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RESEARCH ARTICLE

RELATIVE SUSCEPTIBILITY OF ABO BLOOD GROUPING IN HBV & HIV CO-INFECTED PATIENTS ATTENDING A TERTIARY HEALTH FACILITY IN RIVERS STATE

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Authors' contributions
EW and EC conceptualized and designed the topic, EW did the field sampling and drafted the manuscript, WN, paid attention to CD4 analysis, and EC supervised and read the work to fullness in making sure that all the necessary things are put in place while OI took a look on the diagnostic techniques used in detecting *Plasmodium falciparum* in patients. All authors read and approved the manuscript.

ABSTRACT

Hepatitis B and HIV infections are significant public health problems in sub-sahara Africa, and with co-infected individuals of HBV or HIV experiencing a higher rate of HIV progression. This study was aimed at investigating possible susceptibility of ABO grouping in HBV and HIV co-infected individuals, attending University of Port Harcourt Teaching Hospital, Rivers State. Three Hundred and Seventy –Eight (378) HIV infected individuals participated in the study. Blood samples (5ml) were aseptically collected and tested for HBV using monolisa HBsAg ULTRA kit. Result indicated, 15(4%) been infected and 363(96%) not infected or negative for overall prevalence of HBV. Among the infected for malaria, HBV and HIV co-infection, 15(4%) were 31-80yrs and not infected; 18-80yrs 363(96%) except the age class of 41-50yrs which has a total number of 104 study subjects. A higher prevalence of HBV 9(3.3%) was found in male (272 study subjects) while the female (106 study subject) was 6(5.7%) making up a 14(3.7%) infected for malaria, HBV and HIV co-infection. This indicate a rise in the prevalence of HBV in the study area. Individuals with blood group A had 72(19%) B 40(10.6%), AB 48(12.7%) and O 218(57.7%). "O" is said to confer protection against complicated cases while A have been found to be highly susceptible to *falciparum* malaria 218 of the blood group O is susceptible to all the infections while A is susceptible to all except malaria and HCV, with ($P<0.05$). this may give blood group "O" individuals a survival advantage over the other groups in complicated malaria as suggested. Participants with complicated *falciparum* malaria were generally anaemic and younger than those with uncomplicated disease. In conclusion the study showed a high HBsAg seroprevalence rate among the HIV infected individuals attending the HIV clinic in the tertiary hospital in Port Harcourt Rivers State, Nigeria.

Key Words*: Hepatitis, Rhesus, Blood groups, and Prevalence*.

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1.1. INTRODUCTION

Hepatitis B virus (HBV) infection is an important public health problem worldwide, more than two million people (One-third of the world's population have been infected with HBV, and between 350 and 400 people have chronic liver infection with the presence of hepatitis B surface antigen (HBsAg) (Alter *et al*, 2003, Kao *et al*, 2012). Globally, record has revealed that 96% of the viral hepatitis deaths are attributed to Hepatitis B virus (HBV) and Hepatitis C Virus (HCV) (Cooke *et al*, 2019, Flower *et al*, 2022) but the prevalence of these infections is poorly characterized (Flower *et al*, 2022). The world Health Organization (WHO, 2021) estimates that 1/3 of the global population has serological evidence of HBV infection, of these, 296 million are chronic cancers, with 820,000 deaths from liver complications related to chronic infection per year (WHO, 2021). Among individuals chronically infected with HBV, over 70 million are Africans, resulting in the disease being widely regarded as African's silent killer (Muanya, 2022), 75% live in Asia, and 25% die from complications resulting from infection (Sato *et al*, 2014, Cooke *et al*, 2019, Flower *et al*, 2022, Demarchi *et al*, 2022).

The blood group ABO was the first blood group to be discovered by Karl Land-Steiner an America Scientist of Austrian Origin (Akinnuga and Bamidele, 2011). However, studies have recorded differences in the distribution frequency of ABO and Rhesus (D) blood groups among patients locally and globally (Mohamed *et al*, 2022, Akinnuga & Bamidele, 2011). The ABO and Rhesus (D) blood groups have been recognized and characterized (Mohamed *et al*, 2022, Akinnuga and Bamidele, 2011). The differences in susceptibility and severity of *P.falciparum* malaria infection among the "A" B", AB" and "O" blood groups have been attributed to resetting of parasitized erythrocytes and cytoadherence (Tursen *et al*, 2005, and Migot-Nabias *et al*, 2005) Nigeria has one of the greatest disease burdens from chronic viral hepatitis. The United Nations estimates that Nigeria's population in 2021 is 211.4 million (World Population Dashboard Nigeria, 2021, Ajuron *et al*, 2021).

