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Studies on prevalence, co-infection and associated risk factors of hepatitis B virus (HBV) and Human immunodeficiency virus (HIV) in Benue State, Nigeria

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Abstract: The Benue State of Nigeria is one of the regions in sub-Saharan Africa facing rising morbidity and mortality, among adult individuals, from HIV/AIDS and other sexually transmitted diseases. This study was to determine the prevalence of HBV and HIV singly and concomitantly and to determine the influence of some risk factors on the spread of HBV and HIV in some study groups in Benue State. A total of 1535 serum samples was drawn randomly from consented volunteered participants and analyzed by ELISA for HBsAg. Antibodies to HIV 1 and 2 were detected in sera using Determine and HIV1/2 Stat Pak test strips. One hundred and eighty four (12.0%) had HBV current infection, 244 (15.9%) had HIV but 42 (2.7%) had both HBV and HIV infections. The two infections were strongly associated with each other (P=0.006) and each infection had a significant relationship with the groups studied (P=0.001 and P=0.000 for HBV and HIV respectively). Our study identifies the drivers of HIV infection in Benue State to include, being a divorcee/having a separated marriage (P=0.000), Alcoholism (P=0.007), smoking (P=0.000), blood transfusion (P=0.000) or surgery (P=0.001). Awareness of the occurrence of HIV infection was inversely associated (P=0.000) with the prevalence of HIV infection in the study area. Hence, there is need to upgrade the status of medical facilities especially in rural hospitals as well as the personnel towards safer blood transfusions. In addition, programmes targeting behavioural change should not be restricted to major town but should reach the hinterlands.

Keywords: HBV, HIV, Co-Infections, Risk Factors, Benue State, Nigeria

1. Introduction

Chronic hepatitis B caused by hepatitis B virus (HBV) is the leading cause of chronic liver disease and liver cancer, the third most common cause of death in countries with high HBV endemicity [1].

In 1999 newly infected persons with Human immunodeficiency virus (HIV), the causative agent of Acquired immune deficiency syndrome (AIDS) was 5.4 million worldwide; an estimated rate of 11 persons per minute or 15,000 new infections per day [2]. HIV and HBV co-infections have been reported and co-infected individuals are 17 times more likely to die than those with hepatitis B alone [3]. Reports have shown that HBVx protein accelerates ongoing HIV-1 replication [4], while HIV decreases the rate of HBsAg clearance in acute infection and enhances the progression of liver disease in those with chronic hepatitis B [5]. National HIV sentinel surveys from 1999 have consistently documented Benue State (Nigeria) with higher HIV prevalence than other states for example; 16.8% in 1999, 13.5% in 2001, 10.0% in 2005, 10.6% in 2008 and 12.7% in 2010 [6]. But no sentinel data on HBV infections are available

in Nigeria. Absence of sentinel survey notwithstanding, high HBV prevalence of 11.0%, 20.0% and 39.0% have variously been reported by workers/investigators in Benue State [7, 8, 9]. Invariably, HBV/HIV co-infections would be expected in Benue State. Several researches focused on prevalence of HBV in HIV positive subjects in Nigeria [10, 11, 12, 13], but there are few studies on HBV/HIV in the general population. There are also divergent views on the risk factors associated with these infections in Nigeria. However, low levels of literacy, cultural practices including polygamy, poverty and lack of access to appropriate reproductive health services as well as nonchalant attitudes to HIV infection have been pointed out as definite risk factors [14]. To others lack of sincerity, poor funds administration, unclear motives and lax attitudes of government official toward national health issues has indirectly fuelled the spread of the infection. Therefore, given the high prevalence of HIV in Benue State, careful look should be taken into the factors that influence the spread of HIV and progression of the infection to full blown AIDS as well as the spread of the sister viral infection, HBV, in Benue communities. This is necessary as the liaison of the two viral infections may result in increase in severity of both and accelerated fatal outcome.

