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Seroprevalence and Risk Factors of Hepatitis B and C Virus infection among Inmates in a Correctional Service, Nasarawa State, Nigeria

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Abstract

Hepatitis infection has remained a reoccurring public health challenge. The seroprevalence of Hepatitis B and Hepatitis C virus infection among inmates in Lafia correctional service, Nasarawa State, Nigeria was assessed. Blood samples of 120 inmates were screened using the HBV surface antigen (HBsAg) rapid test Dip-strip and HCVAb plus rapid test strip. Socio-demographic and risk factors were analyzed using Fishers exact test binary logistics regression ($p \leq 0.05$). Inmates were 29.2% HBsAg and 8.3% HCV seropositive. Male inmates were seropositive at 30% HBV and 8.18% HCV females were 20% HBV and 10% HCV seropositive. Inmates ≥ 40 years and married inmates are more likely to be infected with HBV and HCV infections. Illicit drug use and incarceration above 5 years were risk factors significant for HBV and HCV prevalence. The high seroprevalence and risk factors of HBV and HCV infections among inmates needs prompt sensitization, screening and vaccination programmes.

Keywords: Hepatitis B and C, seroprevalence, correctional service, Inmates, risk factors

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Introduction

Hepatitis infection accounted for 1.4 million deaths in 2016 as a result of acute infection; hepatitis related liver cancer, and cirrhosis [1]. The World Health Organization (WHO) global health sector strategy on viral hepatitis has set a goal of eliminating viral hepatitis as a public health risk by 2030, thus reducing emerging infections by 90% and mortality by 65% [1]. Hepatitis B virus (HBsAg) infection remains a significant infectious diseasecausing high mortality and morbidity, particularly in Sub-Saharan African and East Asian countries [2]. Nigeria has long been regarded as a highly endemic country for HBsAg in Sub-Saharan Africaand the integrated disease surveillance and response system routinely documents acute viral hepatitis cases but not chronic viral hepatitis cases leading to underreporting of chronic cases [3, 4].

Hepatitis B virus (HBsAg) infection is a significant public health problem in correctional centers with an overall incidence rate estimated to be 0.8 – 25.5% per year [5]. Prisoners are particularly at risk of viral infections because of the numerous high-risk activities, such as injection of drugs, tattooing and shaving equipment, fights, and sexual activity [6]. Millions of people are detained in prisons globally, with 30 million inmates moving from prison to the community and/or backeach year transmitting high-risk infectious diseases such as Hepatitis B viral (HBaAg) and hepatitis C viral (HCV) infections. The reasons for ease of transmission of these viral diseases may include lack of knowledge about HBsAg transmission modes, overcrowding in prisons, limited access to health care, poor hygienic and environmental conditions, poor ventilation, non-professional tattooing, body piercing and other forms of skin piercing, and trauma [6].

The prison population is at high risk of HBsAg and HCV infections though they are the most often neglected risk group in the area of prevention and management. Since a prisoner can transmit these infections during and after his or her stay in the prison, transmission can contribute to over a wide pool of infections in the population [7]. The economic costs of the failure to control the transmission of infections include increased requirementsfor medical care, high levelof dependency, and loss of productive labor force, placing heavy burdens on already overstretched health and social services and on the natural economy [7].

Adoga *et al*. [8] previously documented the prevalence of HBsAg infection in prison facilities in Nasarawa State, Nigeria including the Lafia correctional service. However, our study further extends the viral hepatitis infection assessment in Lafia correctional service to include HCV seroprevalence among inmates of the Lafia correctional service. The study investigated the seroprevalence of HBsAg and HCV infection among inmates in Lafia correctional service, Nigeria. Data generated from this study may stimulate planning, management, prevention and control strategies of HBsAg and HCV in Nigerian correctional services.

Materials and Methods

Ethical approval

The ethical approval for this study was obtained from the Nigerian Correctional Service, Office of the Controller of Correctional, Nasarawa State Command, Nasarawa State through the office of the State Controller on 7th May, 2021. All inmates who gave their consent were recruited for the study.

