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Prevalence of Hepatitis B surface antigen and Hepatitis C surface antigen among tertiary and secondary school students in Jos Nigeria

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Abstract

Background: The Hepatitis B Virus (HBV) and the Hepatitis C Virus (HCV) are major health problems that account for a significant percentage of liver diseases worldwide and a significant public health concern. **Aim:** This study was conducted to determine the seroprevalence of Hepatitis B and C surface antigens among students at tertiary and secondary schools in Jos, Nigeria. **Methodology:** The surface antigens of HBV and HCV were detected in 226 samples of blood using a rapid strip detection assay. **Results:** Among the 226 blood samples analyzed (113 students from each school) for Hepatitis B surface antigen and Hepatitis C antibody using a one-step Hepatitis strip, 8(3.5%) showed positive results for Hepatitis B surface antigen, among the age groups 10-20 years old, 1.6% prevalence, 21-30 years old, 6.8% prevalence, 31-40 years old, 0.02% and 41-50 years old, 0.0% prevalence, with the male subject recording a higher prevalence rate of 6.3% than the female subject with a prevalence rate of 0.9%, was significant. Based on the results of this study, the prevalence rate for HBV was 3.5%, while there was no record of HCV or dual infection between HBV and HCV among the students. The prevalence of HBV was higher among students from the tertiary institution compared to those from the secondary school. **Conclusion:** Educating students about the importance of Hepatitis B vaccination in preventing chronic infection with Hepatitis B and C viruses, as well as regular HCV testing for early detection and management, is imperative.

Keywords: *Seroprevalence, HBV, HCV, Infection, Vaccine*

1. Introduction

The condition known as Hepatitis involves inflammation of the liver. This disease can progress to fibrosis (scarring), cirrhosis, or liver cancer. Other infections and toxic substances, such as alcohol, certain medications, and autoimmune diseases, can also result in this condition (World Health Organization, 2017).

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About half of the global population resides in areas where Hepatitis B is endemic, with a seroprevalence of Hepatitis B surface antigen (HBsAg) exceeding 8% (Inan and Tabak, 2015). The infection caused by the Hepatitis B virus is the primary risk factor for the onset of liver cancer, which is among the significant malignant cancers, ranking as the second leading cause of cancer mortality in men and the sixth in women (Ishikawa, 2012).

The incubation period for the Hepatitis B Virus (HBV) can range from 4 to 12 weeks, followed by an acute infection phase lasting between 2 and 12 weeks (Kayser *et al.*, 2005). Since the 1980s, vaccines for HBV have been accessible and have proven to be about 95% effective in preventing both acute and chronic infections (ECDC, 2010).

The Hepatitis B virus (HBV) is significantly more contagious than the Hepatitis C Virus (HCV), being 10 times as infectious, and many people infected with HBV are unaware of their condition, leading to the term "silent killer." Individuals who are co-infected with both HBV and HCV face a heightened risk of developing cirrhosis, advanced liver disease, and hepatocellular carcinoma (HCC). There is notable variation in how these viruses replicate and how patients' immune systems respond when co-infected. Since both viruses share similar transmission methods, co-infection is common, particularly in regions where HBV is prevalent. Having concurrent infections of HBV and HCV is associated with more severe liver complications and a higher likelihood of developing hepatocellular carcinoma (Liu and Hou, 2006).

Despite advancements in public health awareness, many people remain uninformed about whether they are infected with the Hepatitis B and C viruses (Ott *et al.*, 2012). Identifying Hepatitis B and C infections at an early stage could help avert liver-related diseases, including cancer. The prevalence of Hepatitis B and C infections among undergraduate students at the University of Jos in comparison to those at Senior Secondary School Gwong is currently unknown. Furthermore, it is crucial to pinpoint the factors that render youth and adults vulnerable to Hepatitis B and C infections in this environment.