Comprehensive prevalence data are essential to support its elimination as a public health threat. Considering the prevalence of HBV infections found in Nigeria, according to epidemiological research, the seroprevalence of HBV/HIV Co-infection ranges from 5 to 10% in the United States to 20 to 30% in some sub-Saharan African and Asian regions (Omatola *et al*, 2019). In Nigeria several report have revealed HBV prevalence among subpopulations in tertiary health care settings, in urban areas, with estimates ranging depending on the population investigated and methodologies used (Mustapha *et al*, 2020). Nevertheless, there is limited information on the incidence of HBV infection among HIV individuals in certain southeastern states in Nigeria. This study aimed to investigate seroepidemiological aspects of HBV infection and its associated factors among patients attending a tertiary hospital in University Port Harcourt Teaching Hospital, Rivers State, Nigeria. This study shall reveal for the first time the concurrent HIV/HCV/HBV and malaria cases in the University of Port Harcourt Teaching Hospital (UPTH) Port Harcourt, Rivers, Nigeria, which shall be accomplished by adopting systematic testing for co-infection with HIV, HBV, HCV and Malaria in HIV individuals.

2.0. MATERIALS AND METHODS

2.1 *Study Area*

The study was conducted at the University of Port Harcourt Teaching Hospital (UPTH), Rivers State, Nigeria, (Latitude 4^{o} 53' 58' and Longitude 6^{o} 55'43E) in Obio-Akpor Local Government Area. This hospital is one of the main treatment facilities for HIV infected and malaria in Rivers State, Southern Nigeria. It is bounded by the states of Imo and Anambra on the North, Akwa-Ibom and Abia on the East and Bayelsa and Delta on the west. It is characterized by constant rainfall during the wet season with resultant mangrove swamp vegetation. In order to obtain a study sample representatives of UPTH area of the State, patients attending the hospital were selected. To further buttress this, it is one of the mostly utilized federal Hospitals in Rivers State, Nigeria.

2.2 *Study Design*

A hospital-based cross-sectional study design was adopted for the present study, which seeks to determine relative susceptibility of ABO blood grouping in HBV and HIV Co-infected individuals attending the University of Port Harcourt Teaching Hospital, Port Harcourt, Nigeria.

2.2.1. Ethics Statement

Administrative approval for this study was obtained from the ethics committee of University of Port Harcourt, Rivers State, Nigeria. The University of Port Harcourt Research Ethics committee received the work for

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ethical issues and approved the standards for research involving human beings. Before samples were taken and processed, everyone who participated gave informed consent.

2.2.2. Study Population

The study population included male and female subjects who were at the clinics, or have a family relationship with this population. The individuals were informed in detail about the research objectives and the confidentiality of the data. The study entailed screening for Co-infections, clinical evaluation and recording of demographic information such as the age and sex of the participant. Serum samples from 378 participants were screened for a serological marker of HBV (HBsAg), infection by monolisa HBsAg using ULTRA enzyme-linked immunosorbent assay (ELISA) Kit (Manufactured by Bio RA Laboratories, California, United States). Following the manufacturer's guideline current HBV infection was defined as a positive HBsAg test result. ABV exposure was defined as a positive HBsAg test result. To compose the data-base, the questionnaires from 378 participants were analyzed to obtain sociodemographic information and factors associated with HBV transmission, including age and sex.

2.3 *Data Analysis*

Data analysis was performed with the statistical package for social sciences (SPSS) software version 20.0. This study used the Chi-squared test (X^2) or the fisher's exact test (for categorical variables to assess differences between proportions and determine P-values (two-tailed). The prevalence rate of HBV exposure (HBV marker: HBsAg positive) and a 95% confidence interval (CJ) were calculated. The 95% confidence intervals (CJ) were used to verify potential predictors of HBV infection and/or exposure (presence of HBsAg marker). (Hosmer *et al*, 2013). A P-value less than 0.05 was considered statistically significant.

3.0. RESULTS

A total of 378 patients were recruited for the study under observation. There were 15(4%) infected and 363(96%) not infected with a P-value of 0.026 which is considered statistically significant (Table 1). The result presented in Table 2 also shows that out of the 378 subjects examined for Hepatitis B in University of Port Harcourt Teaching Hospital, 35(9.3%) were infected for malaria only with the highest infection between the age of 41-50 out of 104 examined. 343(90.7%) not infected for malaria alone, 15(4%) infected for malaria, HBV and HIV Co-infection, 363(4%) not infected for malaria, HBV and HIV Co-infection, 1(0.3%) infected for malaria, HCV and HIV Co-infection and 363(96%) were not infected with malaria, HCV and HIV Co-infection with P-value of 0.016 which has statistically significant among the study subject.