When a pregnant woman is infected with HIV and HBV concomitantly, there are chances that the foetus would be horizontally infected [15]. And the likelihood that newly infected persons will develop chronic HBV infections is dependent on their age at the time of infection [16]. Hence, more than 90 percent of infected infants, 25 – 50 percent of infected children of 1-5 years of age, and 6-10 percent of acutely infected older children and adults are known to develop chronic infection [16]

Furthermore, there is a high prevalence of health conditions requiring blood transfusion in many parts of sub-Saharan Africa. Many endemic diseases, such as malaria, that result in anemia or reduction in haemoglobin levels, fatal automobile accidents, surgical and obstetric emergencies that necessitate blood transfusion as well as malnutrition are all rampant in the region. Thus, there is always high demand for blood, a situation that epidemiologically increases chances of transmission of HBV and or HIV through contaminated blood. This view is aptly supported by reports that a significant proportion of the world's blood supply, particularly in the developing countries, is either unscreened or poorly screened [17]. Hence, blood transfusion accounts for 5-10% of HBV/HIV transmission in sub-Saharan Africa [18]; and 12.5% of blood-transfused patients are reported to be at risk of post-transfusion hepatitis [19].

Protection of health care workers in the developing countries – where even the basics of medical care are difficult to provide and where the protection of health care workers does not appear on any list of health care priorities [20] – is another formidable challenge. Although, the prevalence of blood borne pathogens in many developing countries is high, there is paucity of documentation of infections contracted through occupational exposure in these countries. Only 4% of the reported cases of occupationally acquired HIV infections worldwide come from sub-Saharan Africa [20].

Consequently, this study was aimed at determining the prevalence of HBV and HIV singly and concomitantly; and to determine the significant influence of some already reported risk factors on the spread of the two viruses among the study groups in Benue State, Nigeria.

2. Materials and Methods

2.1. Study Area

The study covers the three Geopolitical Districts of the State (out of which two Local Government Areas (LGAs) were selected in each: Benue North East Senatorial District (Katsina- Ala and Vandekya LGAs); Benue North West Senatorial District(Makurdi and Gwer West LGAs) and Benue South Senatorial district(Oju and Otukpo LGAs). The senatorial districts are here designated as Zones A, B and C, respectively.

Benue State is situated between longitude 7°40' and 10°00' E, latitude 6°30' and 8°24' N. Its population stands at 4,253,641 by the 2006 population census figures [21], with a land mass of 31,400sq kilometres.

Inhabitants are predominantly farmers, with few civil servants and traders and as it is with most areas in Nigeria, they engaged in subsistent farming and are low income earners. The literacy rate in the area remains low; and the dominant ethnic nationalities are Tiv and Idoma. While the Tiv live in scattered habitations, the Idoma and less populous Igede people live in compounds in clustered patterns [22].

2.2. Sample Size

In order to allow for valid analyses and to provide the desired level of accuracy in estimates of proportions, the sample size was determined using the formula;

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

Where;

n = the desired sample size

z = the standard normal deviate =1.96(95% confidence level)

p= proportion in the target population estimated to have a particular characteristic = 50% (0.50)

q = 1.0 – p

d = degree of accuracy desired, set at 0.05

n=384.

Sample size = 1535

2.3. Ethical Clearance

Ethical clearance was sought and obtained from Benue state Ministry of Health and Human Services Makurdi.

Counseling was carried out with the help of professional medical health practitioners. Information was obtained from the subjects/participants through administration of questionnaires in English for the educated or local dialect for

the illiterate rural dwellers as well as through personal interviews and small group discussions.

For reasons of privacy, all data were kept confidential in accordance with World Medical Association (WMA) declaration of Helsinki [23].

All participants voluntarily signed consent forms either in own handwriting or with thumb prints as proof of willingness to provide samples for the tests. Responses to structured questionnaire administered in English or local dialects were used to collect data on epidemiology, demographic trends and causes of vulnerability for both HIV and HBV.

2.4. Study design, Sampling Technique and Specimen Collection

A cross sectional study design was adopted for the study. Population groups such as pregnant women, blood donors, Health care workers and automobile accident victims were easily identified and more accessible in the hospital and were randomly sampled from hospitals in the different sampling locations, while sex workers were recruited by community based selection involving one on one discussion. Sample collection and analysis were carried out between January, 2011 and June, 2013.

After counselling, 4-5 ml of venous blood was aseptically collected from each of the 1535 participant by venepuncture from the cubical fossa into a vacutainer using a standard procedure by trained medical personnel. The blood was allowed to clot and centrifuged at 1000g for ten minutes to separate. Serum was extracted using Pasteur pipettes and was stored in cryogenic vials at -17^{o}c if serum was not to be used immediately. Sera/whole blood collected from locations with epileptic power supply was transported to the assay laboratory in ice packed containers.