In 2013, viral Hepatitis ranked as the seventh leading cause of death globally. Each year, around 1.4 million individuals succumb to liver cancer and cirrhosis as a result of Hepatitis. Approximately 47% of these fatalities can be attributed to the Hepatitis B virus, 48% to the Hepatitis C virus, and the rest to Hepatitis A and Hepatitis E viruses. Hepatitis B is particularly prevalent in Africa, where an estimated 5-8% of the population is impacted (World Health Organization, 2017).

Approximately 19 million adults in the region are affected by chronic Hepatitis C infections. Viral Hepatitis is a leading cause of mortality among individuals diagnosed with HIV. Around 2.3 million people with HIV are also co-infected with Hepatitis C, while approximately 2.6 million are living with Hepatitis B. Recent outbreaks of Hepatitis E virus have been reported in countries such as Chad, Senegal, South Sudan, and Uganda, as well as in other African nations experiencing high levels of endemicity (World Health Organization, 2017).

In Plateau State, the prevalence rates for Hepatitis B and C are 9.13% and 4.5%, respectively (Janaet, 2017). Hepatitis B is part of the Hepadnaviridae family and is recognized as one of the smallest enveloped viruses found in animals, with a virion size of 42 nm. It functions as a partially double-stranded DNA virus. In contrast, the Hepatitis C Virus (HCV) is a small, enveloped, positive-sense single-stranded RNA virus belonging to the Flavivirus family, measuring 50 nm in diameter (Dubuisson and Cosset, 2014). The majority of infections caused by HCV are asymptomatic, with around 70-90% of patients developing chronic Hepatitis, many of whom face the risk of progressing to chronic Hepatitis and cirrhosis (10-20%) (Carrol *et al.*, 2016). A significant number of individuals with HCV are unaware of their infection due to the high incidence of asymptomatic cases (Shawa and Hopkins, 2013). The incubation period for HCV ranges from 2 weeks to 6 months after initial exposure. Roughly 80% of individuals do not show any symptoms (WHO, Hepatitis C fact sheet, World Health Organization, Geneva, Switzerland). The World Health Organization states that there is currently no vaccine available for HCV infection, and a person infected with HCV can transmit the virus to others for 1 to several weeks prior to the onset of symptoms (World Health Organization, 2019).

Just like Hepatitis B, Hepatitis C is mainly spread through the same channels, primarily through sharing injection equipment, insufficient sterilization of medical tools in healthcare environments, and through transfusions of unscreened blood and blood products. It can also be transmitted sexually or from an infected mother to her child, although these methods of transmission are considerably less prevalent. It cannot be transmitted through breast milk, food, or water, nor through casual interaction such as hugging, kissing, or

sharing meals and beverages. In developed nations, for instance, the virus is primarily spread through illicit drug use, injections, and sexual contact, while in developing nations, it is predominantly transmitted through medical procedures due to inadequate infection control and traditional practices like circumcision, especially in resource-poor settings (World Health Organization, 2019; Cooke *et al.*, 2013).

Worldwide, infections caused by Hepatitis B and C viruses represent a significant portion of liver-related diseases. As noted by Livramento *et al.* (2011), Nigeria has a high prevalence of viral Hepatitis (Livramento *et al.*, 2011). Since many Hepatitis B and C infections are asymptomatic, with serious long-term effects emerging later in life, there is an increased risk of morbidity, mortality, and a notable financial impact on both society and families. Consequently, precise and early identification, alongside effective prevention and control measures, is crucial for mitigating the chances of transmission between individuals.

Many studies have been carried out on the prevalence of HBV and HCV in Nigeria (Odinachi *et al.*, 2014; Seyi *et al.*, 2019; Onwuiri *et al.*, 2017; Adda *et al.*, 2020; Babatope *et al.*, 2015), but there is a lack of sufficient information on comparing the rates of HBV and HCV among secondary school and higher education students, and no prior research has explored the relationship between HBV infection prevalence and levels of educational attainment as well as religious beliefs.

This study was undertaken to assess the prevalence of Hepatitis B and C among tertiary and secondary students, as well as to identify risk factors that could pinpoint at-risk students.