Study area

The study followed a cross-sectional approach and was carried out between 1st and 7the June, 2021 among inmates in Lafia Correctional Service, Nasarawa State, Nigeria. The prison facility serves as a correctional service center for offenders from Lafia as well as neighboring towns. It is a universal convict prison with an installed capacity for 320 prison inmates withabout 120 awaiting trial and 182 convicts. Twenty blood samples were collected daily up to a total of 120 samples collected for 6 days.

Study design

Convenient sampling was done to capture inmates who consented to participate in the study. The research was explained to the inmates by the prison warden and the nurse at the medical facility. Participants were interviewed through interviewer-administered questionnaires to obtain sociodemographic data. Each questionnaire was serially numbered and participants'names were not written on the questionnaires to protect participants data. The serial numbers were duplicated on the sampling bottles tallying with the numbers on the questionnaires.

Inclusion and exclusion criteria

Volunteers who are inmates of Lafia correctional service within the age range of 20-70years were enrolled for this study. Informed consent was obtained from the inmates who participated in the study. All individuals below 20 years or above 70 years; and those who did not give their consent were excluded from the study.

Screening of blood samples for HBsAg surface antigen (HBsAg) and HCV antibody (HCVAb)

Firstly, about one millilitre of blood was collected using lancets to prick each inmate and secondly micropipette in the rapid strip was used to collect samples and then placed on HBsAg rapid screening test strip and HCV rapid test strip followed by dispensing the buffer into the sample pad. Blood screening was carried out using Onsite HBsAg rapid test Dip-strip (plasma) (Nantong Economy and Technology Development Zone, China) and HCV plus rapid test strip (plasma) (Nantong Economy and Technology Development Zone, China). Result was interpreted according to manufacturer's instruction.

Principle of the test

The principle of this test is based on the anti-HBsAg and anti-HC RNA reaction. The membrane on the test line region is precoated with anti-HBSAG antibody and that of Hepatitis C antibody. During testing, the specimen (serum) reacts with particles coated with HBsAg antibodies and Hepatitis C antibodies. The sample mixture migrates upward on the membrane chromatographically by capillary action reacting with anti-HBSAG and anti-HC RNA antibodies on the membrane thus generating a colored line.

Interpretation of result

Positive: Two distinct colored lines appear in the control region (C) and the test region (T).

Negative: One colored line appears in the control region and no line appears in the test region.

Measures

The sociodemographic data evaluated were sex, age (in years) and marital status. Sex was categorized into male and female, while age was categorized into ≤ 40 and ≥ 40 years, length of incarceration was categorized as 1-5, 6- 10 and 11-15 years. The risk factors considered were use of illicit drugs, needle sharing, length of incarceration, sexual intercourse, condom usage. Risk factors were evaluated on the yes and no status. Data from the questionnaire was linked to the test results anonymously through specific identifiers.

Data analysis

Using descriptive analysis, the prevalence of HBsAg and HCV were expressed in frequencies.Data was analyzed using Statistical Package for Social Sciences version 22 (IBM Corp, NY). The association between categorical variables and HBsAg and HCV infections were calculated using Fishers exact test and Chi - square. The significant effects of sociodemographic characteristics and risk factors on HBsAg and HCV among inmates were assessed using binary logistic regression model. The Wald test was used to confirm the significance of the odds ratio at $p \leq 0.05$. Seroprevalence of HBsAg and HCV were classified as dependent variables and risk factors as independent variables.

Results and Discussions

The overall hepatitis prevalence among the 120 inmates was 45 (37.5%) whereby 35(29.2%) inmates and 10 (8.3%) inmates were seropositive for HBsAg and HCV infections, respectively (Table 1). The HBsAg prevalence obtained in this study was higher than the prevalence of 13.7% reported by Dan-Nwafor *et al.* [9], 12.2% in a national survey conducted for hepatitis B infection in Nigeria [7], 6.5% obtained from prisoners in Ethiopia [10], and 5.9% HBsAg reported in Champ-Dallon pre-trial prison in Switzerland [6]. A prevalence of HBsAg above 8% in a population is considered high [11].

