

## Research Article



## Serosurvey for HIV, Hepatitis B, and C Viruses Among Apparently Healthy Students of Federal Polytechnic Idah and its Environs

Joseph Oyiguh Abraham<sup>1</sup>, Cornelius Arome Omatola<sup>1\*</sup>, Martin-Luther Oseni Okolo<sup>1</sup>, Ruth Foluke Aminu<sup>1</sup>, Emmanuel Edegbo<sup>1</sup>, Olubunmi Marvelous Emurotu<sup>1</sup>, Danjuma Muhammed<sup>2</sup>, Jesse Joseph Chock<sup>3</sup>, Helen Ojomachenwu Ocean<sup>4</sup> and Yahaya Ocholi<sup>5</sup>

<sup>1</sup>Department of Microbiology, Kogi State University, Anyigba P.M.B. 1008, Kogi State, Nigeria; <sup>2</sup>Department of Biology, Epidemiology, and Public Health Unit, Universiti Putra Malaysia; <sup>3</sup>Department of Medical Laboratory Science, Kaduna State University, Kaduna, Nigeria; <sup>4</sup>Department of Microbiology, Salem University Lokoja; <sup>5</sup>Department of Microbiology, Ahmadu Bello University, Zaria, Nigeria.

**Abstract** | Human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) remain a significant public health concern globally. However, there is a dearth of information about the prevalence of the three viruses in the study area. Therefore, the current study determined the prevalence of HBV, HCV, and HIV among students of a tertiary institution and its environs in Idah, Kogi State, Nigeria. Sera obtained from 1000 consented individuals were screened for HBsAg, anti-HCV, and HIV antibodies using commercial immunoassay test kits. Relevant demographic information was obtained from each participant with a structured questionnaire. Of the 1000 participants, HBV, HCV, and HIV were detected in 28 (2.8%), 2 (0.2%) and 3 (0.3%), respectively. However, no participant was simultaneously infected with any two or three viruses. The age group 21–40 years demonstrated greater exposure to HBV (7.57%), HCV (0.37%), and HIV (1.17%) infection than the others. More male than female participants had HBV (3.3% vs. 2.4%). On the contrary, both genders were equally infected with HCV (0.2% vs. 0.2%), while more of the females had HIV (0.6% Vs. 0.0%). Nevertheless, neither gender nor age of exposure significantly influenced any of the three viral infections. Being single significantly influenced HCV ( $P=0.02$ ) and HIV ( $P=0.001$ ) while levels of education significantly predict HBsAg seropositivity ( $P=0.02$ ). Generally, not knowing about viral infection prevention was associated with a high prevalence of HBV, HCV, and HIV. In conclusion, the study observed a low prevalence of HBV, HCV, and HIV when compared with most reported studies elsewhere. However, the occurrence of more viral infections in association with a lack of knowledge of infection suggests the need to strengthen awareness programs on infection and control strategies in the area.

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**\*Correspondence** | Omatola Cornelius Arome, Department of Microbiology, P.M.B.1008, Kogi State University, Anyigba, Nigeria; **Email:** [omatolac@gmail.com](mailto:omatolac@gmail.com), [omatola.ca@ksu.edu.ng](mailto:omatola.ca@ksu.edu.ng)

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## Introduction

Globally, hepatitis B virus (HBV) remains the most significant etiology of liver disease and death annually (WHO, 2023; Omatola *et al.*, 2020a). HBV accounts for approximately 296 million chronic carrier cases, 1.5 million new infections, and a yearly death rate of 820,000 across the globe (WHO, 2023). In Nigeria with HBV national prevalence of 11% in 2018, a report from the Ministry of Health indicates that the hepatitis virus remains the leading silent epidemic in the country as more than half of the nation's population who have the disease have never been screened for hepatitis virus (HepF, 2020). Of concern, about nine in every ten Nigerians who are chronically infected with HBV do not know their disease status and are missing from the global public health statistics owing to a lack of awareness, resources, and political will for addressing Nigeria's HBV plight (HepF, 2020; FMH, 2016). Thus, Nigeria remains among the countries in West Africa with the highest burden of HBV-associated cancer (deMartel *et al.*, 2020). According to an HIV-AIDS indicator and impact survey in the country, HBV and HCV accounted for a prevalence rate of 8.1% and 1.1%, respectively among adults aged 15–64 years (NACA, 2019). Further, the World Health Report in 2020 indicated that approximately 20 million people in Nigeria are living with HBV, HCV, or both (WHO, 2020).

