and JKb) and Duffy antigens (Fya, Fyb, Fya-b-) among HIV-positive individuals in Port-Harcourt reflects a complex interplay of genetic factors potentially influencing susceptibility to HIV infection. Studies by Sheng [29] and Anzwal *et al.* [30] provided insights into the varying prevalence of Duffy antigens among HIV patients. DARC influences HIV/AIDS susceptibility by mediating trans-infection of HIV-1 and by affecting both chemokine-HIV interactions and chemokine-driven inflammation.

In the MNS blood group system, the presence of M and S antigens, as well as the s phenotype, further underscores the genetic diversity within the study population and its potential implications for HIV susceptibility. These findings resonate with studies exploring the role of MNS antigens in viral infections, albeit with varying conclusions regarding their specific impact on HIV infection rates [6].

The Kell antigen system shows minimal prevalence among HIV-positive subjects in Port-Harcourt. This is consistent with the submission of Bogui *et al*. [31] who reported that K+k- is rare in Africans (blacks) and K+k+ is 2% in Africans (blacks) and its limited influence observed in broader studies on HIV susceptibility. Implications of these findings suggest that while certain blood group antigens may predispose individuals to higher HIV susceptibility, as seen with blood group O and specific Rh antigens, the relationship is multifaceted and perhaps influenced by genetic, regional, and demographic factors. Disagreements with previous studies, such as Ifeanyi [32] and Anyiam *et al.* [28], highlight the need for context-specific research to clarify these complex interactions across diverse populations. Shaikh *et al*. [27] also reported that Kell blood group was significantly associated with HIV, HBcAb, and syphilis.

The results indicated a statistically significant relationship with blood group A and O and HIV infection while Blood groups B and AB did not show significant associations with HIV infection at $p<0.05$. This suggests that individuals with blood group A and O are more likely to be HIV positive compared to those with other ABO blood groups. This is contrary to the meta-analysis by Noori *et al*. [28], which reported a higher susceptibility to HIV infection among blood group AB carrier while the study by Ifeanyi [32] found no significant association between ABO blood groups and HIV infection in a Nigerian population.

The RhD positive and RhDneg antigens showed significant association with HIV infection contrary to study by Davison *et al.* [25], who reported no significant interaction between these antigens and HIV infection. The RhC and RhE antigens demonstrated a significant association which is consistent with the study by Motswaledi *et al*. [6] who reported that RhC and RhE is associated with a lower risk of HIV infection in African population.

The findings indicate varying degrees of association, with some blood group antigens showing protective effects while others appear to increase the risk of HIV infection. The blood

group Fyb and Fya antigens show a slight risk and protective effect of HIV infection respectively. This finding was not in tandem with the findings of Davison *et al.* [25] that observed no association. The absence of the Fya and Fyb antigens (Fya-b-) is significantly associated with an increased likelihood of HIV infection. The association between the Fyb antigen and HIV susceptibility suggests that individuals carrying this antigen might be slightly prone to HIV infection and Fya show some level of protection. This could be due to the role of Duffy antigens in immune cell trafficking and inflammation. Understanding this relationship is crucial for developing targeted prevention and treatment strategies. The highly significant association of the Fya-b- phenotype with HIV susceptibility also warrants further investigation. The absence of the Fyb and Fya antigens could be linked to alterations in the immune response, making individuals more susceptible to infection.

In the Kidd blood group system, the Jka and Jkb antigens showed no relationship with HIV status, which is contrary to the study by Motswaledi *et al.* [6], which reported an increased odds of HIV infection among carriers of the JKa antigen. The absence of association suggests that the presence of the JKa and Jkb antigens may not be linked to HIV infection in this population. While the M antigen, S antigen and the s phenotype was significantly associated with HIV infection with S significantly reducing the odds of HIV infection while M and s significantly increased the odds.

These results suggest that specific antigens within the MNS system might influence susceptibility to HIV, supporting findings by Cooling *et al.* [2], who reported interactions between various red cell antigens and HIV infection.

