



Demographic and Serum Alanine Aminotransferase level of Primary Health Care Workers Positive for Hepatitis B Surface Antigen and Hepatitis C Virus in Cross River North, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2022/v34i131244

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/79993>

Original Research Article

Received 02 November 2021

Accepted 04 January 2022

Published 05 January 2022

ABSTRACT

Background: Healthcare workers (HCW) are perceived to be a high-risk group for hepatitis B due to occupational exposure to infected bodily fluids and often poor availability of protective equipment in sub-Saharan Africa. This study was carried out to assess the serums ALT levels of Primary Health Care workers (PHCW) who are reactive to Hepatitis B surface antigen, hepatitis C virus and evaluate their sociodemographic characteristics amongst.

Methods: The study was carried out in the health care centres of five (5) local government areas of Cross River North Senatorial district of Cross River State, Nigeria which includes Bekwarra, Obanliku, Obudu, Ogoja and Yala local government areas. These primary health care centres provide medical services for patients diagnosed with Hepatitis B, Hepatitis C and HIV. Two hundred (200) health workers' samples were analysed in the study.

Results: The result showed that 192 (96%) of the subjects tested negative to hepatitis B Virus while 8 (4%) were positive for the virus. Data also show that 198 (99%) of the subjects tested negative to Hepatitis C Virus while 2 (1%) were positive. Alanine aminotransferase decreased in subjects that tested positive to the Hepatitis B and C Virus.

Conclusion: The prevalence of hepatitis B surface antigen (HBsAg) and Hepatitis C amongst Health Care Workers was insignificant, and this could be attributed to the knowledge and attitude of the workers towards safety practices as well as vaccination.

Keywords: Hepatitis virus; health worker; aminotransferase and vaccination.

1. INTRODUCTION

Hepatitis has been a growing public health challenge [1] especially in the tropics. Hepatitis B virus (HBV), apart from being a major health challenge globally, is more prevalent in the underdeveloped and developing countries [2]. Approximately three hundred and fifty million people worldwide are affected [3]. A World Health Organisation (WHO) estimate puts the prevalence of chronic hepatitis B infection in sub-Saharan Africa at 6.1%. [4]. This large prevalence implies that a reasonable number of people are at risk of the associated complications such as hepatocellular carcinoma, liver cirrhosis and mortality. Although the year 2030 has been set as the target year for the elimination of viral hepatitis globally by the WHO, significant public health initiatives and drive are necessary to reach this commendable target [5]. Although Hepatitis B can be prevented by vaccine resulting in the introduction of the vaccine by many countries over the last twenty years, yet several countries in sub-Saharan Africa have introduced the vaccination of infants without a plan to include adult population thereby creating a gap in the virus elimination [6-7].

The prevalence of Hepatitis B surface antigen (HBsAg) in China is put at about 8.5% of the adult population [8].

Hepatic illnesses account for 7.9% of medical admissions in Nigeria, with primary hepatic cancer accounting for 44.3 % and cirrhosis accounting for 20.4%. With a prevalence of 49.4 percent after alcohol intake (52.1 percent), HBV is the second most common cause of these disorders [9]. Because HBV infection is on the rise in Nigeria, the danger of contracting the virus is high, not only because of low vaccination rates, but also because up to 75% of the population would be exposed [10]. In 2013, viral hepatitis claimed the lives of 1.45 million people around the world, representing a 63 percent rise in mortality from 1990 to 2013. Hepatitis B is the most common cause of viral hepatitis in Sub-Saharan Africa [11]. HBV infection, which is becoming more common, is a dynamic process that is influenced by the individual's immune

response and HBV replication. Disease progression is divided into multiple phases, based on the levels of serum hepatitis B envelope antigen (HBeAg), HBV DNA and alanine aminotransferase (ALT) and on the degree of liver inflammation. HBV infection can have long-term consequences because the disease can progress to cirrhosis, liver failure, and hepatocellular carcinoma (HCC). More than one million people die each year as a result of HBV-related cirrhosis and/or HCC [11].

The importance of timely infection prevention among health care workers (HCWs) cannot be overstated in a hospital setting where employees' health is constantly threatened by a plethora of infectious hazards, the majority of which can be avoided by following standard precautions [12]. In the literature, at least twenty-six different infectious agents have been reported to be transmitted through occupational exposure during sharp injuries [13]. The transmission of a plethora of infectious agents that have yet to be identified cannot be completely ruled out. The highest share of exposure to contaminated sharps is shared by the HCWs of the developing countries where approximately 40–60% of the occupational Hepatitis B virus (HBV) infections arise due to the sharp injuries [12]. About 14.4% and 1.4% of HBV and HCV rates have been reported in HCWs with the highest prevalence among dentists, nursing staff, dialysis unit staff, laboratory staff or physicians [14]. A study report 600,000 to 800,000 cut or puncture injuries amounting to around 30 injuries per 100 beds per year out of which almost half are not registered [15]. As per the World Health Organisation (WHO), the average number of occupational injuries per HCW varied region wise (0.2–4.7 injuries annually) along with the proportion of HCWs in the general population (0.2%–2.5%) [16-17].