Table 1: Seroprevalence of HBsAg & HCV infection among inmates in Lafia correctional service

Virus	Samples (N=120)	
	Positive	Negative
HBsAg	35(29.2)	85
HCV	10(8.3)	110

HBsAgV = Hepatitis B Virus, HCV = Hepatitis C Virus

Table 2: Sociodemographic factors and their association with HBsAg and HCV infections among inmates in Lafia correctional service

Sociodemographic factors	Frequency (%)	HBsAg (+) (%)	p value	HCV (+) (%)	p value
Sex					
Males	110 (91.7)	33 (30)	0.722*	9 (8.2)	0.596*
Females	10 (8.3)	2 (20)		1(10)	
Age					
≤40	79 (65.8)	23(29.1)	1.000*	6(7.6)	0.734*
≥40	41 (34.2)	12(29.3)		4(9.8)	
Marital status					
Married	43(35.8)	21(48.8)	0.001*	7	0.034
Single	77(64.2)	14(18.2)		3(3.9)	

HBsAg-Hepatitis B Virus, HCVAb- Hepatitis C Virus, (+) - Positive, *- Fishers exact test

The sociodemographic factor and their association with the HBsAg and HCV status were taken (Table 2). Among the 120 inmates, 110 (91.7%) were males and 10 (8.3 %) were females.Fisher'sexact test revealed that sex is not associated with the seroprevalence of HBsAg and HCV infections ($p \geq 0.05$) (Table 2). The odds ratio showed no statistically significant difference in seroprevalence of HBsAg (OR: 1.71; 95% CI: 0.35 – 8.51) and HCV (OR: 0.8; 95% CI: 0.09 -7.06) among the male and female inmates. A higher number of infected male inmates compared to the infected female inmates observed in our study may be attributed to a larger sample size of male enrollees than femaleenrollees in the studied population. This result is similar to the study of Okafor *et al*. [12] who reported a higher infection of HCV among male inmates than female inmates in Calabar, Cross River State, Nigeria.

The mean age among the prison inmates was 40 years. Age stratification was 79 (65.8%) inmates below 40 years and 41 (34.2%) inmates above 40 years. Fishersexact test showed no association between age and HBsAg and HCV infections ($p \geq 0.05$) (Table 2). Inmates above 40 years of age are one time more likely to have HBsAg (OR: 1.0; 95% CI: 0.44 – 2.31) and HCV (OR: 1.32; 95% CI: 0.35 – 4.95) infection than inmates below 40 years of age. A study in Dessie Town, Ethiopia documented a significant association between HBsAg infection and an increase in age above 44 years among prisoners in a correctional center in Ethiopia [10]. Contrary to this report, a reduced susceptibility to HBsAg infection with an increase in age was found among the population tested in another study in Nigeria [7, 9].

The prevalence of infection among married inmates was 43 (35.8%) while single inmates were 77(64.2%). Fishers exact test showed that the marital status of inmates was associated with HBsAg and HCV infections ($p \leq 0.05$) (Table 2). Married inmates are 5 times more likely to contract HCV than single inmates (OR: 5.0; 95% CI: 1.17 – 19.64). A similar report showed a higher prevalence of 32.1% HCV infection among married inmates than among single inmates with 28.8% seroprevalence [13]. Married people may be more prone to these infections as marriage is a medium for unprotected sex which can expose persons to HBsAg and HCV infections [7]. Additionally, married persons are more HBsAg and HCV prevalent than single individuals [14].

Risk factors associated with seroprevalence of HBsAg and HCV infection among inmates in Lafia correctional service

Result on the associated risk factors for HBsAg and HCV infections among inmates are shown in Table 3. These include 20 (16.7%) illicit drug users, 10 (8.3%) needle sharers, 89 (74.2%) incarcerated for 1 – 5 years, 21 (17.5%) between 6 and 10 years and 10 (8.3%) between 11 and 15 years in Lafia correctional service, 66% (n=80) were sexually active and 25% (n=30) use condom. Binary logistics regression analysis was used to test the significant effect of risk factors on the prevalence of HBsAg and HCV infection among inmates.