Table 1: Overall HBV Prevalence

No. Examined	No Infected (%)	No not Infected (%)	P-value
378	15(4%)	363(96%)	P<0.005

Table 2: Overall Malaria, HBV, HCV and HIV Co-infection based on age

Age (Yrs)	Nos Examined	Infected for Mal. alone	Not Infected for Mal. alone	Infected for Mal, HBV & HIV Co-infection	Not Infected for Mal, HBV & HIV Co-Infection	Infected for Mal, HCV & HIV Co-Infection	Not Infected With Mal, HCV & HIV Co-Infection	P-value
18-30	64	3(4.7%)	61(95.3%)	-	64(100%)	-	64(100%)	
31-40	125	7(5.6%)	118(94.4%)	2(1.6%)	123(98.4%)	-	123(98.4%)	
41-50	104	4(3.8%)	100(96.2%)	4(3.8%)	100(96.2%)	1(1%)	99(95.2%)	0.016
51-60	51	8(15.7%)	43(84.3%)	3(94.1%)	48(94.1%)	-	48(94.1%)	
61-70	20	5(25%)	15(75%)	3(15%)	17(85%)	-	17(85%)	
71-80	14	8(57.1%)	6(42.6%)	3(21.4%)	11(78.6%)	-	11(78.6%	
Total	**378**	**35(9.3%)**	**343(90.7%)**	**15(4%)**	**363(96%)**	**1(0.3%)**	**363(96%)**	

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The result further shows in Table 3 that out of the 272 male examined, 9(3.3%) were infected for malaria, HBV and HIV Co-infection, 263(96.7%) not infected for malaria, HBV and HIV co-infection 1(0.4%) infected for malaria, HCV & HIV Co-infection and 271(99.6%) were not infected for malaria, HCV and HIV Co-infection while that of the female, out of 106 had 6(5.7%) infected, 100(94.3%) not infected, giving a total percentage of 14(3.7%) infected for all the disease, 1(0.26%) infected for all and 27(7.1%) not infected with the diseases with a P-value of 0.518 which is very significant.

Table 3: Overall Malaria HBV, HCV and HIV – Co-Infection based on Sex

Sex	No Examined	Infected for Mal, HBV & HIV Co-infection	Not Infected for Mal, HBV & HIV Co-infection	Infected for Mal, HCV & HIV Co-infection	Not Infected for Mal, HCV & HIV Co-Infection	P-value
Male	272	9(3.3%)	263(96.7%)	1(0.4%)	271(99.6%)	0.518
Female	106	6(5.7%)	100(94.3%)	-	-	
Total	**378**	**14(3.7%)**		**1(0.26%)**	**27(7.1%)**	

Co-infection of diseases as presented in Table 4 shows that co-infection was absent in blood group B and AB but present in malaria alone, while the infection was present in malaria 35(9.3%), malaria + HBV 15(4%) and malaria + HBV 1(0.3%) with the P-value of <0.05. it was generally observed in Table 5 that out of 378 percent examined, 72(19%) had blood group A, 40(10.6%) B, 48(12.7%) AB and 218(57.7%) for blood group O.

Table 4.: Overall Blood Group based on Susceptibility to Infection

Blood Groups	No Examined	Malaria alone	Malaria + HBV	Malaria + HCV
A	72	7(9.7%)	2(2.8%)	-
B	40	4(10%)	-	-
AB	48	6(12.5%)	-	-
O	218	18(8.3%)	13(6%)	1(0.3%)
Total	**378**	**35(9.3%)**	**15(4%)**	**1(0.3%) P<0.05**

Table 5: Overall ABO Blood Grouping of the Study Subjects

No. examined	Blood Group A	Blood Group B	Blood Group AB	Blood Group O
378	72(19%)	40(10.6%)	48(12.7%)	218(57.7%)
Total	**378**			

4. DISCUSSION

This study reveals that of the 378 subjects examined for malaria, HBV and HIV Co-infections in the study area, 15 were infected with all the diseases with the malaria given a total prevalence of 9.3%, 15(0.4%) study subjects were infected with malaria, HBV and HIV Co-infection. It was further observed that the prevalence three diseases were not significantly different among the subject as observed in the study. The study subjects that were positive to malaria infection were given antimalarial drugs by competent medical personnel in the health centres while those that were positive for Hepatitis and HIV were referred to virology department in UPTH and HIV centre in Rumuigbo for further confirmatory tests, counselling and therapy. The highest prevalence of malaria (9.3%) when compared to the other two diseases (Hepatitis B and HIV) shows that malaria is the most dominant disease in Port Harcourt metropolis. This corroborates World Health Organization malaria report (WHO, 2021) that malaria is the most important public health problem in terms of morbidity and mortality crushing more than 200 million morbidity and 655,000 mortality every year. The high prevalence of malaria has been associated with the increase in the population living in malaria endemic region (Ajuron *et al.*, 2021).