Human immunodeficiency virus (HIV), HCV, and HBV share common routes of transmission such as sexual intercourse, exposure to infected blood, or vertical (mother to child). Consequently, coinfection of HIV with viral hepatitis is common (Odaibo *et al.*, 2019; Omatola *et al.*, 2019, 2020b). HIV patients who are chronic carriers of HBV or HCV have a greater chance for progressive liver disease and liver-related complications such as cirrhosis and/or hepatocellular carcinoma as well as transmitting the hepatitis viruses to others (Ola *et al.*, 2004). Further, the comorbid state enhances the risk of hepatotoxicity of highly active antiretroviral drugs (HAART) and the appearance of AIDS-defining illnesses relative to HIV mono-infection (Grenb, 2010). Therefore, studies that can generate updated information on the prevalence of these viruses are warranted for proper planning of health control measures.

Currently, a safe and effective vaccine is available to

prevent HBV infection but not against HCV and HIV (WHO, 2023). HBV infection in infancy and early childhood results in chronic hepatitis in >95% of cases, a rationale for strengthening and prioritizing infant and childhood vaccination worldwide (WHO, 2023). Despite the inclusion of the HBV vaccine in the Nigerian expanded pediatric immunization schedules in 2004 (WHO, 2016), Nigeria remains among HBV endemic countries in the world (Ajuwon *et al.*, 2021).

In Kogi State, HIV, HBV, or HCV infection has been widely documented in different populations (Omatola *et al.*, 2018; Okolo *et al.*, 2022). Though, little or no information exists with regards to HIV, HBV, or HCV in Idah albeit in asymptomatic individuals in the area. Thus, the current study investigated the seroprevalence of HIV, HBV, and HCV among apparently healthy students of Federal Polytechnic Idah and its environs, Kogi State, Nigeria. Further, we assessed their knowledge of HIV, HBV, and HCV infection prevention strategies.

## Materials and Methods

### Study area

The study was carried out in Idah metropolis located on the eastern bank of the river Niger, the middle belt region of Nigeria. Idah is a small local government area with an area of 36 km<sup>2</sup> around the town and an estimated population of 79,815. Idah lies between latitudes 7°5'0"N and 6°45'0"E and has commercial routes on the river Niger which connect Lokoja, the Kogi state capital, to the south of Edo State. The occupation of Idah people is mainly farming.

### Study population

The study was carried out among students (aged 11–80 yrs) of Federal Polytechnic Idah and its environs between the months of October 2020 and April 2021. Ethical approval was obtained from Kogi State Ministry of Health Lokoja, Nigeria following the code of conduct for biomedical research involving human subjects. Participant's consent was obtained after a thorough explanation of the nature of the research and its benefits. Using a structured questionnaire, demographic information including age, marital status, employment status, sex, and knowledge of viral infection was obtained from subjects. Sample size (N) of 1000 was determined using Cochran's sample size formula described elsewhere (Omatola *et al.*, 2019).

### Sample collection, preparation, and screening

Two milliliters of venous blood sample was collected from each of 1000 apparently healthy subjects comprising students of Federal Polytechnic Idah and people from its environs into a well-labeled EDTA bottle. Blood samples were centrifuged at 3,000 rpm for 5 min and the sera were subsequently screened for hepatitis B surface antigen (HBsAg) using Prime Rapid Test Kit (Diaspot® HBsAg, Diaspot Diagnostics, USA), anti-HCV antibodies using Promid Rapid Diagnostic kit (Filtrust Nig Ltd, China), and antibodies to HIV type 1 and 2 antibodies using Chembio HIV-1/2 Stat Pak (Combio Diagnostic Systems) and Unigold Determine HIV-1/2 test kit (Abbot Laboratories, USA). All laboratory procedures were performed according to the manufacturer's specifications.