2. Material and Methods

2.1. Study area

The study focused on undergraduate students at the University of Jos and senior secondary school students from Gwong Secondary School, both situated in the Jos North Local Government Area.

2.2. Study population

The target population consisted of students from secondary and tertiary educational institutions, including young males, females, and adults aged 10 to 50 years.

2.3. Inclusion criteria

Only children aged 10 to 23 years from secondary schools and students aged 16 to 50 years enrolled in the selected undergraduate institutions during the study period were included in this research.

2.4. Exclusion criteria

Students who are seriously ill or receiving treatment for Hepatitis B and C virus infections were excluded, along with individuals from outside the selected schools and those who did not provide consent.

2.5. Ethical consideration

The study protocol received approval from the Ethical Committee of the Plateau State Specialist Hospital Board, and permission was granted by the Ministry of Education. Parents of secondary school students involved in the study filled out an informed consent form, while tertiary institution students also signed an informed consent. Anonymity for students was maintained throughout the study.

2.6. Sample collection

A sterile collection of 2 ml of venous blood was conducted on each consenting student through a venous puncture of the median cubital vein into a plain sample bottle, which was transported to the laboratory for processing.

2.7. Laboratory detection of HBV and HCV

2.7.1. Procedure for HBV and HCV rapid strip detection assay

In the laboratory, the blood sample was spun in a centrifuge at 2,000 revolutions per minute (rpm) for 5

minutes to separate the serum. This serum was subsequently utilized to identify antibodies for Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) using a Hepatitis test strip. Both the serum and test kits were allowed to acclimate to room temperature prior to testing.

To initiate the test, the foil packet was opened, and the test strip was delicately extracted. The strip was then dipped into the serum, making sure not to surpass the maximum level indicated. After waiting 10 to 15 minutes, the outcomes were assessed. A positive result was signified by a clear pink band appearing in the test area, accompanied by a control band. A negative result displayed only a single-color band in the control area. An invalid result was noted when no band was seen in the control area, indicating a procedural error or degradation of the test reagent, thus necessitating a retest.

2.8. Data analysis

The collected data were processed using SPSS version 25.0, applying simple percentages and significance tests.

3. Results

Table 1: Seroprevalence of Hepatitis B surface antigen and Hepatitis C surface antigen in relation to socio-demographic characteristics among University of Jos students and Government Senior Secondary School, Gwong students

Parameter	No. of sample examined	HBV no. positive (%)		p-value	HCV no. positive (%)
Location					
Unijos	113	6(5.3)	2.073	0.150	0(0.0)
GSS Gwong	113	2(1.8)			0(0.0)
Age group (years)					
10 – 20	126	2(1.6)	4.617	0.202	0(0.0)
21 – 30	88	6(6.8)			0(0.0)
31 – 40	10	0(0.0)			0(0.0)
41 – 50	2	0(0.0)			0(0.0)
Sex					
Male	111	7(6.3)	4.889	0.027*	0(0.0)
Female	115	1(0.9)			0(0.0)
Marital status					
Single	210	8(3.8)	0.632	0.889	0(0.0)
Married	14	0(0.0)			0(0.0)
Divorce	1	0(0.0)			0(0.0)
Widowed	1	0(0.0)			0(0.0)
Educational level					
Secondary	113	2(1.8)	2.073	0.150	0(0.0)
Tertiary	113	6(5.3)			0(0.0)

Table 1 (Cont.)					
Religion					
Christianity	186		6(3.2)	0.303	0(0.0)
Islam	40	2(5.0)			0(0.0)
Others	0	0(0.0)			0(0.0)
Total	**226**	**8(305)**			**0(0.0)**

Table 2: Seroprevalence of Hepatitis B surface antigen and Hepatitis C surface antigen in relation to knowledge, attitude and practices among University of Jos students and Government Senior Secondary Students Gwong students