The KELL antigen showed no significant association with HIV infection, indicating that this antigen does not influence HIV susceptibility in this population. This aligns with the findings of Legese *et al.* [20], who also found no significant association between the KELL antigen and HIV infection in their study of blood donors.

The discrepancies observed between our findings and those of previous studies highlight the need for further research to elucidate the complex interactions between blood group antigens and HIV infection. Variations in study design, sample size, population genetics, and regional factors might contribute to these differences. Future research should focus on larger, more diverse populations and consider additional genetic and environmental factors that might influence susceptibility to HIV.

Conclusion

The blood antigens Fya-b- and s shows a significant association with HIV infection suggesting that individuals with these antigens are more likely to be HIV positive. The RhC antigen shows a significant protective effect against HIV infection. The study also showed blood group O emerged as the most prevalent among HIV-positive individuals in the ABO blood group system.

References

1. The International Society of Blood Transfusion (ISBT) (2023). Working Party for Red Cell Immunogenetics and Blood Group Terminology (ISBT WP).
2. Cooling L. Blood groups in infection and host susceptibility. Clin. Microbio. Rev. 2015; 28:801–867.
3. Storry JR, Clausen FB, Castilho L, Chen Q, Daniels G, Denomme G, Flegel WA, Gassner C, de Haas M, Hyland C. International society of blood transfusion working party on red cell immunogenetics and blood group terminology: Report of the Dubai, Copenhagen and Toronto meetings. Vox Sanguinis. 2019;114: 95–102.
4. Glenda MD, Heather LH, Tandi EM. Do Blood Group Antigens and the Red Cell Membrane Influence Human

Immunodeficiency Virus Infect. Cells. 2020; 9 (845):2-11.
5. Aljanobi GA, Alhajjaj AH, Alkhabbaz FL, Al-Jishi JM. The relationship between ABO blood group type and the COVID-19 susceptibility in Qatif Central Hospital, Eastern Province, Saudi Arabia. A Retrospective Cohort. Open J. Inter. Med. 2020; 10: 232-238.
6. Motswaledi MS, Kasvosve I, Oguntibeju OO. Blood Group Antigens C, Lub and P1 May Have a Role in HIV Infection in Africans. Public Libr. of Sci. One. 2016; 11(2): 14 - 18.
7. Javadi S, Menias CO, Karbasian N, Shaaban A, Shah K, Osman A, Jensen, CT, Lubner, MG, Gaballah, AH, Elsayes, KM. HIV-related Malignancies and Mimics: Imaging Findings and Management. Radiographics. 2018; 38(7): 2051 - 2068.
8. Pires CAA, Noronha MAN, Monteiro JCMS, Costa ALCD, Abreu Júnior JMC. Kaposi's sarcoma in persons living with HIV/AIDS: A case series in a tertiary referral hospital. A Bras Dermatol. 2018; 93(4): 524 - 528.
9. National Library of Medicine. Acquired Immunodeficiency Syndrome. Available at: https://www.ncbi.nlm.nih.gov/mesh/68000163. Accessed 22 May 2022.
10. Brew BJ, Garber JY. Neurologic sequelae of primary HIV infection. Handbook of Clinical Neurology, 2018; 152: 65 - 74.
11. Capriotti T. HIV/AIDS: An Update for Home Healthcare Clinicians. Home Health Now, 2018; 36(6):348 - 355.
12. UNFPA. World population dashboard Nigeria. 2020.
13. National Agency for the Control of AIDS (NACA) (2019).
14. NAIIS. New survey results indicate that Nigeria has an HIV prevalence of 1.4% reliefweb.int>report>new.survey result. 2019
15. Oleribe OO, Aliyu S, Taylor-Robinson SD. Is the prevalence of HIV wrongly estimated in Nigeria? Some insights from a 2017 World AIDS day experience from a Nigerian Non-Governmental Organisation. The Pan Afri. Med. J. 2018; 29:119-127.
16. Boukhari R, Breiman A, Jazat J, Ruvoën-Clouet N, Martinez S, Damais-Cepitelli A. ABO Blood Group Incompatibility Protects Against SARS-CoV-2 Transmission. Frontiers of Microbiology. 2022;12: 799519.
17. Nordgren J, Nitiema LW, Ouermi D, Simpore J, Svensson L. Host Genetic Factors Affect Susceptibility to Norovirus Infections in Burkina Faso. PLoS ONE. 2013;8: e69557.
18. Chanzu NM, Mwanda W, Oyugi J, Anzala O. Mucosal Blood Group Antigen Expression Profiles and HIV Infections: A Study among Female Sex Workers in Kenya. Pub. Libr. Sci. One. 2015; 17(7):10 – 15.
19. Butler EA, Parikh R, Grandi SM, Ray JG, Cohen E. ABO and Rh blood groups and risk of infection: systematic review and meta-analysis. BMC Infect Dis. 2023; 23: 797.
20. Legese B, Shiferaw. M, Tamir. W, Eyayu. T, Damtie S, Berhan A, Getie B, Abebaw A, Solomon, Y. Association of ABO and Rhesus Blood Types with Transfusion-Transmitted Infections (TTIs) Among Apparently Healthy Blood Donors at Bahir Dar Blood Bank, Bahir Dar, North West, Ethiopia: A Retrospective Cross-Sectional Study. J. Blood Med. 2022; 13: 581 - 587.
21. Fan Q, Zhang W, Li B, Li DJ, Zhang J, Zhao F. Association between ABO blood group system and COVID-19 susceptibility in Wuhan. Front Cell Infect. Microbiol . 2020; 10: 404.
22. Okeafor IN, Okeafor CU. Evaluation of HIV Surveillance System in Rivers State, Nigeria. The Nig. Health J. 2017 17(1):
23. Ogbonna DN, Amangabara GT, Ekere TO. Urban solid waste generation in Port Harcourt metropolis and its implications for waste management.