Table 3: Associated risks factors and seroprevalence of HBV and HCV infections among inmates in Lafia correctional service

Risk factors	Status of Inmates (%)	HBsAg (+) (%)	HCVAb (+) (%)
Illicit drug use			
Yes	20 (16.7)	11(55)	2(10)
No	100 (83.3)	12(12.0)	8(8)
Needle sharing			
Yes	10 (8.3)	2(20)	2(20)
No	110(91.7)	21(19.1)	8(7.3)
Length of stay			
1-5 years	89 (74.2)	15(16.9)	6(6.7)
6-10 years	21(17.5)	13(61.9)	3(14.3)
11-15 years	10 (8.3)	5(50)	1(10)
Sexual intercourse			
Yes	80(66.7)	23(28.8)	3(3.8)
No	40(33.3)	10(25)	7(17.5)
Condom use			
Yes	30 (25)	8(26.7)	2(6.7)
No	90 (75)	25(27.8)	8(8.9)

HBsAg-Hepatitis B Virus, HCVAb- Hepatitis C Virus, (+) - Positive

Eleven inmates (55%) and two inmates (10%) who are illicit drug users were seropositive for HBsAgand HCV, respectively. Illicit drug users are 9 times (OR: 9.0; 95% CI: 3.08 – 26.07) more likely to have HBsAg infection than non-illicit drug users but are one time (OR: 1.3; 95% CI: 0.25 – 6.52) less likely to have HCV infectionthan non-illicit drug users. An Australian study conducted between 2005 and 2009 on 210 anti-HCV negative subjects with a history of illicit drug use for up to 4 years showed a prevalence rate of 14.8 per 100 persons with HCV transmission annually due to incarceration [15] while Musa *et al*. [13] demonstrated that illicit drug use was not risk factors predisposing inmates to HCV infection in Calabar, Cross River Nigeria. Illicit drug use and needle sharing were channels of transmitting HBsAg infection in the Lafia correctional service which was similar to the result obtained from Kuje prison inmates in Abuja, Nigeria [9]. The use of contaminated cutting or piercing instruments is a high-risk behaviour for transmitting

HBsAg in prisons, particularly in the case of sharing needles for IV drug use [16].

Two inmates each (20%) who share needles were seropositive for HBsAg and HCV infection. Inmates who share needles are one time (OR: 1.1; 95% CI: 0.21 – 5.36) more likely to have HBsAg infection than inmates who do not share needlesand are 3 times (OR: 3.2; 95% CI: 0.58 – 17.60) more likely to have HCV infection than inmates who do not share needles, although the differences are not statistically significant. The useof contaminated cutting or piercing instruments is a high-risk behaviour for transmitting HBsAg in prisons, particularly in the case of sharing needles for IV drug use [7]. Sexually active inmates have a higher risk of contracting HBsAg [9].

Inmates who have been incarcerated for 6 – 10 years had the highest seroprevalence of 13 (61.9%) HBsAg and 3 (14.3%) HCV infections, followed by inmates between 11 – 15 years of incarceration with 10 (50%) HBsAg and 1 (10%) HCV, respectively while the lowest seroprevalence, was found among inmates with 1 – 5 years of incarceration, 15 inmates (16.9%) HBsAg and 6 (6.7%) HCV infection. The length of stay had a statistically significant effect on the prevalence of HBsAgand HCV. Inmates within 6 to 10 years of incarceration are 8 times (OR: 8; 95% CI: 2.83 - 22.70) more likely to have HBsAg infection than inmates within 1 to 5 years of incarceration while inmates within 11 to 15 years of incarceration are 5 times (OR: 5; 95% CI: 1.27 -19.19) more likely to have HBsAg infection than inmates within1 to 5 years of incarceration in the correctional service. The length of incarceration above 5 years was a risk to contracting Hepatitis B and C infection among inmates. Inmates who had been incarcerated above 5 years were highly infected with HBsAg. The length of incarceration has been found to be significantly associated with the risk of having HBsAg and HCV infection among inmates in Nasarawa State, Nigeria [8]. The American Advisory Committee on immunization and the Centers for disease control and prevention recommendhepatitis B vaccination for inmates with long term incarceration in correctional services and IDUs [15].