Hepatitis B virus (HBV) transmission in medical settings was a serious public health issue prior to vaccination. A high rate of HBV infection in health care workers (HCW) was observed, with 5–10% of infected subjects becoming chronic HBV carriers. HBV transmission was particularly common in situations involving direct contact with

blood, such as surgery, haemodialysis units, or oncology wards. Unlike hepatitis C, HBV transmission from patient to HCW can be prevented through vaccination. As a result, the number of HBV infections among healthcare workers has decreased significantly over the last 20 years [18]. This sustained decline in the incidence of hepatitis B among persons with occupational exposure can be attributed to hepatitis B vaccination of HCW, graduates of medical school, and emergency medical technicians [19]. Introduction of a series of measures to prevent exposure to HBV in addition contributed to the reduction of the rate of HBV infections [20]. As a result, the incidence of HBV infection among HCW is now lower than among the general population. Because more than 95% of vaccines develop protective antibodies, the risk of vaccinated HCW to acquire HBV during their professional activities is minimal. However, not all HCW are vaccinated or are responders to vaccine and, therefore, are at risk to acquire HBV infection. HBV is among one of the important public health challenges with a mortality accounting for almost a million deaths annually [19]. HBV infection, the most important aetiology of cancer mortality worldwide, accounts for almost 80% of the cases of primary liver carcinoma [21]. What is more worrisome is that there are no national strategy plan for prevention and control of hepatitis B in Nigeria either among healthcare workers or the general population, and no routine surveillance or sero-surveys of

infection [22]. Increasing use of various newer invasive diagnostic or therapeutic modalities makes the exact estimation of the incidence of nosocomial HBV difficult. Furthermore, in resource-strapped nations where HBV is common, the implementation of preventative techniques is even more critical due to a lack of suitable treatment options. Employees and employers in health-care settings are both responsible for taking appropriate actions to protect PHCWs, patients, and/or health workers from being exposed to or transmitting blood-borne diseases. The aim of this study is to assess the serums alanine aminotransferase levels of Primary Health Care workers who are reactive to Hepatitis B surface antigen, hepatitis C virus and evaluate the sociodemographic characteristics amongst primary health care worker who are reactive to Hepatitis B surface antigen in Cross Rivers North.

2. METHODS

2.1 Study Area/Population

This study was conducted among health care workers at Primary Health Care centres in five local government areas of Cross River North Senatorial district of Cross River State. They include Primary Health Centers in Bekwarra, Obanliku, Obudu, Ogoja and Yala local government areas.

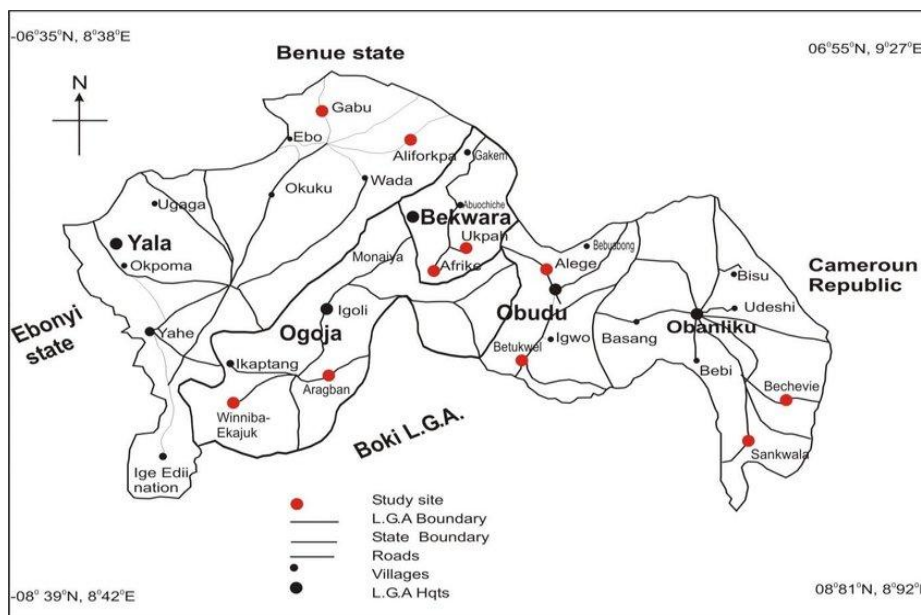


Fig. 1. Map of Northern Cross River State, showing study sites, neighbouring states and Country [23]

These primary health care centres provide medical services for patients diagnosed with Hepatitis B, Hepatitis C and HIV. The total population of primary health care workers in the study area was six hundred and thirty two (632) people, outlined as follows: Bekwarra (n = 115), Obanliku (n = 117), Obudu (n = 150), Ogoja (n = 120) and Yala (n = 130). The study was a multicentre, hospital-based cross-sectional study.