Parameter	No. of sample	HBV no. positive (%)		p-value	HCV no. positive (%)
Knowledge of HBV/HCV					
Know about a disease called Hepatitis-B infection					0(0.0)
Yes	134	6(4.5)	0.848	0.357	0(0.0)
No	92	2(2.2)			0(0.0)
Knows how HBV/HCV is spread					
Yes	104	5(4.8)	0.907	0.341	0(0.0)
No	122	3(2.5)			0(0.0)
Isolate HBV/HCV patient					
Yes	105	3(2.9)	0.268	0.605	0(0.0)
No	121	5(4.1)			0(0.0)
Total	**226**	**8(3.5)**			**0(0.0)**

Table 3: Seroprevalence of Hepatitis B surface antigen and Hepatitis C surface antigen in relation to risk factor among University of Jos and Government Senior Secondary School Gwong students

Parameters	No. of samples	HBV no. positive (%)		p-value	HCV no. positive (%)
Alcohol					
Yes	22	1(4.5)	0.072	0.788	0(0.0)
No	204	7(3.4)			0(0.0)
No. of sexual partners					
1	31	3(9.7)	20.844	<0.001**	0(0.0)
2	7	1(14.3)			0(0.0)
3	8	0(0.0)			0(0.0)
Above	5	0(0.0)			0(0.0)
None	175	4(2.3)			0(0.0)

Table 3 (Cont.)

Sharing of injection, drug use/sharing					
Yes	5	0(0.0)	0.188	0.665	0(0.0)
No	221	8(3.6)			0(0.0)
Surgery/tattooing					
Yes	23	0(0.0)	0.894	0.344	0(0.0)
No	203	8(3.9)			0(0.0)
Blood transfusion					
Yes	31	2(6.5)	0.892	0.345	0(0.0)
No	195	6(3.1)			0(0.0)
Sharing of toothbrush					
Yes	4	0(0.0)	0.149	0.699	0(0.0)
No	222	8(3.6)			0(0.0)
Family history					
Yes	22	1(4.5)	0.072	0.788	0(0.0)
No	204	7(3.4)			0(0.0)
Total	**226**	**8(3.5)**			**0(0.0)**

Table 4: Risk factors associated to seroprevalence of Hepatitis B surface antigen in relation to risk factor among University of Jos and Government Senior Secondary School Gwong students. Binary Logistic Regression (n = 226)

Variables in the Equation								
Risk Factors	**B**	**Std. error**	**Wald**	**df**	**Sig**	**Exp (B)**	**95%**	
Alcohol	-0.738	0.454	2.640	1	0.104	0.478	0.196	1.165
No. of sexual partners	2.340	0.318	16.027	1	0.000	10.941	0.509	1.769
Sharing of injection, drug use/sharing	0.164	0.530	2.096	1	0.757	1.178	0.417	3.332
Surgery/tattooing	-0.143	0.316	0.205	1	0.651	0.867	0.467	1.609
Blood transfusion	-0.564	0.558	1.022	1	0.312	0.569	0.190	1.699
Sharing of toothbrush	17.801	1.426	1.042	1	0.594	1.114	0.134	17.309
Family history	2.000	0.597	9.843	1	0.009	7.389	0.179	1.863
Intercept	15.653	3.591	19.001	1	0.000			

4. Discussion

The findings of this study revealed that, out of two hundred and twenty-six (226) samples analyzed for Hepatitis B surface antigen, the prevalence of HBV was 8(3.5%) which is higher than the number in previous work done in South Western Nigeria with 3(1.5%) (Enitan *et al.*, 2019).