2.5. Assay of Blood Samples for HBsAg

All Sera were assayed for Hepatitis B surface antigen (HBsAg) and Human immunodeficiency virus (HIV) antibodies.

HBsAg in serum was detected using a direct antigen-antibody – antigen 'Sandwich' ELISA method. The commercial kits were obtained from Diagnostic Automation/Cortez diagnostic Inc. U.S.A. The kits consisted of a 96-well polystyrene titer-plate, each well pre-coated with monoclonal antibodies specific for HBsAg. For the test proper approximately 50µl of the patient's serum sample was added to the microwell together with antibody horseradish peroxidase conjugate (HRP conjugate). The experiment was incubated for 60min at 37^{o}C in a microwell incubator (Model: STAT FAX 2200, Awareness Technology Inc, USA).

After incubation, the microwells were washed 5 times with an automatic plate washer (Model: STAT FAX 2600, Awareness Technology, USA) to remove excess sample and unbound HRP-conjugate. About 50µl Chromogen solution A containing tetramethylbenzidine (TMB) and 50µl urea peroxide (Chromogen solution B) were added into the wells. After further incubation for 15 min at 37^{o}C, blue colour developed and the reaction was stopped by adding sulphuric acid solution, also provided with the kit. The blue colour turned yellow after stopping the reaction with surphuric acid. The colour intensity or optical density (OD) was measured using double filters at 450 and 630nm with the automated microplate ELISA reader (Model: Stat Fax 2100, Awareness Technology Inc, USA). The absorbance was measured and interpreted to be a measure of the amount of antigen captured in the wells or contained in the sample. Wells that contained negative antigen or controls remained colourless. The cut-off for each batch was calculated using the mean optical densities (OD) of the negative control in accordance with the manufacturer's instruction. This cut-off value was then used to calculate the activity index for each sample by dividing the mean OD of each sample with the cut-off value. Samples with the activity index values higher or equal to those of positive control were considered positive, while those with values below were reported as negative.

Determine HIV1/2 test strips (Inverness Medical, Japan) and HIV 1/2 stat pak (Combio Dignostic systems, USA) were used for the detection of HIV 1 and 2 specific antibodies in the serum. All assays were carried out in the ELISA room of the Department of Biological Sciences Laboratories, Benue State University Makurdi, Nigeria.

2.6. Statistical Analysis

Data generated were entered into a computer software; Statistical Package for Social Sciences (IBM SPSS version 20.0). Differences in proportions among the different subgroups and other categorical variables were compared using Chi square χ^2 test. Probability values (P values) less than or equal to 0.05 were considered significant.

3. Results

A total of 1535 subjects participated in the study, 477 (31.1%) were males while 1058 (68.9%) were females (Mean age 29.2, Age SD 10.3, Range 1 – 78years). HBV positivity was recorded in 184 (12.0%) and HIV was found in 244 (15.9%) subjects. Forty two (2.7%) had both HBV and HIV infection which also indicates 17.2% HBV prevalence in HIV positive subjects. HBV prevalence in HIV was higher in automobile accident victims (34.4%) followed by sex workers (21.2%) and the two viral infections were significantly associated with each other (P=0.006). The distribution of HBV and HIV infections among the study groups (Table 1) showed lower HBV (7.5%) and HIV (10.3%) infection rates in antenatal women, while higher rates of 16.9% and 33.8% were recorded among Sex workers for HBV and HIV, respectively. There were significant relationships between these infections and subject groups studied (P=0.001and P=0.000 for HBV and HIV).

Table 1. *Sero-prevalence of HBsAg and HIV among Sample Groups in Benue State, Nigeria, 2013*

Subject Type	Number Tested	HBV^+ (%)	HBV/HIV (%)	HIV^+ (%)	HBV in HIV (%)
Antenatal Women	507	38 (7.5)	5(1.0)	52 (10.3)	5(9.6)
HCW	255	27 (10.6)	6(2.4)	43 (16.9)	6(14.0)
Blood Donors	216	33 (15.3)	3(1.4)	27 (12.5)	3(11.1)
Sex Workers	154	26 (16.9)	11(7.1)	52 (33.8)	11(21.2)
Accident Victims	260	42 (16.2)	11(4.2)	34 (13.1)	11(34.4)
Patents	143	18 (12.6)	6(4.2)	36 (25.2)	6(16.7)
Total	1535	184 (12.0)	42(2.7)	244 (15.9)	42(17.2)

Among the Senatorial Districts covered in the study (Table 2), HBV was significantly (P=0.013) higher in Zone C (16.1%) while HIV was significantly (P=0.000) higher in zone A and B with 18.3%, respectively.