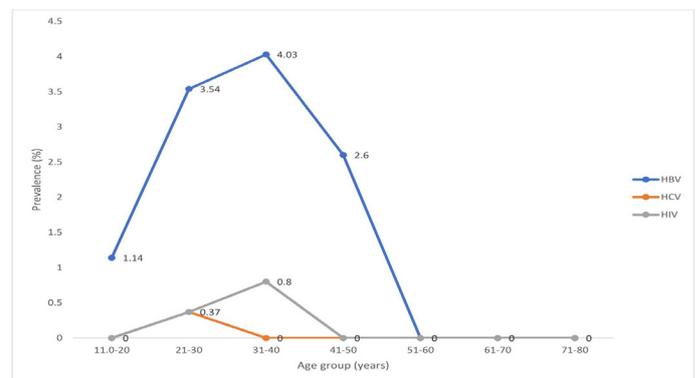
### Statistical analysis

Data entered in Excel were imported and analyzed using Statistical Package for the social sciences version 16 for Windows (SPSS Inc., Chicago). The relationship between each virus status and the participant's variable was assessed using a chi-square test and logistic regression where appropriate. The latter statistics were computed at a 95% confidence interval. The level of statistical significance was set at  $p < 0.05$ .

## Results and Discussion

Of the 1000 participants, 28 (2.8%), 2 (0.2%) and 3 (0.3%) were positive for HBV, HCV, and HIV, respectively. None of the participants was simultaneously infected with any two or three viruses. Subjects aged 31-40 years with HBsAg seropositivity of 4.03% (5/120) demonstrated greater exposure to HBV compared to other age groups. Two of the subjects with HCV and HIV infection (0.37% each) were aged 21-30 years. However, the difference between the age of infection with either HBV, HCV, or HIV and the viral positivity rate was not significant ( $P > 0.05$ ) (Figure 1). Analysis by gender showed that more males than females had HBV (3.3% vs. 2.4%). Furthermore, while both male and female participants were equally infected with HCV (0.2% vs. 0.2%), more of the females than their male counterparts were predisposed to HIV (0.6% Vs. 0.0%). Generally, participants with a lack of knowledge about HBV, HCV, and HIV infection prevention and control were more seropositive to HBsAg, Anti-HCV, and anti-

HIV antibodies (2.93%, 0.4%, 0.6%), respectively than the informed individuals with 2.7% HBsAg positivity rate and zero prevalence of HIV and HCV. However, neither gender nor knowledge of infection prevention significantly influenced the rate of infection by the three Viruses ( $P > 0.05$ ). Single participants were significantly infected with HCV ( $P = 0.02$ ) and HIV ( $P = 0.001$ ). Although married individuals had more HBV than the other marital groups, the difference was not significant ( $P > 0.05$ ). The educational qualification of the participant was found to significantly predict HBsAg seropositivity ( $P = 0.02$ ) as subjects with primary (prevalence: 5.5%) than tertiary (prevalence: 3.4%) qualifications had HBV infection. On the other hand, participants with tertiary qualifications though had higher HCV and HIV compared to other levels with zero prevalence for both infections, the difference was not significant ( $P > 0.05$ ). In terms of occupation, artisans, and Farmers with seroprevalence of 8.0% and 7.7% respectively, were more predisposed to HBV than the other occupational groups. However, neither HBV nor HCV or HIV infections were significantly associated with participants' occupation ( $P > 0.05$ ) (Table 1).



**Figure 1:** Prevalence of HBV, HCV, and HIV by age of study participants.

Human Immunodeficiency virus, and Hepatitis B and C viruses remain a worldwide public health concern, particularly in Africa where opportunities for viral transmission are highly variable (WHO, 2020, 2023; Ajuwon *et al.*, 2021). The prevalence of infection by these viruses is changing and investigation of each infection alongside associated risk factors in asymptomatic individuals are needed to highlight the danger associated with asymptomatic infections and further generate baseline information for future studies to build on in the area. To our knowledge, there is currently no documented evidence of HBV, HCV, and HIV in the asymptomatic population in

the study area. Therefore, the current study provides the first serological evidence of HBV, HCV, and HIV infections among the apparently healthy population in the Idah metropolis.

