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# SEROLOGICAL EVIDENCE OF HEPATITIS B VIRUS AMONG SECONDARY SCHOOL STUDENTS IN A COMMUNITY IN PLATEAU STATE, NIGERIA

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**ABSTRACT:** *Hepatitis B virus is among the common viral infectious agents of global public health concern because it increases the risk of hepatocellular cancer, liver fibrosis, and mortality from liver disease. The study's objectives were to detect hepatitis B surface antigen (HBsAg) in the blood samples of students of Government Secondary School, Bet, Pankshin, Plateau State. A cross-sectional analytical study was conducted between October and November 2018. Blood samples were collected from 168 participants which were analysed for HBsAg using a One-step Rapid Strip (Royal Care) and HBeAg by Combo Test Device (Skytech USA). Data were analyzed using SPSS version 21.0 (USA). P-values < 0.05 were considered significant. An overall 7.1% of the 168 samples analysed were seropositive for HBsAg and 6.7% for HBeAg. Males had a seropositivity of 11.6%, whereas females had a seropositivity of 4.0% (p = 0.061). The distribution of HBsAg in relation to age group was higher in the age group 13-19 years with 7.3% and the lowest in the age group 6-12 years with 6.7%. Those with history of sexual exposures had a seropositivity of 14.3% (p = 0.174; OR = 0.371, those with history of exposure to sharp objects had 7.3% (p = 0.869; OR = 0.876), those with the history of blood transfusion had none (p = 0.319; OR = 1.00), participants without history of ever screened for the virus had a seropositivity of 7.4% (p = 0.529; OR = 1.00) while the alcoholics had 13.6% (p = 0.205; OR = 0.416. It is imperative to act quickly to prevent liver disease morbidity and mortality given the seropositivity of 7.1% of HBV, which is of considerable public health concern. There is need to intensify campaign awareness and vaccination against HBV among all unvaccinated age groups.*

**KEYWORDS:** HBV, Infection, Seroprevalence, Socio-Demographic Data, Liver Disease.



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## INTRODUCTION

The double-stranded circular DNA virus known as the hepatitis B virus (HBV) has an envelope. HBV is categorized as an orthohepadnavirus in the hepadnaviridae family. A spherical 22 nm particle, a 42 nm spherical particle (containing DNA and DNA polymerase known as the Dane particle), and tubular or filamentous particles that vary in length are the three different antigenic particles that makeup HBV. The 3.2 kb viral genome is made up of four partially overlapping open-reading frames that each encode one viral protein. Hepatocytes are where viral multiplication primarily occurs (Kourtis *et al*., 2012).

A potentially fatal liver illness known as hepatitis B is brought on by the hepatitis B virus. People are at an increased risk of dying from cirrhosis and liver cancer as well as chronic infection. The onset of consequences such as chronic illness and liver cancer can be avoided by preventing hepatitis B infection (WHO, 2022). Infected blood and bodily fluids, such as saliva and menstrual, vaginal, and seminal secretions, as well as needle stick injuries, tattooing, piercing, and exposure to these substances can all spread hepatitis B. Reusing contaminated needles or other sharp objects in the community, in health care facilities, or among drug injection users can also spread the infection. In unvaccinated individuals who have several sexual partners, sexual transmission is more common (WHO, 2022).

In the WHO Western Pacific Region and the WHO African Region, where 116 million and 81 million individuals respectively are chronically infected, the burden of hepatitis B infection is highest (WHO, 2022). The virus is widespread throughout Africa, and even within a single nation, the endemicity level varies by target population and by district. One of the nations in the HBV hyper-endemic zone is Nigeria (Zampino *et al*., 2015). The prevalence of viral hepatitis B was reported to be 11% nationwide (National AIDS/STIs Control Program, 2016), while a survey conducted across Nigeria found a prevalence of 12.2% HBV (Olayinka *et al*., 2016).

