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Evaluation of Vaccination Status, Awareness, and Seroprevalence of Hepatitis B Virus Infection among Female Sex Workers in Jos

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Abstract

The hepatitis B virus (HBV) is the cause of hepatitis B infection, which can lead to malignancy and chronic liver cirrhosis. There is a dearth of research on the incidence of HBV among Nigerian women who work as sex workers despite the country being characterized as an endemic zone with prevalence among different occupational groups. The study evaluates the immunization status, awareness of the virus, and seroprevalence and predictors of hepatitis B virus infection among female sex workers. A descriptive cross-sectional study including 86 female sex workers in Jos brothels was conducted. Blood samples were collected using the Recombi LISA HbsAg ELISA kit (CTK Biotech Inc., San Diego, USA) to qualitatively detect HBsAg. Twenty (21) out of the 86 subjects tested positive, yielding a 24.4% prevalence rate. The highest prevalence was found among women in the 36-40 age range (40%), while the lowest (0.0%) was found among those in the age group <20 years. Married sex workers recorded the highest prevalence of 50%, while separated/divorced recorded the lowest prevalence of 10.0%. Also, female sex workers without a formal education had the highest prevalence of 66.7%. In comparison, the lowest prevalence of 0.0% was found among those with tertiary education. Those who engaged in sex work for less than five years had the highest prevalence of 30.8%, while the lowest was recorded among those who had five years and above in the sex trade, with a prevalence rate of 0.0%. There was no statistically significant correlation seen between these high percentages and HBV infection. Out of the 86 female sex workers, only 9 had received all three doses of the immunization. This high frequency of vaccine-preventable illness is intolerable; therefore, immunizing this high-risk HBV reservoir population should be justified.

Keywords: Vaccination, Awareness, Seroprevalence, Hepatitis, ELISA

INTRODUCTION

The hepatitis B virus (HBV) is the cause of hepatitis B, a potentially fatal liver infection that increases a person's risk of developing cirrhosis and liver cancer as well as chronic infection (WHO, 2017). The hepatitis B virus belongs to the Hepadnaviridae family and is a tiny, enveloped, hepatotropic virus with a genome made up partially of double-stranded DNA (Block *et al.*, 2007). HBV is extremely contagious; only one to ten HBV virions are needed to start an infection. Contact with blood or a bodily fluid contaminated with the virus spreads the infection. Perinatal transmission is the primary mode of infection in highly endemic places, such as sub-Saharan Africa. Another pathway that is being downplayed, particularly in high-risk populations, is horizontal transmission of HBV in adulthood, which can result in perinatal transmission (El-magarabe *et al.*, 2010; Zhang *et al.*, 2010; Drazilova *et al.*, 2020).

In 2010, the Federal Ministry of Health classified a "female sex worker" as any woman who is paid by a man to have sex in establishments like pubs, hotels, nightclubs, restaurants, or on the street or who receives other expensive presents or incentives in exchange. Female sex workers (FSWs) exhibit high-risk behaviors and continue to play a significant role in the acquisition and spread of HBV and other STIs. This might be the result of FSW having multiple sexual partners and participating in unprotected or other types of intercourse that expose them to bodily fluids from a partner who has STI. FSWs are frequently less able to negotiate safe sex because of social, cultural, and economic factors. (Scheibe *et al.*,2020) Also, other factors, including drug and substance abuse, economic factors, marital disruption, low educational attainment, risky alcohol consumption, and co-infection with other STDs, are linked to the acquisition of HBV in female sex workers.(Scorgie *et al*, 2012, Lawan *et al.*, 2012, Mutagoma *et al.*, 2017)

Sexually transmitted infections such as HBV are common among several population groups, especially among FSWs, in African countries. Numerous characteristics, including having genital sores, age, marital status, educational attainment, length of time as FSWs, early sexual debut, and client count, were linked to their prevalence among FSWs.(Akilu *et al*, 2001; Nzivu *et al*,2019).

Investigations of sex workers should occur more regularly because STDs are spreading, particularly with the introduction of AIDS. Research on AIDS indirectly offered information regarding behavioral and biological characteristics related to the transmission of hepatitis B because of the closeness of the processes of transmission and, subsequently, of the more vulnerable groups (Passos *et al.*, 2007). The human immunodeficiency virus (HIV) is between 50 and 100 times less contagious than the hepatitis B virus (HBV). Undoubtedly, it has a far more profound effect on public perception and the academic community. Because of this, studies pertaining to sex workers focus far more on AIDS than on hepatitis, which hinders our understanding of the latter's epidemiologic state in this high-risk demographic (Passos *et al.*, 2007). This is the situation in Nigeria, where data on hepatitis B infection among female sex workers is notably lacking in comparison to other populations. According to Okonkwo et al. (2017), Nigeria is a hyper-endemic area for HBV, and those who have the virus may not show any symptoms for a long time and act as a reservoir for infection throughout that time.