**Table 1: Distribution of HBV, HCV, and HIV in relation to participants' sociodemographic risk factors.**

Variable	No. tested	Virologic status		
		HBV+, n (%)	HCV+, n (%)	HIV+, n (%)
<b>Gender</b>				
Male	492	16 (3.3)	1 (0.2)	0 (0.0)
Female	508	12 (2.4)	1 (0.2)	3 (0.6)
Total	1000	28 (2.8)	2 (0.2)	3 (0.3)
P-value		0.25	1.00	0.12
<b>Knowledge</b>				
Yes	452	12 (2.7)	0 (0.0)	0 (0.0)
No	546	16 (2.9)	2 (0.4)	3 (0.6)
Total	1000	28 (2.8)	2 (0.2)	3 (0.3)
P-value		0.60	0.05	0.32
<b>Marital status</b>				
Single	812	18 (2.2)	2 (0.2)	2 (0.2)
Married	141	9 (6.4)	0 (0.0)	0 (0.0)
Separated	16	1 (6.3)	0 (0.0)	0 (0.0)
Widowed	15	0 (0.0)	0 (0.0)	0 (0.0)
Divorced	11	0 (0.0)	0 (0.0)	0 (0.0)
Cohabiting	5	0 (0.0)	0 (0.0)	1 (20.0)
Total	1000	28 (2.8)	2 (0.2)	3 (0.3)
P-value		0.21	0.02	0.001
<b>Educational qualifications</b>				
Non-formal	108	0 (0.0)	0 (0.0)	0 (0.0)
Primary	55	3 (5.5)	0 (0.0)	0 (0.0)
Secondary	125	1 (0.8)	0 (0.0)	0 (0.0)
Tertiary	712	24 (3.4)	2 (0.3)	3 (0.4)
Total	1000	28 (2.8)	2 (0.2)	3 (0.3)
P-value		0.02	1.00	0.95
<b>Occupation</b>				
Business	204	5 (2.3)	0 (0.0)	0 (0.0)
Healthcare workers	23	0 (0.0)	0 (0.0)	0 (0.0)
Clergy	8	0 (0.0)	0 (0.0)	0 (0.0)
Applicant	157	1 (0.6)	0 (0.0)	0 (0.0)
Armed force	5	0 (0.0)	0 (0.0)	0 (0.0)
Artisan	25	2 (8.0)	0 (0.0)	0 (0.0)
Civil servant	87	2 (2.3)	0 (0.0)	0 (0.0)
Farmer	39	3 (7.7)	0 (0.0)	0 (0.0)
Housewives	27	0 (0.0)	0 (0.0)	0 (0.0)
Students	425	15 (3.5)	2 (0.5)	3 (0.7)
Total	1000	28 (2.8)	2 (0.2)	3 (0.3)
P-value		0.23	1.00	1.00

In the current study, HBsAg seropositivity rate of 2.8% was estimated, similar to low prevalence rates of 2.5% and 2.4% previously observed among asymptomatic populations in India (Neerja *et al.*, 2012) and elsewhere in the state (Arome and Oseni, 2021) but lower than the HBV national prevalence of 11% in 2018 (Abutu, 2018), 9.5% prevalence from a meta-analytic study of pooled published data from 2010 and 2019 (Ajuwon *et al.*, 2021) and 6-10% prevalence rates previously observed among febrile population and apparently healthy students of a tertiary institution elsewhere in the state (Okolo *et al.*, 2022; Omatola *et al.*, 2018). Similar to HBV, a comparatively low prevalence of HCV (0.2%) and HIV (0.3%) was observed in our study. Previously, a similar study among undergraduate students in Rivers and Kogi State documented HCV prevalence of 0% (Okonko *et al.*, 2014) and 4.5% (Omatola *et al.*, 2016), respectively. The current HIV prevalence rate is comparable with a 0.3% anti-HIV seropositivity rate recently reported by Odaibo *et al.* (2021) among Sickle Cell Disease individuals in southwestern Nigeria but substantially lower than the 3.3% prevalence rate reported for Kogi State by the Ministry of Health in 2015 (FMH, 2015). The findings of this study corroborate previous epidemiological national health data which indicated a clear decline in national HIV prevalence of 2.8% in 2018; 1.4% in 2019 (FMH, 2019). The decreasing trend in the prevalence of HBV, HCV, and HIV in our study, which generally agree with previous epidemiological reports from the state and national health statistics could be attributed to the positive influence of various national health education programs aimed at reducing blood-borne and sexually transmitted infections in the country. Our findings support the report of Odaibo *et al.* (2021) which attributed the increased availability of vaccines for HBV, prevention of mother-to-child transmission programs for HIV, and nationwide improvement in the screening of blood for transfusion to the widespread report of low prevalence HBV, HIV, and HCV infections in different epidemiological investigations.