Table 2. *Distribution HBV and HIV infections among the Three Senatorial Districts of Benue State, Nigeria, 2013*

Senatorial District	Number Tested	HBV^+ (%)	HIV^+ (%)
Zone A	301	39 (13.0)	55 (18.3)
Zone B	892	90 (10.1)	163 (18.3)
Zone C	342	55 (16.1)	26 (7.6)
Total	1535	184 (12.0)	244 (15.9)

A significant distribution of HBV (P=0.000) and HIV (P=0.000) was found among the different LGAs studied (Table 3). Highest HBV prevalence was recorded in Oju LGA (21.1%) but HIV was highest in Gwer west (45.3%) followed by Katsina Ala LGA with 23.8%.

Table 3. *Sero-prevalence of HBV and HIV infections among the Studied Local Government Areas in Benue State, Nigeria, 2013*

LGA	Number Tested	HBV^+ (%)	HIV^+ (%)
Katsina- Ala	160	2(13.8)2	38 (23.8)
Vandekya	141	17 (12.1)	17 (12.1)
Makurdi	754	67 (8.9)	101 (13.4)
Gwer West	137	22 (16.1)	62 (45.3)
Oju	171	36 (21.1)	11 (6.4)
Otukpo	172	20 (11.6)	15 (8.7)
Total	1535	184 (12.0)	244 (15.9)

Table 4. *Comparison of HBV and HIV infections between Makurdi Antenatal Attendee and Other Subjects in Benue State, 2013*

Subjects	Number Tested	HBV^+ (%)	HIV^+ (%)
Antenatal Women	507	38 (7.5)	52 (10.3)
Other Women	549	75 (13.7)	120 (21.9)
Men	479	71 (14.8)	72 (15.0)
Total	1535	184 (12.0)	244 (15.9)

Comparatively, HIV infection was significantly higher (P=0.000) in women other than the antenatal women and men but HBV infection was significantly higher (P=0.001) in men than in women (Table 4).

Over all, HBV was higher (P>0.05) in males (14.3%) than females (11.0%) while HIV was higher (P>0.05) in females (16.5%) than 14.5% in males.

Though no difference (P=0.479) was found between HBV infection rates among the different age categories (Table 5), higher prevalence was observed in subjects less than 13 years old (16.7%) but no evidence of infection in subjects aged 60 years and above. HIV infection on the other hand was significantly higher (P=0.000) among subjects 30 – 39 years of age (21.8%) but no serological evidence of HIV infection among subjects ≤12 years of age was found.

Table 5. *Age Distribution of HBV and HIV infection in Benue State, 2013*

Age	Number Tested	HBV^+ (%)	HIV^+ (%)
≤ 12	12	2 (16.7)	0 (0.0)
13 – 19	125	14 (11.2)	8 (6.4)
20 – 29	828	104 (12.6)	128 (15.5)
30 – 39	344	37 (10.8)	75 (21.8)
40 – 49	119	17 (14.3)	23 (19.3)
50 – 59	79	10 (12.7)	5 (6.3)
≥ 60	28	0 (0.0)	5 (17.9)
Total	1535	184 (12.0)	244 (15.9)

High HBV (15.1%) and HIV (23.1%) infections were observed among farmers in this study (Table 6) but low HBV (9.3%) was found in traders, while lower HIV infection was recorded in House wives (11.3%). There was no association (P=0.660) between HBV infection and occupation but a significant association (P=0.017) was found between HIV infection and the occupations of the studied subjects.

Sero-prevalence of 15.7% for HBV recorded in divorcee/separated was closely followed (P=0.183) with 14. 3% for both widows and single subjects while HIV was significantly higher (P=0.000) among divorced/separated (43.1%) and was followed by widows with 26.8% (Table 7).