Sexually active inmates were 23 (28.8%) and 3 (3.8%) seropositive for HBsAg and HCV infections, respectively. Sexually active inmates (OR: 0.18; 95% CI: 0.05 – 0.75) are less likely to have HCV than the inmates who are not sexually active. Among condom users, 8 (26.7%) and 2(6.7%) had HBsAg and HCV infections, respectively. The risk of having HBsAg infection (OR: 0.95’ 95% CI: 0.37 – 2.4) and HCV infection (OR: 0.7; 95% CI: 0.15 – 3.66) among inmates using condom and inmates not using use condom was not statistically significant.

A high seroprevalence of hepatitis among inmates has serious implication for public health. The rate of contracting the infection is high due to high-risk behaviour engaged in by inmates such as indiscriminate sexual intercourse. Due to non-routine screening of hepatitis for inmates, many inmates are not aware of their infection status thus easily transmitting infection among themselves. A high HBsAg and HCV among inmates may be hazardous as inmates having the hepatitis infectionmay be released into the society after incarceration or may be transferred from a correctional service center to another thus transmitting the virus. Thus, routine HBsAg vaccination intervention in the correctional centers as Nigeria will strengthen the health management programs on eliminating hepatitis virus infection [13]. The development of a national guideline that will enable standardization in data collection and data interpretation will improve the quality of data reporting [11].

Limitations of the study

The limitations of this study were that lack of data on screening of hepatitis infection among inmates before incarceration, therefore time acquisition of HBsAg and HCV cannot be ascertained. Only one seropositive marker (HBsAg) and (HCVAb) were determined for HBsAg and HCV compared to other studies with reports on multiple seropositive markers.

Conclusion

This study observed a high seroprevalence of HBsAg and HCV infections among inmates in Lafia correctional service, Nigeria, and reaffirmed the need to routinely screen all prisoners before incarceration for the presence of these viral infections. HBsAg was more prevalent than HCV infection, as expected. The significant sociodemographic characteristics and risk factors underlying the prevalence of HBsAg and HCV infection among inmates in the Lafia correctional service were the age group below 40 years, marital status, illicit drug use, and length of stay above 5 years. As a safety measure, vaccine administration must be made compulsory among inmates with complete vaccination programs because active and untreated HBsAg and HCV infections among prison inmates can result in active transmission among the incarcerated populations and increase further transmission in the communities after discharge of inmates. It is therefore recommended that regular screening forHBsAg and HCV infection in correctional services is necessary to identify infected inmates leading to rapid response in health care this will help reduce the spread of the infections.

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References

[1] World Health Organization (2016). Global health sector strategy on viral hepatitis 2016–2021(2016). Towards ending viral hepatitis. World Health Organization. Available on https://apps.who.int/iris/handle/10665/246177. Accessed 23/03/2023.

[2] World Health Organization (2017). Global Hepatitis Report. Geneva: Switzerland, World Health Organization (WHO). Available on https://apps.who.int/iris/bitstream/handle/10665/255016/9789241565455-eng.pdf?sequence=1&isAllowed=y. Accessed 23/03/2023.

[3] Olayinka, A. T., Oyemakinde, A., Balogun, M. S., Ajudua A., Nguku, P. & Aderinola, M. (2016). Seroprevalence of Hepatitis B Infection in Nigeria: A National Survey. *Am. J. Trop. Med. Hyg.*, 95(4), 902–907. doi:10.4269/ajtmh.15-0874.

[4] Adekanle, O., Komolafe, A. O., Olowookere, S. A., Ijarotimi, O. & Ndububa, D. A. (2020). Hepatitis B infection: A mixed methods of disclosure pattern and social problems in the Nigerian family. *J. Patient Experi.*, 7(2), 208-216. https://doi.10.1177/2374373519827965.