Cluster sampling technique was used to cluster five major facilities in the study area and all primary health care workers in those facilities that gave informed consent were sampled by Systematic random sampling. The sample population of this study stood at 200 primary health care workers across the five local government areas.

Subject selection criteria:

All subjects who are health workers in primary health care centres within the study area and period who gave informed consent were recruited into the study.

Structured questionnaires and interview were used to exclude subjects who were not health workers and did not fit into the inclusion/eligibility criteria. Patients with the following conditions were excluded: co-infection with hepatitis C, antiviral drugs taken 6 months before enrolment, pregnancy or lactation, co-infection with HIV and cirrhosis.

2.2 Sampling

Instrument for data collection:

All primary health care workers who were sampled for this study were screened for hepatitis B surface antigen, hepatitis C virus and retro virus by way of blood test, Alanine aminotransferase levels was also checked on subjects.

A questionnaire was used in the study. The content of this instrument was based on information about hepatitis B and the biodata of participants.

The cubital fossa of each participant was cleaned with alcohol pad, and was gently pricked with lancet. About five millilitres (5 mL) of blood was collected into a plain bottle and transported to the laboratory immediately for analysis. Each

sampling bottle was properly labelled for easy identification.

About 1 mL of whole blood was kept aside for use in a fast test right away, while the remaining 4 mL were allowed to clot for 1 hour at room temperature before being centrifuged at 2500 rpm for 10 minutes in a vacutainer. After that, the sera were sorted into a simple blood collection container and kept at <20°C until needed [24].

2.3 Laboratory Analysis Serology Tests

For each participant, a sealed pouch was opened by tearing along the notch. The test strip was removed from the pouch. A drop of blood was introduced onto the marked "T" point on the test strip, and one drop of the buffer solution was added to the drop of blood on the test strip. This was allowed to mix and react based on the antigen/antibody reaction principle for about 10 minutes and then the result was interpreted as follows: Those who were negative to HBsAg, only one colour band appeared on the control region. No apparent band on the test region. This indicated that there was no detectable HBsAg in the serum of such participants. For those who were positive, distinct colour bands appeared on the control and test regions. Both test line and control line indicates that the specimen contains detectable amounts of HBsAg.

Biochemical tests:

Sera were subjected to liver function Reflotron tests in order to determine the level of ALT. It was analysed biochemically using the Reflotron instrument which was switched on and a test strip was removed from the container when the display showed "READY". The desiccant stopper was replaced immediately on the container. The strip was unwrapped with care taken not to bend it. Sample material was drawn using the Reflotron pipette and was applied as a drop to the red application zone with care taken not to touch the application zone with the pipette tip. With the sliding cover or flap open, the test strip was placed on to the guide within 15 sec and was slid forward horizontally until it locked into place. The sliding cover or flap was closed. The instrument displayed GPT to confirm that it has correctly read in the test-specific magnetic code. The display showed the number of seconds left before the result was displayed. GPT activity was calculated automatically from the reading taken using a function and conversion factors that were entered in the instrument via the magnetic strip

on the underside of each test strip. The enzyme activity was shown for 37°C in U/L. The used test strip was removed from the Reflotron and disposed of accordingly.

2.4 Statistical Analysis

The statistical software IBM SPSS Version 20 (IBM Corp. Armonk, NY, USA) was used to analyse the data collected from the test results. Binary logistic regression was used to assess the connection between HBV serologic markers and aberrant liver enzymes/compounds, with a p-value of less than 0.05 at the 95 percent confidence interval (CI) considered statistically significant.

3. RESULTS

Sociodemographic Characteristics of Primary Health Care workers in Cross Rivers North:

In this segment, the socio-demographic characteristics of primary health workers in Cross Rivers North were analysed.

Table 1 shows the socio-demographic parameters of health workers in cross rivers north LGA. It was generally observed that 146 (73%) of the subjects were women. This was consistent from the data collected across the different town within the study area. Most of the health workers, 116 (58%) are observed to be more than 40 years old. Despite this, a high number of Primary Health Workers in Bekwarra and Yala are below the age of 30 years. Distribution in level of education of these subjects show that 184 (92%) of the primary health workers had tertiary education. Data also

show that 94 (47%) of the subjects have spent more than 20 years as Primary Health Workers.