Table 6. *Distribution of HBsAg and HIV in Benue State, Nigeria According to Occupation, 2013*

Occupation	Number Tested	HBV^+ (%)	HIV^+ (%)
Civil servants	145	18 (12.4)	24 (16.6)
Public servant	322	40 (12.4)	57 (17.7)
Farmers	186	28(15.1)	43 (23.1)
Traders	236	22 (9.3)	40 (16.9)
Vocational Skills	115	13 (11.3)	18 (15.7)
Students/Applicants	345	44 (12.8)	41 (11.9)
House wives	186	19 (10.2)	21 (11.3)
Total	1535	184 (12.0)	244 (15.9)

Table 7. *Distribution of HBsAg and HIV in Benue State, Nigeria, 2013 according to Marital Status*

Marital Status	Number Tested	HBV^+ (%)	HIV^+ (%)
Married	979	104 (10.6)	141 (14.4)
Single	449	64 (14.3)	66 (14.7)
Divorced/Separated	51	8 (15.7)	22 (43.1)
Widow	56	8 (14.3)	15 (26.8)
Total	1535	184 (12.0)	244 (15.9)

No significant relationship was observed between HBV or HIV and literacy in this study (P=0.186). All the same, high HBV prevalence was recorded in those with no formal education (15.1%), followed by those with secondary education (13.2%). High HIV infection rate on the other hand, was found among those with primary literacy (17.4%), followed by those with no formal education with 16.0% (Table 8).

Table 8. *Distribution of HBsAg and HIV Sero-prevalence According to Literacy Levels in Benue State, Nigeria, 2013*

Education	Number Tested	HBV^+ (%)	HIV^+ (%)
Non formal	106	16 (15.1)	17 (16.0)
Quranic	10	0 (0.0)	0 (0.0)
Primary	219	18 (8.2)	38 (17.4)
Secondary	645	85 (13.2)	102 (15.8)
Above Secondary	555	65 (11.7)	87 15.7)
Total	1535	184 (12.0)	244 (15.9)

Table 9. *Questionnaire Responses to History of Risk Factor and HBV/HIV status for each Response group*

Risk Factor History	Responses Sought	No. of Responders (%)	No. Positive for HBV (%)	P value	No. Positive for HIV (%)	P value
Smoking	Yes	164 (10.68)	22 (13.4)	0.55	50 (30.5)	0.000**
	No	1371 (89.32)	162 (11.8)		194 (14.2)	
Alcoholism	Yes	533 (34.72)	72 (13.5)	0.181	103 (19.3)	0.007*
	No	1002 (65.28)	112 (11.2)		141 (14.1)	
Transfusion	Yes	204 (13.29)	25 (12.3)	0.899	51 (25.0)	0.000**
	No	1331 (86.71)	159 (11.9)		193 (14.4)	
Surgery	Yes	297 (19.35)	23 (7.7)	0.012*	66 (22.2)	0.001**
	No	1238 (80.65)	161 (13.0)		178 (14.4)	
Infection awareness	Yes	996 (64.89)	126 (12.7)	0.227	177 (17.8)	0.006*
	No	539 (35.11)	58 (10.8)		67 (12.4)	
Vaccination[1]	Yes	345 (22.48)	34 (9.9)	0.166	NA	-
	No	1190 (77.52)	150 (12.6)		NA	
Abdominal pains	Yes	392 (25.54)	48 (12.2)	0.855	81 (20.7)	0.003*
	No	1143 (74.46)	136 (11.9)		163 (14.3)	
Peptic Ulcer	Yes	380 (24.76)	40 (10.5)	0.312	81 (21-3)	0.001**
	No	1155 (75.24)	144 (12.5)		163 (14.1)	

[1]History of vaccination was applicable to HBV only , NA = Not applicable, *Significant, ** Highly significant

Possible impacts of several risk factors on spread of HBV and HIV infections in Benue State were evaluated with a combination of questionnaire responses and laboratory screening of the responders for both infections.

Although higher HBV prevalence was observed in Smokers, Alcoholics, those with history of transfusion and those that accepted being aware of HBV infection, the differences observed were not statistically significant (P>0.05). Similarly, HBV infection was not significantly different between those that had abdominal pains at the upper right quadrant and those that had not. HBV infection was higher in those that claimed not having stomach/peptic ulcer (P>0.05). Conversely, smoking (P=0.000), Alcoholism (P=0.007), previous blood transfusion (P=0.000), surgery (P=0.001) were observed to be strongly associated with higher HIV prevalence in the study area. Furthermore, affirmative responders to awareness of the occurrence of HIV infection significantly had higher HIV infection than those that were not (P=0.006), while Persistent complaint of abdominal pains as well as claims of stomach/peptic ulcer were significantly associated with HIV positivity (P=0.003 and P=0.001 respectively) as shown in Tables 9.