In earlier research, Forbi *et al*. (2008) found that among commercial sex workers in Nasarawa State, Nigeria, 17.1% of the population had HbsAg. This prevalence figure obtained is higher than many other professional groups investigated in Nigeria. This can be linked to the high-risk behaviours that sex workers engage in, including early and unprotected sexual activity, a lack of education, not using condoms during any sexual encounter, and drug and alcohol usage (Magalhaes *et al.*, 2016). Aniche *et al.* 2022 study in Enugu revealed that 41% of female sex workers had a seropositive hepatitis B virus. In Togo, West Africa, a study on the prevalence of HBV and HCV in female sex workers revealed a 9.9% prevalence for HBV. In a similar vein, female sex workers in Kenya had an HBV prevalence of 10.1% in 2020, and when compared to other research conducted among other populations in the area, this report presented a higher prevalence (Jefkemei *et al.*, 2020 Alexander *et al.*, 2021). In China, a prevalence of 10.7% for HBV was reported among female sex workers, and the prevalence was found to be higher compared to the general population (Su *et al.*,2016)

The Nigerian Society for Gastroenterology and Hepatology in the hepatitis B and C treatment guideline also recommends population-based screening of all adults for HBV, with opportunities to screen at any visit to a healthcare facility, antenatal care, preschool and pre-employment, Risk-based screening, among others (Malu *et al.*, 2015).

Information regarding the incidence of hepatitis B infection among female commercial sex workers is lacking, particularly in the study area, despite evidence of the virus being spread through sexual activity. Therefore, this study aimed at determining the seroprevalence of hepatitis B virus infection among female sex workers in Jos, Plateau State, Nigeria

MATERIALS AND METHODS

Study Area

The investigation was conducted in Jos, the capital of Plateau State, Nigeria. The region is 1,200 meters above sea level. Despite being in a tropical region, Plateau State has a nearly temperate climate with an average temperature of 18°C and 22°C due to its greater elevation.

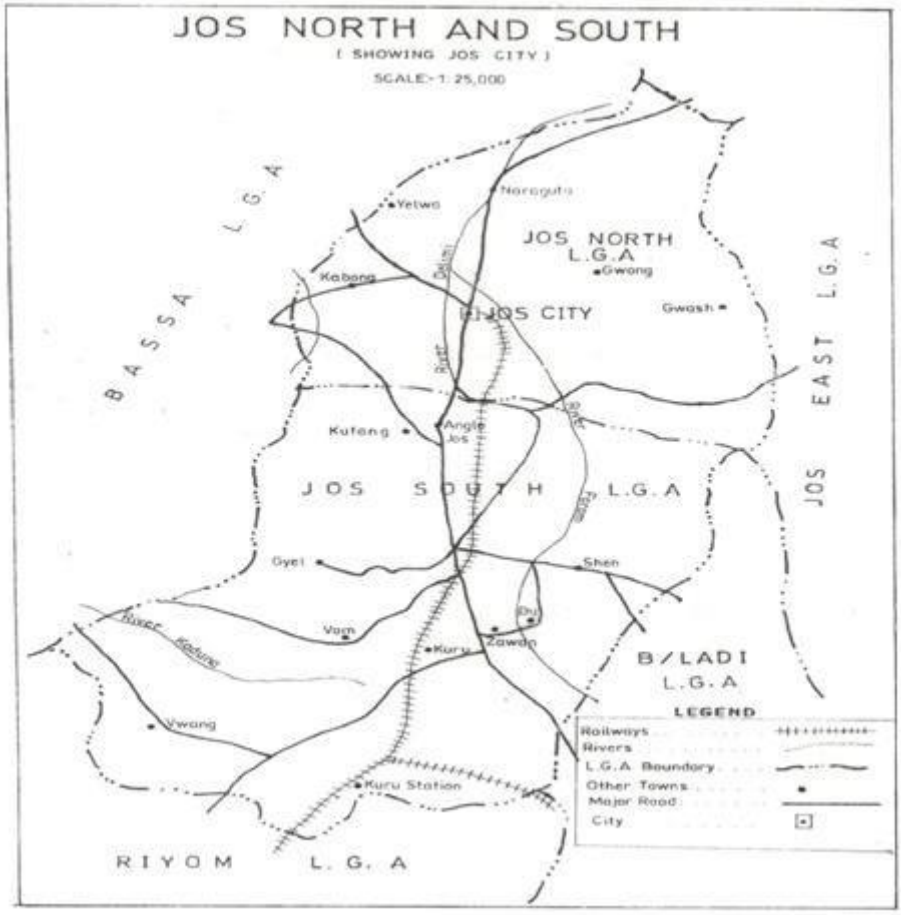

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Figure .1: Map of Jos North and South LGA Plateau state. Source Ministry of Land and Survey Plateau State. (Diana *et al.*,2016)

Study Population

The study population included adult female sex workers over 16 years who operate in brothels and other establishments and who are paid by males for sex services.