The table above [Table 2] shows knowledge and attitude to vaccination of primary health workers in cross rivers north towards the hepatitis B and C Virus. Records show that, across the five different towns within the study area, most of the health workers have not been vaccinated against the Hepatitis B Virus. Generally, 110 (55%) of the total study subjects have not been vaccinated. It was also observed that 187 (93%) have knowledge on the mode of transmission of the hepatitis virus while 13 (7%) do not have knowledge on the transmission of hepatitis B and C virus. Similarly, most of the health workers, 155 (78%) know the precautionary measures in avoiding the contact and transmission of hepatitis B virus. Also, 115 (57%) of the health workers are not exposed to accidental needle while 85 (43%) find themselves exposed to accidental needle.

Table 3 shows the distribution of Hepatitis B and C Virus among Primary Health Workers in Cross Rivers North. It was observed that 192 (96%) of the subjects tested negative to hepatitis B Virus while 8 (4%) were positive to the virus. Data also show that 198 (99%) of the subjects tested negative to Hepatitis C Virus while 2 (1%) were positive.

This experiment shows the effect of Hepatitis B Virus on Liver enzyme, alanine aminotransferase. Data show that the alanine aminotransferase decrease in subjects tested positive to the Hepatitis B Virus. The decrease was not statistically significant when compared to the ALT level of subject tested negative to Hepatitis B surface antigen.

Table 1. Social-Demographic Variables of Subjects

Factors	Variables	Towns					Total N(%)
		Bekwarra N(%)	Obanliku N(%)	Obudu N(%)	Ogoja N(%)	Yala N(%)	
Gender	Male	16 (48)	13 (31)	5 (9)	12(36)	8(24)	54 (27)
	Female	17 (52)	29 (69)	54 (91)	21(64)	25(76)	146 (73)
Age (Years)	<30	15 (44)	13 (31)	0 (0)	3 (8)	15(44)	44 (22)
	31 – 40	5 (16)	13 (31)	9 (16)	8 (24)	3 (12)	40 (20)
	>40	13 (40)	16 (38)	50 (84)	22(68)	15(44)	116 (58)
Level of Education	Primary	1 (4)	3 (6)	2 (4)	0 (0)	3 (8)	10 (5)
	Secondary	19 (57)	1 (3)	1 (2)	0 (0)	3 (8)	6 (3)
	Tertiary	13 (39)	38 (91)	56 (94)	33(100)	27(84)	184 (92)
Duration in Public Service (Years)	<10	22 (68)	17 (41)	7 (11)	8 (24)	16(48)	70 (35)
	11 – 20	0 (0)	10 (25)	17 (29)	1 (4)	8 (23)	36 (18)
	>20 years.	11 (32)	15 (34)	35 (60)	24(72)	9 (29)	94 (47)

Table 2. Knowledge and Attitude to Vaccination of subjects toward Hepatitis B and C Virus

Factors	Variables	Towns					Total N(%)
		Bekwarra N (%)	Obanliku N (%)	Obudu N (%)	Ogoja N (%)	Yala N (%)	
Vaccination	Vaccinated	4 (12)	1 (3)	10 (16)	4 (12)	0 (0)	18 (9)
	Not vaccinated	21 (64)	32 (75)	22 (38)	12 (36)	24 (72)	110 (55)
	Partially vaccinated	8 (24)	9 (22)	27 (46)	17 (52)	9 (28)	72 (36)
Knowledge on Mode of Transmission	Aware	30 (92)	37 (88)	55 (93)	32 (96)	33(100)	187(93)
	Not aware	3 (8)	5 (12)	4 (13)	1 (4)	0 (0)	13 (7)
Knowledge on Precautionary Measures	Aware	21 (64)	35 (84)	42 (71)	33 (100)	24 (72)	155(78)
	Not Aware	12 (28)	8 (16)	17 (29)	0 (0)	9 (28)	45 (22)
Exposure to accidental needle	Exposed	8 (24)	20 (44)	34 (58)	12 (36)	11 (32)	85 (43)
	Not Exposed	25 (76)	22 (53)	25 (42)	21 (64)	22 (68)	115 (57)
	Exposed						

Table 3. Distribution of reaction to hepatitis B virus (HBV) among the study group (n = 152)

Serological Markers	Frequency (N)	Percentage
HBsAg negative	192	96
HBsAg Positive	8	4
HCV negative	198	99
HCV Positive	2	1