4. Discussion

The overall prevalence of 12.0% and 15.9% for HBV and HIV respectively observed in this study suggest that the two viral infections are endemic in Benue State. HIV prevalence of 10.3%, 12.5% and 13.1% recorded among antenatal attendees, prospective blood donors and automobile accident victims, respectively, are similar to the 12.7% in the national sentinel survey report for Benue State in 2010. These groups were considered in this study as low risk groups that could give a better reflection of the diseases burden in the Benue community. On the other hand, Health care workers, sex workers and patients with HIV prevalence of 16.9%, 33.8% and 25.2% respectively were the high risk groups, thus, explaining the significantly high prevalence recorded among these groups over and above 12.7% national report for Benue state [6]. The total prevalence of HIV (15.9%) in this study is also higher than national sentinel survey figures for Benue in 2005(10.0%), 2008 (10.6%) and 2010 (12.7%), consecutively. Hence, a combination of both the low risk and high risk groups' assessment for prevalence of these viruses should be employed to actualized the total in a society with diverse risk

groups like Benue State.

Higher HIV prevalence of 27.5% has been reported [24] in Abwa, a rural community in Benue state.

Conversely, HBV prevalence in this study was higher among the groups that were considered low risk such as blood donors (15.3%) and accident victims (16.2%) but was lower in HCW (10.6%) and patients (12.6%). This is because HBV infection is apparently an unknown disease due to the invisibility of the chronic form of the disease [25] and as such can silently bear heavy burden on groups that are not closely monitored. The significantly low HBV prevalence of 7.5% recorded in closely monitored antenatal attendees in this study further illustrate this fact.

HBV/HIV concomitant infection of 2.7% reported in this study implies that for every 37 persons among the studied subjects, at least one had both HBV and HIV infections or for every 6 HIV positive individuals, one had HBV or for each 4 HBV positive subjects one was positive for HIV infection. Therefore, a significant association (P=0.006) found between the HBV and HIV explains their similar modes of transmission and associated risk factors. The 2.7% concomitant infection in this study is high but is similar to 2.7% reported among prison inmates in Nasarawa state, Nigeria [26]; and it is higher than 0.3%, 0.5% and 1.14% reported in Ibadan [27], Yenegoa [28] and Ebonyi state [29], respectively. Low co-infection reported by these authors also reflects the low HBV and HIV prevalence in their study area which reflects the regional distribution of HIV infection reported by FMOH, [6] with Ebonyi state and Oyo state having an HIV prevalence of 3.3% and 3.0%, respectively.

High prevalence of HBV (16.2%) and HBV cum HIV (34.4%) among automobile accident victims in this report could pose high risk on health care workers and others that may be of assistance in safe guarding the lives of these victims. Though HIV and HBV are reported to have similar modes of transmission and associated risk factors [30], our study reveals that high HIV does not necessarily connote high HBV prevalence (Table 2). While HBV was significantly higher (P=0.013) in Zone C, HIV was significantly higher (P=0.000) in Zones A and B. This has also being confirmed comparing our findings with those of Chinedu *et al*. [29] in which HIV (7.43%) was lower than the 15.9%, in this study but their HBV result of 13.425% is higher than 12.0% recorded in this study. Probably, the difference in HBV distribution observed between the Senatorial Districts may have a genetic explanation. Blumberg [31] reported that individuals homozygous for t allele at the vitamin D receptor locus (VDR) are more likely to become carriers of HBV. Farnik [32] also associated higher levels of HBVDNA with low level of 25-hydroxylvitamin D (25OHD). Tumour necrosis factor (TNF) is a cytokine that has many roles, including the control of inflammation and the stimulation of the proliferation and destruction of cancer cells and was also shown [31] to have several polymorphic sites related to susceptibility to HBV chronicity. Therefore, the significant difference in HBV distribution between the Senatorial Districts in this report needs to be further investigated.

Highest HIV rate as shown in Table 3, recorded in Gwer West LGA was driven by high HIV prevalence in sex workers (63.9%), HCW (61.0%) and blood donors (42.9%). In Katsina-Ala LGA, high HIV rate was influenced by sex workers (47.2%) and accident victims. On the other hand, highest HBV reported in Oju LGA was influenced by the high prevalence recorded among accident victims (28.3%), blood donors (25.0%) and sex workers (25.0%) in the LGA. High HBV and HIV reported among HCW in Gwer West LGA were mostly associated with students on training than the permanent workers. This calls for a proper review of the medical facilities of the hospitals in the area as well as more orientation through conferences and workshops in the area on safety procedures on handling infectious agents. Blood donations for transfusion in most part of Nigeria are done by volunteered family relations when emergencies arise. All the same, thorough screening of such donated blood should be carried out so as to reduce this high transmission of blood borne pathogens in Benue State.