Determination of Sample Size

Using

$$n = \frac{z^2 pq}{d^2}$$

Where:

n= required sample size

z = confidence level at 95% (standard value of 1.96)

p = reported prevalence 9.2% (Derrese *et al.*,2021)

q = 1 - p

d = margin of error at 5% (standard value of 0.05)

$$p = \frac{9.2}{100} = 0.092$$

$$q = 1 - 0.092 = 0.908$$

$$n = \frac{(1.96)^2 (0.092\ X\ 0.908)}{(0.05)^2}$$

n = 128

Therefore, the determined sample size was 128, but 86 samples were analyzed using convenience sampling due to limitations.

Ethical Clearance and Consent of Participants

The Plateau State Specialist Teaching Hospital's ethical committee approved (Appendix1), and before sample collection, each participant's informed and signed consent was obtained.

Collection of Samples and Processing

Using a syringe and needle, two milliliters (2 ml) of blood was collected by venipuncture. The blood was then put into an EDTA bottle, and the plasma was separated between two and four hours after the sample was taken. The samples of blood were centrifuged for five minutes at 1500 rpm. Each plasma sample was placed into a sterile blood tube using a micropipette, and it was then stored at -20°C until needed (Megalhaes *et al.*, 2016).

Data Collection

Data on demographics, risk behaviors, immunization status, and awareness of hepatitis B virus infection were collected from the participating female sex workers using a structured questionnaire. (Yeshi *et al.*, 2021)

Detection of Hepatitis B Surface Antigen (HBsAg) Using ELISA

The Hepatitis B surface antigen (HBsAg) was detected using a commercially available Enzyme-Linked Immunosorbent Assay (CTK biotech inc., San Diego, USA) called HBsAg ELISA. The manufacturer's instructions were followed for performing the analysis (Megalhaes *et al.*,2016).

Data Analysis

Following data collection, the data was transferred from its initial format into the Statistical Package for the Social Sciences (SPSS) version 22 software for analysis. A chi-square test was employed to assess potential statistical associations between variables. The predetermined level of statistical significance was set at $p < 0.05$, corresponding to a 95% confidence level (Adebola *et al*, 2016).

RESULTS

Hepatitis B surface antigen was detected in serum samples from 21 (24.0%) out of the 86 female sex workers participating in the study.

The seroprevalence of HBV in relation to age is presented in Table 1. The age group 36-40 had the highest seroprevalence of HBV infection among the female sex workers. However, there was no significant difference between the different age groups (P>0.0). The seroprevalence of HBV infection according to marital status showed that married female sex workers had the highest prevalence of 50%, while separated sex workers had the lowest prevalence (10.5%), and there was no statistically significant difference. (P>0.05) (Table 2)

Table 3 depicts the seroprevalence of HBV infection in relation to educational attainment. The sex workers having no formal education had the highest HBV seroprevalence (66.7%), while those who reported having higher education had the lowest seroprevalence ($p > 0.05$). Table 4 shows the seroprevalence of HBV in relation to the length of time spent as sex workers and the HBV seroprevalence with respect to the number of customers each per week. Female sex workers who had spent less than six months had the highest prevalence of 30.8%, while those who had spent more than five years had the lowest prevalence of 0.0%.

Sex workers with fewer than ten customers per week had the highest prevalence (34.6%), while those with eleven to twenty customers per week had the lowest incidence at 16.7%. The relationship between HBV seropositivity and the number of clients was not statistically significant ($P > 0.05$).

The seroprevalence of HBV in relation to Condom use, the existence of non-paying clients, and awareness of the Hepatitis B virus by commercial sex workers are shown in Table 5.