Mgt. Environ. Quality An Intl. J. 2007:71-88
24. Siransky LK, Nanga ZY, Zaba FS, Tufa NY, Dasse SR. ABO/Rh Blood groups and risk of HIV infection and Hepatitis B among blood donors of Abidjan, Cote D'Ivoire. European Journal of Microbiology and immunology. 2015; 5: 205–209.
25. Davison GM, Hendrickse HL, Matsha TE. The relationship between immunogenic red blood cell antigens and Human Immunodeficiency Virus infection. Trans. & Aphe. Sci. 2018; 57: 58 – 62.
26. Noori M, Shokri P, Nejadghaderi S, Golmohammadi S, Carson-Chahhoud K, Bragazzi N, Ansarin K, Kolahi A, Arshi S, Safiri S. ABO blood groups and risk of human immunodeficiency virus infection: A systematic review and meta-analysis. Reviews in Medical Virology, 2021; 32.
27. Shaikh AA, Alqasem HM, Alshubruqi YA, Alasmari SZ, Makkawi MH. Association of ABO, Rh-D and Kell blood groups with transfusion transmitted infections among blood donors from the Asir Region, Saudi Arabia. Saudi Med J. 2024; 45(4):414-423
28. Anyiam AF, Arinze-Anyiam OC, Irondi EA, Obeagu E.I. Distribution of ABO and rhesus blood grouping with HIV infection among blood donors in Ekiti State Nigeria. Medicine. 2023;102: 47(e36342).
29. Sheng W. Research on relationship between erythrocyte Duffy antigen and HIV infection in high-risk group. Lab. Med. & Clinic. 2015.
30. Anzwal P, Ekwalanga M, Kambote A, Kasali J, Saragosti S, Situakibanza H, Gonzalez J. Unveiling an Atypical Response to HIV-1 Infection by the Patient Carrier of the Beta-S Globin Gene and Duffy Antigen Gene Double Mutation. J. AIDS & HIV Trmt. 2020; https://doi.org/10.33696//aids.2.005.
31. Bogui IS, Dembele B, Sekongo Y, Abisse S, Konate S, Sombo M. Phenotypic profile of Rh and Kell Blood Group systems among blood donors in Cote D ivoire West Africa. J. Blood Trans. 2014;1-4
32. Ifeanyi O. Association of ABO Blood Group with HIV Infection. Journal of Infectious Diseases & Microbiology, 2022.