Infection with hepatitis B during adulthood causes chronic hepatitis in less than 5% of instances, but infection during infancy and early childhood causes chronic hepatitis in approximately 95% of cases. It is on the basis of this that baby and childhood vaccination should be strengthened and given priority (WHO, 2022).

The WHO advised that all babies receive the hepatitis B vaccine as soon as possible after delivery, preferably within 24 hours, followed by 2 or 3 doses of the vaccine spaced at least 4 weeks apart (WHO, 2021). Hepatitis B vaccination was added to the National Program on Immunization (NPI) schedule in 2004 by the Nigerian government. In Nigeria, only around 53% of infants have received the hepatitis B birth dose (HepB-BD) vaccine. Children are less likely to receive the vaccine if they were given birth to at home or in a private health institution (Olakunde *et al*., 2021).

Sadly, there are no HBV-free vaccination programs for elementary schools and secondary school students in the country, despite the efforts of the Nigerian government to vaccinate children against the disease from birth. The purpose of this study was to ascertain the evidence of HBV among secondary school students and the most likely risk factors for the infection's spread within the study population.


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## MATERIALS AND METHODS

### Study Area

In Nigeria's Plateau state, Pankshin is a well-known local government, and Pankshin town serves as its administrative headquarters. The highest point in this local government's 1,524 km² territory is at a height of 1371 metres. Pankshin reported 191,685 residents as of 2006. The town can be found at longitude 9.4500 (92660.0) and latitude 9.3333 (91959.9880 N). Pankshin's weather can get very cold, especially during the harmattan season. Most of the time, smog develops, making it challenging for cars to access the road. With daily temperatures averaging between 19 $^0$C and 23 $^0$C, Pankshin is often considered as one of the coldest parts of the Plateau state. However, because of its present state of growth, the town is currently split into two different parts: Old Pankshin and New Pankshin (Brown, 2023).

### Study Design and Population

A cross-sectional study was conducted between October 2018 and May 2019 among students (males and females) of Government Secondary School, Bet, Pankshin.

### Ethical Consideration

Ethical approval was obtained from the Ministry of Health, Plateau State and permission was also obtained from the school before the commencement of the study. Before getting involved in the study, the students provided written informed consent.

### Administration of Questionnaire and Sampling Criteria

Semi-structured questionnaires were randomly administered to all consenting participants to obtain some socio-demographic data.

### Inclusion and Exclusion Criteria

The study included every participant who gave their agreement and fit the criteria for selection. The study did not include anyone who refused to participate or who had previously undergone testing or got the entire course of the hepatitis B immunization.

### Sample Collection

Three (3) millilitres of blood were aseptically collected in an anticoagulated EDTA tube from each patient by venipuncture of the cubital vein using sterile disposable needles and syringes. Samples were well labelled, and separated by centrifugation at 2000 rpm for five minutes and the resultant plasma was transferred into pre-labelled cryovials and stored at -20°C until ready for use.

### Detection of HBV Serological Markers

The samples were tested in accordance with the manufacturer’s instructions using One-Step Rapid Test Strip (Royal Care) and Combo Test Device (Skytech, USA).


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**Detection of HBsAg Using Royal Care One-Step HBsAg Immunochromatography Test Kit**

The HBsAg one-step surface antigen test strip is a qualitative lateral flow immunoassay based on the principle of sandwich immunoassay for the determination of HBsAg in blood.

**Assay Procedure**

The test strip was removed from the foil pouch by tearing at the notch and placed on a flat, clean, dry, nonabsorbent surface, and a drop of plasma was applied to the sample pad. Two drops of the buffer were added to the sample pad as well, after which the result was read within 10–20 minutes.

**HBV-5-in-1 Markers Rapid Test Panel (Colloidal Gold Chromatography)**

The sample when mixed with Colloidal Gold monoclonal antibody moves along the T-line of the membrane when the human serum/plasma and whole blood contains HBsAg, HBsAb, and HBeAg, based on the principle of Double Antibody Sandwich and Gold Immunochromatographic assays.