Ages 21-40 years with higher exposure to HBV, HCV, and/or HIV infections correspond to the period during which the participants are likely more engaged in high-risk lifestyle habits such as promiscuity, unprotected sex, and/or intravenous drug use (Omatola *et al.*, 2020b; Moonsamy *et al.*, 2019). Furthermore, lack of prior immunity acquired through vaccination or natural infection may increase

chances of viral transmission observed in these age groups (Moonsamy *et al.*, 2019). Despite higher testing rates in females, both males and females were equally comparable with regard to HBV, HIV, and HCV infections. The high prevalence of HBV in males although, not significant, as reported elsewhere (Moonsamy *et al.*, 2019) is concerning as more males than females are likely to progress to chronic liver disease (Moonsamy *et al.*, 2019).

In the current study, the high prevalence of three viruses among those with no knowledge of HBV, HCV, and/ or HIV infection is expected as they are less likely to implement viral control and prevention strategies. The high prevalence of viral hepatitis in relation to lack of knowledge of infection has been previously documented (Arome and Oseni, 2021). Interestingly, the significantly high hepatitis B surface antigenemia rate among subjects with primary qualification may further justify the role of education in disease prevention. Thus, the need to intensify health education about infection prevention and control strategies among students of Federal Polytechnic Idah and its environs is warranted for breaking disease transmission. The high prevalence of HBsAg among subjects who were married in the study agrees with previous reports in India (Neerja *et al.*, 2012) and Middle-belt Nigeria (Omatola *et al.*, 2019). Apparently, marriage creates opportunities for viral transmission via sexual intercourse, and high-risk sexual behavior by any of the spouses may amplify the chances of predisposition to viral infection.

## Conclusions and Recommendations

In conclusion, findings from this study indicate a low prevalence of HBV, HCV, and HIV among students of Federal Polytechnic Idah and its environs when compared with epidemiological reports from some parts of the world. Notwithstanding, the current prevalent rates of HBV, HCV, and HIV is important considering that the estimated rate is among the asymptomatic population. Overall, HBV, HCV, and HIV infection were higher in individuals with a lower level of education than the enlightened subjects. Thus, there is a need for the government to strengthen HIV and hepatitis B and C prevention programs in all socioeconomic settings to reduce the burden of the three viruses considerably and rapidly.

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## Novelty Statement

The study reported the serological evidence of HBV, HCV, and HIV infections among asymptomatic individuals in Idah metropolis. To our knowledge, this is the first epidemiological surveillance study that highlights the danger posed by asymptomatic infections by the three viruses in the area. Further, high viral infection in connection with poor knowledge of disease transmission dynamics was observed, highlighting the need for intensified health education of the general populace about HBV, HCV, and HIV prevention and/ or control.

## Author's Contribution

JOA designed the study, obtained ethical approval and ran assay. CAO analyzed data. CAO, JOA, MOO, RFA, AE, OME, DM, CJJ, HOO, and YO wrote the draft manuscript.

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## Ethics approval

This ethical approval for the study was obtained from the state Ministry of Health in accordance with Helsinki's code of conduct for biomedical research involving human subjects.

## Conflict of interest

The authors have declared no conflict of interest.

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