Low infection rates of hepatitis B (4%) and HIV (3.7%) might be as a result of increase in the public enlightenment in the area. The people living in endemic area like Port Harcourt metropolis are aware of the various preventive measures for the two diseases. Low prevalence of hepatitis B recorded in the study area is supported by Demarchi *et al.* (2022) at medical wards of University of Maiduguri Teaching Hospital, Nigeria where a low prevalence of 12.3% for hepatitis B virus was reported among HIV positive patients. The distribution of malaria among groups shows that the prevalence of the disease is higher among 41-50 years and 31-40 years. This shows that the lower age groups are more predisposed to malaria infections than older groups. This might be because the

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lower age groups are still building up immunity against malaria parasites compared to the older age groups where their immunity has been fully developed to combat the malaria parasites.

The results of this study further show that there is no significant difference in prevalence of malaria, hepatitis B and HIV between genders. This implies that gender has nothing to do with the transmission of the disease. Both gender have equal chance of contracting the diseases when exposed to the parasites. In addition, it was observed that malaria parasite, hepatitis B virus and Human Immunodeficiency virus can cohabit in immunodeficiency or immunocompromised hosts. All the individuals that were positive for hepatitis B and HIV/AIDS tested positive for malaria test. This also suggests that individuals with HIV/AIDS have higher risk of contracting hepatitis B virus. It shows that malaria and HIV/AIDS could Co-exist in human host. The result of this study also show that Four of the Three Hundred and Seventy Eight (378) individuals infected with HIV/AIDS also tested positive for hepatitis B virus, which shows the presence of HIV in the same host and vice versa. The Co-infection of HBV and malaria parasite noted in this research is contrary to the report of Cooke *et al.* (2019). The authors reported that presence of HBV and malaria Co-infection reduces the severity of HBV and malaria as mono infection in Kano. The Co-infection of HBV and malaria observed in this study suggest that HBV and malaria parasite can co-exist in a host and HBV patients have the higher risk of contracting malaria.

The distribution of blood group from our study revealed that most prevalent blood group on the study subject at the University of Port Harcourt Teaching Hospital (UPTH) is blood group O (57.7%),followed by A (19%), AB (12.7%) and B (10.6%) (Table 5). The distribution was in agreement with the findings in Somalia on blood groups in relation to malaria and other diseases showed that malaria (9.3%), malaria & HBV (4%) and malaria & HCV (0.3%) respectively (Mohamed *et al*, 2022, Akinnuga and Bamidele, 2011). This was not in agreement with the study in Philippines and India with blood group B as the most prevalent blood group (Alem and Mama, 2016). The significance of anaemia in pathogenesis of complicated *P.falciparum* malaria has been documented (Carlson *et al*, 1990, Rowe *et al*, 2007). Destruction of both Parasitized and non-parasitized erythrocytes as well as rotting and sequestration of parasitized erythrocytes has been cited to be the major cause of severe anaemia in complicated *falciparum* malaria (Carlson *et al*, 1990, Rowe *et al*, 2007), our data in the present study appear to suggest that RBCs of blood group "O" individuals were more susceptible to *falciparum*-induced hemolysis than the RBCs of individuals of other blood groups. Thus, the apparent protection offered by blood group "O" may be lost at relatively higher levels of parasitaemia.

5. CONCLUSION

High prevalence of malaria observed among the 378 study subjects attending University of Port Harcourt Teaching Hospital in the study area suggest that campaigns about the prevention and control of malaria infection should be intensified. Presence of malaria parasite in all the subjects that are infected with hepatitis and HIV/AIDS suggest that there patients should always be encouraged to employ all preventive measures such as habitat control, use of treated nets and regular medical checkup and prompt treatment of malaria when infected. This implies that people employed several preventive measures against the disease patients with blood O may have some protection against complicated *falciparum* malaria and may posses a survival advantage over their counterparts with other blood groups. However, this protection may be lost at high parasitaemia due to enhanced RBC destruction. With the systematic testing for co-infection with HIV, HBV, HCV and Malaria in HIV individuals been adopted, this study reveals for the first time that University of Port Harcourt Teaching Hospital (UPTH) Port Harcourt, Rivers, Nigeria, has concurrent HIV/HCV/HBV and malaria cases.

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CONFLICT OF INTEREST

The Authors have stated no conflicts of interest among them**.**

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