**Assay Procedure**

The reagent was brought to room temperature before the commencement of the assay. The outer package was removed and the cassette and put on a flat surface with the sample window up. Two drops of plasma (50 µl) were dropped vertically into the circular groove of the cassette, and a drop of buffer (25µl) was added into the circular groove of the cassette. The results were read within 15 minutes. Visible lines were observed at the test and control regions for a positive test, while only the control line was observed in the case of negative results.

**Data/Statistical Analysis**

Data obtained were subjected to statistical analysis using the statistical software (SPSS) version 21.0 (USA). Pearson chi-squares test was used to compare categorical data at a 95% confidence interval. P values < 0.05 were considered statistically significant.

## RESULTS

Out of all the 168 samples analysed, 12 (7.1%) were seropositive for HBsAg and 11 (6.5 %) were also positive for HBeAg (Table 1). Of all the samples examined, the males had a seropositivity of 8 (4.7%) while the females had a seropositivity of 4 (2.4%); $\chi 2=3.498$; P=0.061. The age group 13–19 years recorded the highest prevalence of 9 (7.3%), and the age group 6–12 years, 3 (6.7%). $\chi 2=0.021$; P=0.885 (Table 2).

In relation to the history of sex, those with previous sex history had a higher prevalence of 3 (14.3%), even though they were few but compared with 9 (6.1%) of those without any previous sex history: $\chi 2=1.846$; P=0.174 (Table 3). Prevalence of HBsAg in relation to exposure to sharps shows that 10 (7.3%) had been exposed to sharps while 2 (6.2%) have never been exposed to sharps: $\chi 2=0.027$; P=0.869 (Table 3).


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Table 3 shows the distribution of HBsAg positivity in relation to a history of blood transfusion. The result shows that 12 (7.7%) had never been transfused with blood while none (0.00) had been transfused: $\chi 2=0.994$; P=0.319. The distribution of HBsAg in relation to the history of being screened for the virus shows that 12 (7.4 %) of those who had never been screened for the infection were positive, while none of those ever screened were positive for HBsAg: 0(0.0%); $\chi 2=0.396$; P=0.529. Also, the distribution of HBsAg in relation to alcohol consumption indicates that the alcoholics had a positivity of 3 (13.6%) while the non-alcoholics had a positivity of 9 (6.2%); $\chi 2=1.609$; P=0.05.

**Table 1: Distribution of HBsAg and HBeAg in the Study**

| Number of Sample Examined | Number Positive for HBsAg(%) | Number Positive for HBeAg(%) |
|---|---|---|
| 168 | 12 (7.1) | 11 (6.5) |

**Table 2: Distribution of HBsAg in Relation to Some Sociodemographic Factors**

| Variables | No. Examined | No. Positive (%) | $\chi 2$ | DF | P-Value |
|---|---|---|---|---|---|
| **Gender** | | | | | |
| Male | 69 | 8 (11.6) | 3.498 | 1 | 0.061 |
| Female | 99 | 4 (4.0) | | | |
| **Total** | **168** | **12 (7.1)** | | | |
| **Age (Years)** | | | | | |
| 6–12 | 45 | 3 (6.7) | 0.021 | 1 | 0.885 |
| 13–19 | 123 | 9 (7.3) | | | |
| **Total** | **168** | **12 (7.1)** | | | |

**Table 3: Distribution of HBsAg in Relation to Some Risk Factors**

| Variables | No. Examined | No. Positive (%) | $\chi 2$ | DF | P-Value | OR |
|---|---|---|---|---|---|---|
| **History of sex** | | | | | | |
| Yes | 21 | 3 (14.3) | 1.846 | 1 | 0.174 | 0.371 |
| No | 147 | 9 (6.1) | | | | |
| **History of Exposure to Sharp objects** | | | | | | |
| Yes | 137 | 10 (7.3) | 0.027 | 1 | 0.869 | 0.876 |
| No | 31 | 2 (6.5) | | | | |
| **History of blood transfusion** | | | | | | |
| Yes | 12 | 0 (0.0) | 0.994 | 1 | 0.319 | 1.00 |
| No | 156 | 12 (7.7) | | | | |