Effect of Hepatitis B virus on Alanine Aminotransferase levels

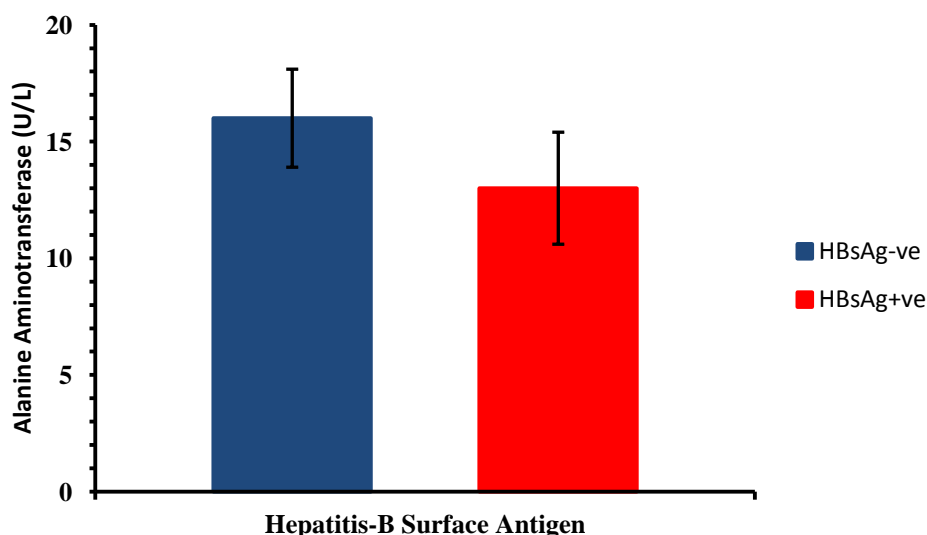


Fig. 2. Effect of Hepatitis B Virus (HBV) on Alanine aminotransferase Level

Fig. 2 shows the Effect of Hepatitis C Virus (HCV) on Alanine aminotransferase Level of Primary Health Care Workers in Cross River north. It was observed that the serum alanine

aminotransferase level was significantly reduced ($p < 0.05$) in the subjects tested positive for HCV when compared to the alanine aminotransferase of subject who are not infected with HCV.

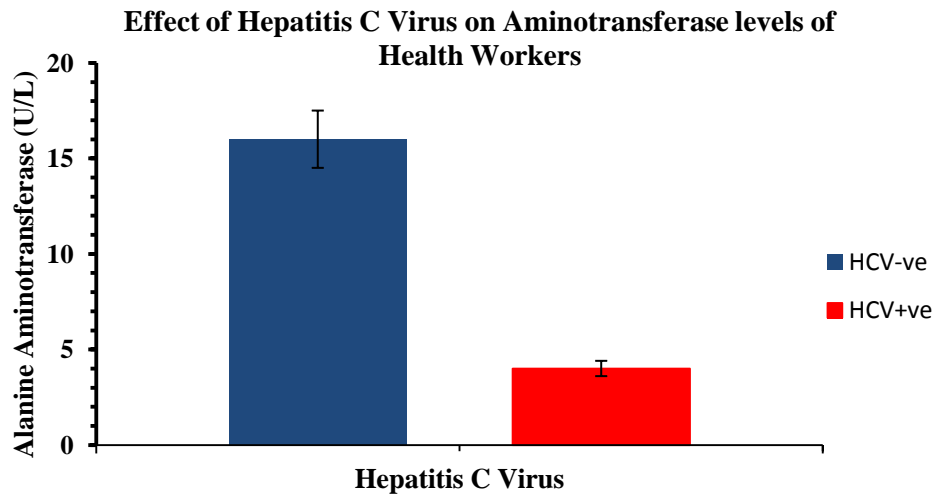


Fig. 3. Effect of Hepatitis C Virus (HCV) on Alanine aminotransferase Level

4. DISCUSSION

Hepatitis B, which is caused by the hepatitis B virus, is a serious global health problem. The most common cause of chronic hepatitis, liver cirrhosis, and hepato-cellular cancer is this infection of the liver [4]. In Nigeria, it is estimated that roughly 12% of the population is chronically infected with HBsAg. For health care workers, the hepatitis B virus is a significant occupational threat. It can be avoided with the use of a safe and effective vaccine. It is simple to believe that health professionals should have appropriate understanding of diseases and other health issues due to their proximity to the health institution. The current study was sought to evaluate the serum alanine aminotransferase level of Primary Health Care workers who are reactive to Hepatitis B surface antigen in Cross Rivers North. A vaccine against hepatitis B infection has been available since 1982. Hepatitis B vaccine is 95% effective in preventing HBV infection and its chronic consequences, and it is the first vaccine against a major human cancer. Vaccination rates however have been found to be low among health care providers who paradoxically, given their level of exposure are supposed to have higher vaccine coverage rates. In this study, many of the respondents had a negative attitude towards the hepatitis B infection and vaccine, only 9% of them have been vaccinated and 55% were not vaccinated against Hepatitis B Virus. According to this study, only 36% of study participants were partially vaccinated for hepatitis B. This means that they took less than the recommended three doses. Furthermore, findings from other researchers

[25-26] on health workers showed that only 37.9 and 18.1% of their respondents respectively were reported to be fully vaccinated against Hepatitis B infection.