Awareness campaigns and routine monitoring of HIV and HBV infections are better carried out among pregnant women because they are sexually active and constitute an easily identifiable and accessible single population. This must have contributed to the significantly low (P=0.001) HBV and HIV (P=0.000) prevalence among pregnant women compared to men and other women in our study. Similar low HBV prevalence in pregnant women has been reported across Nigeria. HBV prevalence of 6.67% and 6.5% has been reported in Keffi [33] and in Minna [34], North central Nigeria. In Lagos, South western Nigeria, 6.8% have been reported [35] while 7.95 and 8.2% were recorded in North Eastern Nigeria [36, 37]. Similarly, 8.3% was reported [38] in Nnewi, south eastern Nigeria and 4.1% in Yenegoa, south Southern Nigeria [28].

Highest HBV rate of 16.7% coupled with no HIV infection that was found in children below 13 years indicates other transmission modes rather than sexual transmission but significant(P=0.000) higher HIV prevalence among subjects within the age of 20- 49 years could be attributed to their sexual active nature.

National (Nigeria) Agency for the control of AIDS (NACA) [39] identified the drivers of HIV/AIDS in Nigeria to include, high illiteracy, high rates of sexually transmitted diseases, poverty, low condom use and lack of perceived personal risk for HIV/AIDS. Though HBV and HIV rates in this study show no significant relationship with literacy, significantly higher HBV and HIV infections among farmers that are less literate than the other occupations in our study is consistent with NACA's findings. Similar findings were reported in Makurdi, Benue State, Nigeria, where a significant relationship was found between HBV infection and occupation (P=0.000), literacy (p=0.000) with farmers (75.0%) and the illiterates (84.6%) being the most infected hospital patients [9]. Similar association between HBV and occupation has been reported [38] among pregnant women in Nnewi, Nigeria.

Though no association was found between HBV infection and the risk factors, our study identifies the indirect determinants of HIV infection in Benue State to include, being

a divorcee or having a separated marriage as well as widowhood (P=0.001), being a smoker (P=0.000), Alcoholics (p=0.007), transfusion (P=0.000) or having a surgical operation (p=0.001). Significantly higher HIV prevalence (P=0.006) recorded among subjects that were already aware of the occurrence and effects of HIV in Benue state is an indication of lack of perceived personal risk for HIV as earlier reported [39].

HIV prevalence of 43.1% recorded among divorcee/separated in this study, is lower than 60.0% reported [24] among the divorcees in a rural community in Benue State. Amuta *et al*. [9] reported significantly higher (P=0.000) HBV infection in divorcees followed by widows. However, higher HBV infection among the married (P=0.001) compared to the singles/divorced have been reported in kogi state, Nigeria [40]. High prevalence of these viruses among divorcee/separated may be due to absence of family cover, which could shield or restrain them from multiplicity of sexual partners, sex for favour, sexual assaults and unusual freedom [24].

Strong association observed between alcoholic consumption and HIV infection in this study has also been reported [26] among prison inmates in Nasarawa, Nigeria. But the significant association between HIV and blood transfusion in this study has been refuted in Adoga's study. This is because our subjects were not confined and had the liberty to visit any hospital of their choice but inmates are confined and are always taken to Government standard hospitals for medical care and as such may have lower chance of encountering unscreened blood transfusions. No association between HBV and blood transfusion as well as alcoholism recorded in this study was earlier reported among pregnant women in Makurdi [7]. However, a significant association between HBV and blood transfusion has been reported among patients in Kogi state [40].

In this study, persistent complaint of abdominal pains both at upper and lower region as well as undiagnosed claims of stomach and peptic ulcers were not associated with HBV but were significantly ($P<0.05$ and P=0.001) associated with HIV infection. This finding could be of importance to clinicians as early clinical markers of HIV infection.

Conclusively, HBV and HIV infections are endemic in Benue State, Nigeria. Hence, there is need to upgrade the status of primary health centres so as to improve health care and safer blood transfusions. Awareness campaigns should also be stepped up.

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