Female sex workers who used condoms occasionally had the lowest prevalence (20.0%), while the subjects who used condoms consistently had the highest prevalence (25%). The individuals who were exclusively patronized by paying customers had the lowest incidence (20.0%), whereas the subjects who occasionally were patronized by non-paying clients was highest at 25.4%, and there was no statistically significant difference between them and HBsAg seropositivity (P>0.05). Of the 86 subjects, 67 knew about the virus, with the highest prevalence of 25.4%, while the lowest prevalence of 21.1% was noted among those who did not know about HBV. The difference between the two groups was statistically not significant. ($P > 0.05$). The sex worker's vaccination history is presented in Table 6. The lowest frequency of 0.0% was seen in 9 out of 86 female sex workers who had received all three doses of the HBV vaccine, while the highest prevalence of 60% was seen in those who had not received the first doses of the Vaccine and there was no statistically significant difference (P> 0.05).

Table 1: Seroprevalence of HBVamong female sex workers in Jos in relation to age

Age	Samples Screened (%)	Positive samples (%)
<20	2(2.3)	0(0.0)
21-25	41(47.7)	14(34.1)
26-30	28(32.6)	4(14.3)
31-35	10(11.6)	1(10.0)
36-40	5(5.8)	2(40.0)
TOTAL	86 (100)	21(24.4)

$X^2 = 0.193$ P >0.05

Table 2: Seroprevalence of HBV among female sex workers in Jos in relation to marital status

Marital Status	Samples Screened (%)	Positive samples (%)
Single	56 (65.1)	15 (26.8)
Married	6 (6.9)	3 (50.0)
Separated/Divorced	19 (22.1)	2 (10.5)
Widow	5 (5.8)	1 (20.0)
TOTAL	86(100)	21 (24.4)

X^2 =0.227 P>0.05

Table 3: Seroprevalence of HBV among female sex workers in Jos in relation to educational level

Educational level	Samples Screened (%)	Positive Samples (%)
None	3 (3.5)	2 (66.7)
Primary	15 (17.4)	3 (20.0)
Secondary	57 (66.3)	16 (28.1)
Tertiary	11 (12.8)	0 (0.0)
TOTAL	86 (100)	21 (24.4)

X^2 = 0.071 P >0.05

Table 4: Seroprevalence of HBV among female sex workers in Jos in relation to Duration of Sex work and Number of Clients per week

Durationof sex work	Samples screened(%)	Positive samples(%)	X^2	P -level
≤ 6 Months	26 (30.2)	8(30.8)		
≤ 1 year	16 (18.6)	4 (25.0)		
≤ 2 years	8 (9.3)	1 (12.5)		
3 years	27(31.4)	8 (29.6)		
>5 years	9 (10.5)	0 (0.0)		
TOTAL	86 (100)	21 (24.4)	0.344	P >0.05
Number of Clients per week				
≤10	26 (30.2)	9 (34.6)		
11-20	30 (34.9)	5 (16.7)		
>20	30 (34.9)	7 (23.3)		
TOTAL	86 (100)	21 (24.4)	0.292	P >0.05

Table 5: Seroprevalence of HBV among female sex workers in Jos in relation to Condom use, No-paying Clients, and Knowledge of HBV

Condom Use	Samples screened(%)	Positive samples(%)	X^2	P-level
Sometimes	10 (11.6)	2 (20.0)		
Always	76 (88.4)	19 (25.0)		
TOTAL	86 (100)	21 (24.4)	0.729	P >0.05
No-paying Clients				
Yes	71 (82.6)	18 (25.8)		
No	15 (17.4)	3 (20.0)		
TOTAL	86 (100)	21 (24.4)	0.661	P >0.05
Knowledge of HBV				
Yes	67 (77.9)	12 (25.4)		
No	19 (22.1)	9 (21.1)		
TOTAL	86 (100)	21 (24.4)	0.699	P >0.05

Table 6: Vaccination status of female sex workers in Jos

Vaccination Status	Samples Screened (%)	Positive Samples (%)
Vaccinated		
1st Dose	5 (5.8)	3 (60.0)
2nd Dose	4(4.7)	1 (25.0)
3rd Dose	9(10.5)	0 (0.0)
Non-Vaccinated		
All Doses	68 (79.1)	17 (25.0)
TOTAL	86(100)	21 (24.4)

DISCUSSION

This study investigated the prevalence of HBV infection among female sex workers (FSWs) in Jos, Nigeria. Eighty-six (86) consenting participants aged 16-40 were recruited and tested for HBsAg. The overall seroprevalence rate was 24.4% (21), indicating a high burden of HBV infection in this population. This prevalence is higher than those reported in Nassarawa state (17.1%, Forbi *et al.*, 2008) and Benin City (14.1%, Halim *et al.*, 2004) but similar to the finding in southern Brazil (23.1%, Schuelter-Trevisol *et al.*, 2013). Female sex workers in Jos have a high prevalence of HBV, which suggests that active sexual transmission plays a significant role in the disease's spread and that individuals who participate in the sex work business serve as a reservoir for the virus, and it was reported that both Nigeria and other parts of the world have high background rates of HBV infection in the general population this creates a larger pool of potential sources for transmission.