This study revealed that 93% had knowledge of the mode of transmission of hepatitis virus while 7% did not have knowledge of the transmission of hepatitis B and C virus. Findings in the study were higher than the reports from a study among health workers in southern Nigeria were 68.5% knew viral hepatitis B could be transmitted through non sexual means and 37% knew it could be transmitted through sexual intercourse [27]. High risk groups comprised blood transfusions, health care and laboratory personnel, homosexuals, prostitutes, and percutaneous drug abusers, infants of HBV carrier mothers and mothers who were immuno-compromised [28]. Despite the low compliance to hepatitis B vaccination among Health Care workers in Cross Rivers North, most of the health workers, 78% knew the precautionary measures in avoiding the contact and transmission of hepatitis B virus. Also, 57% of the health workers were not exposed to accidental needle prick.

Data from the study showed that 4% of Health Care Workers in Cross Rivers North tested positive to hepatitis B Virus while 1% tested positive to Hepatitis C Virus. The finding that just 4% of respondents were positive for HBsAg differed from the findings of 25.7 percent among surgeons in a research conducted in Lagos [29], but it was consistent with the findings of 2.18 percent and 2.4 percent in studies conducted in Peshawar, Pakistan [30] and Korea [31]. The low

incidence of HBsAg in this study could be due to the patients' greater awareness of viral Hepatitis B infection and high vaccination rates. Those who were seropositive may have been transferred to administrative units under the state ministry of health, as screening for HBSAg is done before any vaccination begins. Prevalence of HCV recorded in this study is in accordance with other reports of HCV prevalence for Health Care Workers in other parts of Nigeria such as 0.4% in Kano State [32], 2.0% for Anambra State [33] and 5.0% for Port-Harcourt in Rivers State [34].

Data from our study shows that alanine aminotransferase levels in subjects that tested positive to Hepatitis B Virus was similar to subjects that tested negative, in contrast to a finding that showed elevated ALT [35]. This could be associated with the histological grading and staging of the disease. Similarly, another study showed that higher rate of hepatitis B virus e-antigen (HBeAg) seroconversion is associated with increased ALT [36]. Furthermore, the similarities in ALT level between subjects testing negative and positive to Hepatitis B Virus can be explained by a finding [37] which showed that up to 40–50% of all HBeAg-positive patients may have normal ALT levels for prolonged periods.

It was also observed that the serum alanine aminotransferase level significantly ($p < 0.05$) reduced in the positive HCV subjects when compared to the alanine aminotransferase of subjects who were infected with HCV. This decrease could be attributed to the extremely low prevalence (1%) of HCV in this study. The prevalence rate of 1% obtained from this study is less than the World Health Organization global prevalence rate of 3% [38]. HCV prevalence rates in several population subgroups in Nigeria, Africa, and the Middle East have been reported in previous research [34]. Just like the prevalence of 1% obtained in this study, low HCV prevalence rates were recorded in some studies conducted among blood donors in Kano, Nigeria (0.40%), Namibia (0.90%), Sudan (1.90%), Senegal (0.80%), and Ghana (0.90%) [32,34]. However, previous studies in Nigeria found higher prevalence rates: 4.50 percent among sickle cell disease patients receiving regular blood transfusions in Benin, 5.70 percent among HIV patients in Jos, 8% among university undergraduates in Ilorin, 5%, and 12.30 percent in Port-Harcourt and Benin, respectively [39-41]. High prevalence rates have also been found in

different parts of Africa and the Middle -East. For instance prevalence rates of 5.20%, 5.70%, 19.20% were reported among blood donors in Ghana, Saudi Arabia and Egypt respectively [34, 42]. These variations in prevalence rates could be due to a variety of factors. For starters, it could be a true reflection of global regional variation in HCV prevalence as a result of unwholesome health practises prevalent in such regions [43] or because of the high risk of exposure in the particular population subgroup studied, such as Sickle cell disease patients, HIV/AIDS patients, commercial blood donors, and so on. Second, it could be due to differences in diagnostic methodologies and the accuracies of the various tests utilised in the research. Finally, it could be due to a birth cohort effect on illness prevalence, which is most likely due to the influence of recent improvements in health practises [43].

5. CONCLUSION

Conclusively, there was a low prevalence of Health Care Workers testing positive to hepatitis B surface antigen (HBsAg). This study has shown that a fair proportion of the Health Care Workers have been vaccinated. Most of these workers have knowledge of the mode of transmission of the virus and precautionary measures, and they are not exposed to accidental needle pricks. Encouragingly the liver enzymes of these workers were not adversely affected as the ALT level was within normal range.

CONSENT

Informed consent of each participant was obtained prior to sample collection by the issuance of a consent form.