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| | | | | | | |
|---|---|---|---|---|---|---|
| **History of HBsAg screening** | | | | | | |
| Yes | 5 | 0 (0.0) | 0.396 | 1 | 0.529 | 1.00 |
| No | 163 | 12 (7.4) | | | | |
| **Alcohol consumption** | | | | | | |
| Yes | 22 | 3 (13.6) | 1.609 | 1 | 0.205 | 0.416 |
| No | 146 | 9 (6.2) | | | | |

**OR=Odds Ratio**

## DISCUSSION

In this study, the overall seropositivity of HBsAg detected was 7.1%. This finding is in tandem with earlier studies carried out in different parts of the country. For instance, Nworie *et al*. (2015) in a study among school children in Ebonyi State, Southeastern Nigeria reported an overall prevalence of HBV at 6.5%; Odita *et al*. (2022) reported a prevalence of 7.6% in a study among secondary school children in an urban community in Southeastern Nigeria; David *et al*. (2013) reported a prevalence of 11.5% HBsAg among children and adolescents in Ekiti State, Southwestern Nigeria; and Mathew *et al*. (2018) reported a HBV prevalence of 9.1% among adolescents in Jos, Plateau State, North Central Nigeria. Ndako *et al*. (2012) reported a seroprevalence of 15.2% HBV infection among children in a community in North Central Nigeria. HBV prevalence in this study, however, is higher than the findings of Olasinde *et al*. (2022) who reported a seopositivity of 1.0% HBV among children attending the outpatient clinic of a tertiary health centre in Southwestern Nigeria, while Ikobah *et al*. (2016) reported an overall prevalence of 1.2% HBV among secondary school children in Calabar, Cross River State, Southsouthern, Nigeria. These variations are probably due to increasing awareness and vaccination against the viral infection or it could also be attributed to differences in sample size, methods of diagnosis, and sociodemographic or cultural factors that affect the likelihood of contracting HBV infection in the areas.

Of all the samples that tested positive for HBsAg as shown in Table 1 which affirmed the evidence of exposure to the virus among the participants in the study, 91.7% of those tested positive for HBsAg were HBeAg positive, which is an indication of active replication of the DNA of the virus among those participants and is a mark of the infectiveness of the virus (Liang, 2009). The result obtained in this study showed high infectivity of the virus among the participants with the evidence of the virus. The prevalence of HBV infection varies geographically, from high (>8%), intermediate (2–7%) to low (<2%) prevalence (Hou *et al*., 2005). Hence, the study setting or community where this research was conducted will be classified as being an intermediate endemic area for hepatitis B virus infection.

In this study, the seropositivity in relation to gender revealed that the seroprevalence is substantially higher in males than in females. This is consistent with earlier studies carried out by Ikobah *et al*. (2016) who reported sex-specific prevalence as 0.8% for males and 1.8% for females, Ndako *et al*. (2012) reported a seroprevalence of 11.2% for males compared to females with 4.0% positivity. So also, Nworie *et al*. (2015) found that gender-related distribution showed equal prevalence in both males and females (6. 5%). These variations in the prevalence


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of the disease according to gender may be attributed to differences in some sociocultural practices or behaviors specific to each sex that may put people at risk of the infection.

The distribution of HBsAg with respect to age showed in this study that the age group 13–19 years had the highest prevalence while the age group 6–12 years had the lowest. The result obtained in this study is in consonance with the findings of David *et al*. (2013) who obtained the highest prevalence in the age group 13 to 16 years and the lowest in the age group 9 to 12 years. Ndako *et al*. (2012) in a similar study in North Central Nigeria observed that children aged 10–12 years had a higher prevalence of 5.3% and the least prevalence was recorded among age group 3–6 years with 2.6% seropositivity. This could be a result of lifestyle and youthful exuberance which increases their risk of exposure, such as sexual activities and sharing of contaminated sharp objects for fashion.