[5] Gétaz, L., Casillas, A., Siegrist, C., Chappuis, F., Togni, G., Tran, N. *et al.* (2018). Hepatitis B prevalence, risk factors, infection awareness and disease knowledge among inmates: a cross-sectional study in Switzerland's largest pre-trial prison. *J. Global Health*, 8(2), 1 – 11. http://doi.org/10.7189/jogh.08.020407.

[6] Jafari, S., Buxton, J. A., Afshar, K., Copes, R. & Baharlou, S. (2012). Tattooing and risk of hepatitis B: a systematic review and meta-analysis. *Can. J. Public Health*, 103, 207-12. Medline: 22905640.

[7] Uchechukwu, O. F., Abdulrahman, Y., Aliyu, A. U., Mustaphar, U., Zama, I. & Charles, A. T. (2018). Seroprevalence of HIV, HBsAg and HCV among prisoners in Sokoto, Nigeria. *Asian J. Med. Health*, 13(3), 1-8.

[8] Adoga, M. P., Banwat, E. B., Forbi, J. C., Nimzing, L., Pam, C. R. & Gyar, S. D. (2009). Human immunonodeficiency virus, hepatitis B virus and hepatitis C virus: seroprevalence, co-infection and risk factors among prison inmates in Nasarawa State, Nigeria. *J. Infect. Dev. Count.*, 3(7), 539-547.

[9] Dan-Nwafor, C. C., Adeoye, I., Aderemi, K., Onuoha, M., Adedire, E, Bashorun, A. *et al.* (2021). Serological markers and risk factors associated with Hepatitis B virus infection among Federal Capital Territory prison inmates, Nigeria: Shuld we be concerned? *PloS One*, 16(3), e0248045. https://doi.org/10.1371/journal.pone.0248045.

[10] Kassa, Y., Million, Y., Biset, S. & Moges, F. (2021). Hepatitis B and Hepatitis C viral infections and associated factors among prisoners in Northeast Ethiopia. *J. Blood Med.*, 12, 561–570. https://doi.org/10.2147/JBM.S314556.

[11] Ajuwon, B. I., Yujuico, I., Roper, K., Richardson, A. & Sheel, M., L. (2021). Hepatitis B virus infection in Nigeria: a systematic review and meta-analysis of data published between 2010 and 2019. *BMC Infectious Dis.*, 21, 1120. https://doi.org/10.1186/s12879-021-06800-6.

[12] Okafor, I. M., Ugwu, S. O. & Okoroiwu, H. U. (2020). Hepatitis C virus infection and its associated factors among prisoners in a Nigerian prison. *BMC Gastroenterol.*, 20, 360. https://doi.org/10.1186/s12876-020-01504-8.

[13] Musa B. M., Bussell S., Borodo, M. M., Samaila, A. A. & Femi, O. L. (2015). Prevalence of Hepatitis B virus infection in Nigeria, 2000-2013: A systematic review and meta-analysis. *Nig. J. Clin. Pract.*, 18(2), 163 -172.

[14] Babatope, I. O., Inyang, N. J., Imhanrenezor, K. & Aghahowa, A. (2015). Seroprevalence of Hepatitis B and C viruses among apparently healthy adults in Ekpoma, Edo State, Nigeria. *SVPJ*, 1(1), 0015–20.

[15] Luciani, F., Bretaña, N. A., Teutsch, S., Amin, J., Topp, L., Dore, G. J. *et al.* (2014). A prospective study of Hepatitis C incidence in Australian prisoners. *Addiction*; 109, 1695-1706. https://doi.org/10.1111/add.12643.

[16] Gough, E., Kempf, M. C., Graham, L., Manzanero, M., Hook, E. W., Bartolucci, A. *et al.* (2010). HIV and Hepatitis B and C incidence rates in US correctional populations and high-risk groups: a systematic review and meta-analysis. *BMC Public Health*, 10, 777.

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