ETHICAL CONSIDERATION

Ethical approval was sought and then obtained from the University of Nigeria College of Medicine through the research and ethical committee and from Cross River State Ministry of Health through the Health Research Ethical Committee (CRSMOH-HREC), with REC No. CRSMOH/RP/REC/2017/901.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Stanaway J, Flaxman A, Naghavi M, Fitzmaurice C, Vos T, Abubakar I. The global burden of viral hepatitis from 1990 to 2013: Findings from the Global Burden of Disease Study 2013. *The Lancet*. 2016;388:1081-1088.
2. Johnson AOK, Sodeinde O, Odeola HA, Ayoola EA. Survey of Hepatitis A and B infections in childhood in Ibadan - Preliminary Study. *Nig. J. Paed.* 1986;13:83-6.
3. Dienstag JL. Hepatitis B Virus Infection. *New Eng. J. Med.* 2008;359(14):1486-500.
4. World Health Organization. *Who Global Hepatitis Report 2017*; 2017. Available:<http://www.who.int/hepatitis/publications/globalhepatitis-report2017/en/>
5. Allain JP, Opare-Sem O. Screening and diagnosis of HBV in low-income and middle-income countries. *Nature Rev. Gastroenterol.* 2016;13:643-653.
6. Lewis JD. Hepatitis B in healthcare workers: Transmission events and guidance for management. *World J. Hepatol.* 2015;7:488-498.
7. Spearman CW, Hene M, Ally R, Apica B, Awuku Y, Cunha L. Hepatitis B in sub-Saharan Africa: strategies to achieve the 2030 elimination targets. *The Lancet Gastroenterol. & Hepatol.* 2017;2:900-909.
8. Liu J, Zhang S, Wang Q, Shen H, Zhang M, Zhang Y. Seroepidemiology of hepatitis B virus infection in 2 million men aged 21±49 years in rural China: a population-based, cross-sectional study. *The Lancet Infect. Dis.* 2015;16(1):80-6.
9. Nwokediuko SC, Osuala PC, Uduma UV, Alaneme AK, Onwuka CC, Mesigo C. Pattern of liver disease admissions in a Nigerian tertiary hospital. *Niger. J. Clin. Pract.* 2013;3:339-342.
10. Caligiuri P, Cerruti R, Icardi G, Bruzzone B. Overview of hepatitis B virus mutations and their implications in the management of infection. *World J. Gastroenterol.* 2016;22:145-154.
11. Liaw YF, Chu CM. Hepatitis B virus infection. *The Lancet*. 2009;373(9663):582-92.
12. Prüss-Üstün A, Rapiti E, Hutin Y. Sharps injuries: Global burden of disease from sharps injuries to health-care workers. In: Prüss-Üstün A, Campbell-Lendrum, D, Corvalán, C, Woodward, A., editors. *Who Environmental Burden of Disease Series*. Geneva: World Health Organization. 2003;3:1-40.
13. Tarantola A, Abiteboul D, Rachline A. Infection risks following accidental exposure to blood or body fluids in health care workers: a review of pathogens transmitted in published cases. *Am. J. Infect. Control.* 2006;34:367-75.
14. Bosques-Padilla FJ, Vázquez-Elizondo G, Villaseñor-Todd A, Garza-González E, Gonzalez-Gonzalez J A, Maldonado-Garza HJ. Hepatitis C virus infection in health-care settings: Medical and ethical implications. *Ann. Hepatol.* 2010;9:132-140.
15. EPINET (1999). Needlestick prevention devices. *Health Dev.* 1999;28:381-407.
16. Pruss-Ustun A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am. J. Ind. Med.* 2005;48:482-90.
17. Singhal V, Bora D, Singh S. Prevalence of hepatitis B virus infection in healthcare workers of a Tertiary Care Centre in India and their vaccination status. *J Vaccines Vaccin.* 2011;2:118.
18. Kralj N, Hofmann F, Rieger MA, Selmaier H, Manns M. Hepatitis B and hepatitis C epidemiology in health care workers. In: Editors. *Virushepatitis als Berufskrankheit*. *Eco Med.* 2000;71-81.
19. Lee WM. Hepatitis B virus infection. *N. Engl. J. Med.* 1997;337(24):1733-45.
20. Centre for Disease control and prevention (CDC), Division of viral hepatitis, National Centre for infectious Disease, *Viral Hepatitis B*; 2003. Available:<http://www.cdc.gov/ncidod/cliseases/nonehepatitis/b/fact.htm>.
21. Khakhkhar VM, Thangjam RC, Parchwani DN, Patel CP. Prevalence of hepatitis B virus infection in health care workers of a tertiary care hospital. *Nat. J. Med. Res.* 2012;2(2):176-8.
22. Lemoine M, Shimakawa Y, Njie R, Taal M, Ndow G, Chemin I. Acceptability and feasibility of a screen-and-treat programme for hepatitis B virus infection in The Gambia: The Prevention of Liver Fibrosis and Cancer in Africa (PROLIFICA) study. *The Lancet Global Health.* 2016;4:559-567.
23. Edu E, Patrick, Akwaji P. *Pentaclethra macrophylla* Benth (African oil bean tree) and *Parkia biglobosa* Jacq (African locust bean tree): The Declining Giants of The