In terms of socio-demographic characteristics, the current data reveal that the prevalence of Hepatitis B Virus (HBV) is 6.3% among males and 0.9% among females. This aligns with findings from previous studies that consistently indicate a higher prevalence of HBV in males compared to females. For example, Wasa and Maigana (2013) reported a prevalence rate among undergraduate students at Gombe State University (Wasa and Maigana, 2013). Similarly, a study conducted among staff and students at the

University of Jos, reported by Solomon *et al.* (2014), found a prevalence rate of 9.9% among males and 3.7% among females (Solomon *et al.*, 2014). Tula and Iyoha (2015) also noted a prevalence of 43% among male students at Federal Polytechnic, Mubi, Adamawa State, Nigeria, compared to 27% among female students (Tula and Iyoha, 2015). Furthermore, a study conducted among students at Federal University Wukari, Taraba State, Nigeria, indicated a prevalence rate of 6% among male participants and 0% among female participants (Imarenezor *et al.*, 2016).

According to the age distribution data, 2 students (1.6%) out of a total of 126, aged between 10 and 20 years, tested positive for HBV. In contrast, 6 students (6.8%) from a group of 88, aged between 20 and 30 years, were seropositive for the Hepatitis B Virus. This finding aligns with previous studies that indicate a higher prevalence of HBV among young adults aged 30 and younger. For instance, Wasa and Maigana (2013) reported a significantly higher prevalence rate of 18.2% among undergraduate students aged 16 to 30 years at the University of Gombe in Gombe State, Nigeria (Wasa and Maigana, 2013).

Regarding the marital status of the study participants, out of the 210 singles screened, 8(3.8%) tested positive for HBV. In contrast, none of the married participants, as well as one divorced and one widowed participant, were found to have HBV infection. These findings differ from the research conducted by Pennap *et al.* (2016), which reported a prevalence of 27.2% among singles and 21.3% among married individuals. According to their study, singles are at a higher risk of infection due to their more relaxed lifestyle (Pennap *et al.*, 2016).

This research found no significant differences in the number of students who tested positive for HBV based on their educational background or religious beliefs. To our knowledge, there have been no prior studies that have examined the relationship between HBV infection prevalence and levels of education or religious affiliations.

The data obtained identified several risk factors associated with the occurrence of Hepatitis B Virus (HBV) infection among the study population. These factors include alcoholism, the number of sexual partners, history of blood transfusions, and family history of Hepatitis B. This aligns with findings reported by Uleanya and Obike (2015). Conversely, factors such as shared injections, drug use, surgeries, tattooing, and sharing toothbrushes appeared to have no connection with the 3.5% prevalence observed in this study. In binary logistic regression analysis, two variables were associated with HBV positivity: sexual partners (Exp(B) = 10.941; 95% CI [0.509 - 1.769], p = 0.000) and family history (Exp(B) = 7.389; 95% CI [0.179 - 1.863]), p = 0.009) (Table 4).

Moreover, 59.3% of the participants reported knowing HBV and HCV infections. Notably, 58% of the participants, who are students from a private tertiary institution in South-Western Nigeria, indicated awareness of these Hepatitis viruses, as documented by Enitan *et al.* (2019).

Interestingly, there was a 0% prevalence of Hepatitis C antibodies among the 226 samples analyzed in this study, which is consistent with previous research from South-Western Nigeria that also reported a 0% prevalence (Samson *et al.*, 2019). However, this finding contrasts with a study conducted at the University of Maiduguri in Borno State, Nigeria, which reported a prevalence of 4.0% (8 positive cases for Hepatitis C antibodies) (Joshua *et al.*, 2012).

5. Conclusion

This study was carried out among University of Jos and Government Senior Secondary School Students comprising of one hundred and thirteen (113) students from each school given a total of two hundred and twenty-six (226) students in Jos North Local Government Area of Plateau State, Nigeria. With the use of a Hepatitis test strip, the findings of this study show the prevalence rate for HBV to be 3.5%, whereas there was no record of HCV, as well as HBV/HCV dual infection among the students. The tertiary institution has the highest prevalence of HBV compared to secondary schools. There is a need to massively educate students on the importance of Hepatitis B vaccine to reduce the incidence of Hepatitis B antigen carrier rate and chronic Hepatitis B and C virus infection among students and regular testing for HCV for early detection and management as it has no vaccine yet.

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