The prevalence of HBV among FSWs was highest in the 36-40 age group, which is in contrast with studies by Deresse *et al.* (2021), who reported the lowest prevalence in this age range. Two decades ago, Vázquez-Martínez *et al.* (2003) reported that FSWs within the age group of 31 to 35 had the highest frequency of HBV and that being older than 30 is associated with an increased risk of HBV infection.

In this study, the highest rate of 50% for HBV was seen among married female sex workers and is in line with a study by Mutagoma *et al.* 2017 that showed a rise in the prevalence of HBsAg among married female sex workers. Equally, as sex workers made up the study's population and may not behave sexually like the general public, it is unclear why there was a higher prevalence of HBV among married FSWs (Sayamon *et al.*,2020). However, Married sex workers may not negotiate condom use consistently, especially with regular clients, due to economic pressure or poverty, and in some cases, a woman may feel emotionally or sexually neglected in her marriage and seek intimacy or fulfillment elsewhere and may be involved in unprotected sexual behaviors.

Notably, women with no formal education had a high prevalence (66.7%) compared to those with tertiary education (0.0%). Though this association lacked statistical significance, this is consistent with the work of Bugssa *et al.*, 2015 who reported that educational level was not significantly associated with HBV infection in female sex workers. A higher prevalence of Hepatitis B among female sex workers with non-formal education could be attributed to limited Knowledge of Safe Sex Practices, and without this knowledge, FSWs may be unaware of the risks associated with unprotected sex. Also, FSWs with limited education may not know about testing and vaccination programs for Hepatitis B or face challenges accessing them.

In this study, a higher prevalence was recorded among female sex workers who always use condoms. The reason for this high prevalence might be due to condom rupture and leakages or due to other Sexual Practices. Hepatitis B can also spread through contact with infected blood or bodily fluids outside the genital area. Oral sex or unprotected contact with wounds could be a risk factor if a client is infected. Sharing of needles or equipment might be a concern in situations where injecting drug use or unsafe medical practices are present within the sex work environment.

A concerning finding was that 71 women reported engaging in unprotected sex with "non-paying clients," with 25.4% of them being HBsAg positive. This aligns with Magalhales *et al.* (2016), who identified unprotected sex as a risk factor because a non-paying client might be perceived as less risky than someone with money. However, statistical significance was not reached in our study.

Encouragingly, 67(77.9%) of the participants reported knowledge of HBV, exceeding the value (61.4%) reported by Magalhales *et al.* (2016). However, 25.2% of those claiming knowledge were still HBsAg positive. This may be explained by the fact that FSWs may have trouble convincing customers to use condoms even when they are aware of the risks. Client resistance or refusal may affect the sex worker's capacity to defend oneself. Additionally, some FSWs may be coerced by their intimate partners into having sex without using condoms, which puts them in danger.

In this study, a higher prevalence of HBV was recorded among FSWs who had received just a single dose of the HBV vaccines, but the difference was not significantly associated with the status of immunization and HBV infection...Nigeria's National neonatal HBV vaccination program was started in 2004. Vertical transmission of the virus may not be completely ruled out in this study population, as a larger proportion of them may have been born before the immunization program began, but their high-risk sexual behaviours may have made them much more likely to get the virus than females in the general population. Also, low vaccination coverage was observed, with only 10.5% receiving all three doses. This suggests insufficient access to healthcare services among FSWs, potentially contributing to their vulnerability to HBV. However, the group recorded the lowest prevalence of HBV infection. This goes to show the importance of vaccination in reducing the risk of contracting the virus by female sex workers.

Unexpectedly, factors like duration of sex work and number of sexual partners were not significantly associated with HBV infection in this study. This contrasts with Forbi et al. (2008) and Magalhales et al. (2016) findings. Several explanations are possible: on-sexual transmission routes, incomplete participant information, or evolving trends in HBV epidemiology.

Study limitations

There were certain restrictions on our investigation. Even among the consenting Participants, several declined to donate a blood sample. As a result, there was a discrepancy between the stated population whose blood samples were tested and the study population.

CONCLUSION

This study reveals a high prevalence of HBV infection among female sex workers in Jos. Further research with a large sample size is recommended to further understand and provide an association between certain behavioural factors and the infection. To develop targeted interventions to address the low vaccination coverage and stem the high-risk sexual practices in this population.

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Conflict of Interest

There is no conflict of interest by the authors to declare.

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