- Rainforest of Nigeria (The Northern Cross River Situation). Researchgate; 2018.
24. Tula MY, Iyoha OA. Cross-sectional study on the sero-prevalence of hepatitis b surface antigen (hbsag) among apparently healthy students of a tertiary institution in North-Eastern Nigeria. *Int. J. Trop. Dis. Health.* 2015;7:102–108.
 25. Sofola OO, Folayan MO, Denloye OO, Okeigbemen SA. Occupational exposure to bloodborne pathogens and management of exposure incidents in nigerian dental schools. *J. Dent. Edu.* 2007;71(6):832-837.
 26. Adebamowo CA. Knowledge attitude and practices related to hepatitis B virus infection among Nigerian obstetricians and midwives. *J. Obst. Gynae.* 1998;18(6):528-532.
 27. Samuel SO, Aderibigbe SA, Salami TAT, Babatunde OA. Healthworkers' attitude and behaviour towards hepatitis B infection: Southern Nigeria. *Int. J. Med. & Med. Sci.* 2009;1(10):418-424.
 28. Park KP. Textbook of preventive and social medicine. 21st ed: Banarsidas Bhanot. 2011;192-196.
 29. Bello A. Prevalence of hepatitis virus marker in surgeons in Lagos, Nigeria. *E. Afr. Med. J.* 2000;77(5):283-285.
 30. Atallah S, Khan S, Naseemullah AS, Khan SN, Ali I. Prevalence of HBV and HBV vaccination coverage in health care workers of tertiary hospitals of Peshawar, Pakistan. *Viol. J.* 2011;8:275.
 31. Shin BM, Yoo HM, Lee AS, Park SK. Seroprevalence of hepatitis b virus among health care workers in Korea. *J Korean Med Sci.* 2006;21(1):58-62.
 32. Imoru M, Eke C, Adeyoke A. Prevalence of hepatitis B surface antigen (HBsAg), hepatitis C virus (HCV) and human immuno-deficiency virus HIV) among blood donors in Kano state. Nigeria. *Niger. J. Med. Lab. Sci.* 2003;12:59-63.
 33. Odenigbo C, Oguejiofor C, Okonkwo U, Afomuyha A, Ezeh T, Okocha E. Prevalence of antibody to hepatitis C virus in blood donors in Nnewi South-Eastern Nigeria. In association with blood groups. *Int. J. Gend. Entrep.* 2010;10:1-6.
 34. Jeremiah ZA, Koate B, Buseri F, Emelike F. Prevalence of antibodies to hepatitis C virus in apparently healthy Port Harcourt blood donors and association with blood groups and other risk indicators. *Blood Transfusion.* 2008;6:150-5.
 35. Liaw YF, Leung N, Guan R, Lau GK, Merican I, McCaughan G. Asian-Pacific consensus statement on the management of chronic hepatitis B: A 2005 update. *Liver Int.* 2005;25:472-89.
 36. Lok AS, McMahon BJ. Chronic Hepatitis B. *Hepatol.* 2007;45:507-39.
 37. Dore G, Guan R, Jafri W, Sarin S. Management of chronic hepatitis B in challenging patient populations. *Liver Int.* 2008;26:38-46.
 38. World Health Organization, No Scientific Justification to suspend Hepatitis B Immunization. Press Release WHO/67 2" dOct; 1998. Available: <http://v.r.who.int/inf-fr-1998/en/pr98-67.htm>
 39. Nwannadi IA, Alao OO, Bazuaye GN, Omoti CE, Halim NK. Seroprevalence of Hepatitis C Virus Antibody in Sickel Cell Anaemia patients in Benin-City, Nigeria. *Gomal J. Med. Sci.* 2012;10:1.
 40. Udeze AO, Bamidele RA, Okonko IO, Sule WF. Hepatitis C Virus (HCV) Antibody Detection Among First Year Students of University of Ilorin, Ilorin, Nigeria. *World J. Med. Sci.* 2011;6:162–167.
 41. Inyama PU, Uneke CJ, Anyanwu GI, Njoku OM, Idoko JH, Idoko JA. Prevalence of antibodies to Hepatitis C virus among Nigerian patients with HIV infection. *Online J. Hlth. Allied Scs.* 2005;2:2.
 42. Acquaye JK, Tettey-Donkor D. Frequency of hepatitis C virus antibodies and elevated serum alanine transaminase levels in Ghanaian blood donors. *West Afr. J. Med.* 2000;19:239-241.
 43. Wasley A, Alter MJ. Epidemiology of hepatitis C: Geographic differences and temporal trends. *Semin Liver Dis.* 2000;20:1–16.

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