The prevalence of HBsAg in relation to sex history showed that those with a previous sexual history had the highest prevalence as against those that had no previous history. This agreed with an earlier study carried out by David et al. (2013) who reported 22.6% seropositive for subjects who had a history of sexual intercourse. The prevalence of hepatitis B virus infection observed among those with previous sex history could be attributed to unprotected sexual activities which might have exposed them to the infection as compared to those who had no previous sex history.

The prevalence in relation to the history of use of sharps indicated that those who had a history of injuries sustained from sharps recorded the highest prevalence compared to those who have never been exposed to sharp objects who recorded a lower prevalence. Earlier findings from Eke *et al*. (2015) observed that participants with a history of sharing sharp instruments had 76.9%; David *et al*. (2013) reported a prevalence of 18.3%; Aderibigbe *et al*. (2016) reported a prevalence of 12.7% among secondary students in a metropolitan city of North Central Nigeria with history of needle prick or any other sharp object injury; so also, Ndako *et al*. (2012) reported that the respondents with a history of cuts recorded a prevalence of 9.6% positivity. The outcome of this study and the other studies stated could be attributed to their exposure to sharp objects that have been pre-contaminated with the virus.

The prevalence of HBsAg in relation to a history of blood transfusion in this study indicated that those who had a history of blood transfusion recorded no evidence of HBsAg as against those who had never been transfused who recorded a higher prevalence of 7.7%. Earlier studies such as that of David *et al*. (2013) reported that participants who had a previous history of blood transfusion recorded a seroprevalence of 6.1%; Eke *et al*. (2015) in a study among adolescents in Enugu reported those with a history of blood transfusion had 7.7% while Aderibigbe *et al*. (2016) reported that those with a history of blood transfusion had a prevalence of 10.1%. The disparity in the result obtained in this study and the others stated could be due to improvements in the guidelines for the safe transfusion of blood and blood products. The high prevalence among those with no history of transfusion indicated that they might have been infected through other risk factors.

This study reveals that most of the participants were unaware of their hepatitis B virus status and out of all of them that were screened a seroprevalence of 7.4% was recorded, while the few that knew their HBsAg status showed no evidence of the virus. This outcome is in consonance with an earlier report that only 10.5% of the infected people in the year 2016 were aware of their HBV status (WHO, 2021). The inability of many people in low-resource countries like


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Nigeria to access diagnosis, vaccination, and treatment of hepatitis B virus is mainly due to lack of adequate health facilities, awareness, and poverty.

The prevalence of HBsAg in relation to alcohol consumption showed a higher prevalence of 13.6% for those who were alcoholics as against 6.2% for those who did not take alcohol. Eke *et al*. (2015) in a similar study among adolescents reported that those who were alcoholics had no evidence of the infection. These variations could be due to the effect of alcohol on the behavior of a person which can lead to some abnormal behaviours such as fighting and sexual promiscuity which can predispose them to the infection. So also, the sample sizes and the methodologies for the studies can affect the outcomes of the studies.

## CONCLUSION AND RECOMMENDATIONS

The overall positivity of 7.1% of HBsAg obtained in this study affirmed the endemicity of the hepatitis B Virus in the study area. This may not be unconnected to the low level of awareness of the mode of transmission, prevention, and control of the viral infection, especially poor vaccination coverage among the age groups. This study also observed that the majority of the participants were unaware of their HBsAg status. Vaccination and prevention of the infection still remain the hallmark of the elimination of the virus. Adolescents are not targeted for vaccination programmes and coupled with their high-risk behaviours, they can delay the actualization of the WHO goal. There is a need to intensify awareness campaigns, free immunization programmes across all age groups, and free treatments by both governmental and non-governmental organizations in the study area and the country at large; this will go a long way in achieving the WHO goal for the elimination of viral hepatitis by 2030.

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### Conflict of Interest

The authors declare that no conflict of interest exists.

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