Screening for Hepatitis B Virus among HIV Infected Women Seeking for Antiretroviral Therapy at National Institute for Pharmaceutical Research and Development, Abuja, Nigeria

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Original Research Article

ABSTRACT

Background: Hepatitis B virus (HBV) infection is endemic and well documented in different locations of Nigeria among different sub-groups. Information regarding the prevalence of HBV in HIV infected women is scarce especially in Abuja, the capital city of Nigeria.

Aim: This study aimed at determining the prevalence of Hepatitis B surface antigen (HBsAg) among HIV infected women seeking for antiretroviral therapy (ART) at the National Institute for Pharmaceutical Research and Development (NIPRD), Abuja, Nigeria.

Materials and Methods: A health facility-based cross-sectional study was carried out in our laboratory from May, 2017 to March, 2019 among 1,386 recruited HIV infected women that were screened for HBsAg. Positive samples were confirmed using ELISA. Their socio-demographic data were collected using a questionnaire and written informed consent was obtained prior to study. Data were analyzed using frequency distribution table and SPSS (version 20.0).

Results: Out of the 1,386 HIV infected women tested, 114 were seropositive for HBV infection giving an infection prevalence of 8.2%. The highest prevalence (2.2%) was observed at age group 25 – 29 years and followed by (1.7%) at age groups of 20 – 24 and 35 – 39 years.

Conclusion: This finding confirms high endemic of HBV infection. We recommend that HIV infected women should be routinely screened for HBV as part of ART commencement requirement.

Keywords: Cross-sectional; prevalence; hepatitis B virus; antiretroviral therapy; questionnaire; Nigeria.

1. INTRODUCTION

The national prevalence of HIV was estimated to be 1.8% in 1991 to 4.5% in 1996, 5.8% in 2001, 5.0% in 2003 and 4.4% in 2005. However, the national prevalence seemed to stabilize between 2005 and 2010 as shown by the reported prevalence 4.4% (2005), 4.6% (2008), and 4.1%

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(2010), which ranged from 1.0% in Kebbi State to 12.7% in Benue State [1]. Based on the overall national prevalence of 4.1% obtained in 2010, it is estimated that 3.1million people in Nigeria are living with HIV and AIDS in 2010 and about 1.5 million require antiretroviral drugs (ARDs) [2]. The national prevalence was further reduced in 2014 to 3.0% and in 2019 to 1.4% which implied that over 3.4 million Nigerians are currently infected with the virus and about 2.5 million needs ART in 2014 [3, 43].

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Hepatitis B virus (HBV) infection primarily affects the liver. It is transmitted through sexual intercourse, newborns of infected mothers during mother to child transmission, breastfeeding and through the placenta during childbirth, and also by exchange of saliva or other mucosal fluids during kissing with an infected person [4]. The virus is an enveloped DNA virus that infects the human liver that causes inflammation, hepatocellular necrosis and other liver challenges. Potentially, this virus is seen as life-threatening cause of liver diseases worldwide that can either be acute or chronic and it may range from symptomless infection or mild disease to symptomatic or greatly fulminant inflammation [5]. The acute or chronic viral hepatitis B infection is usually a self-limiting disease known to cause hepatocellular necrosis and mild inflammation with a case mortality rate between 0.5 to 1% [6].

Some studies depict increasing access to ART and therefore burden of viral hepatitis infection in resource limited settings is expected to raise as is now the case in Europe and North America [7,8]. It is therefore, of great importance to addressed issues relating viral hepatitis challenge that may hinder the success of ART programs in developing countries [8]. Understanding the prevalence and disease characteristics of HBV coinfection with HIV is thus significant [9]. Guidelines for the clinical management of HIV patients recommends screening for viral hepatitis but unfortunately this is not a standard practice in Nigeria, as it is not included in the recommended package of baseline commencement laboratory tests.

In 2018, World Health Organization (WHO) reported an estimated 257million people were living with HBV infection (as defined by hepatitis B surface antigen reactive) [10]. In the developed countries, chronic HBV co-infection are found among estimated 30% of HIV-positive persons, with only non or approximately 1% being co-infected with HIV and HBV [11]. Some studies carried out across the country Nigeria has showed great difference in prevalence rates of HIV/HBV co-infection from 9.2% to as high as 70.5% [12,13,14,15]. The seroprevalence of HBV infection is very high in the developing countries of sub-Saharan Africa and South East Asia where about 8 - 10% are chronic infectious carriers; and these same geographic regions have over two-thirds of the worldwide HIV burden [16,17].

HBV infections occur more frequently among HIV infected patients due to the shared routes of transmission and further worsens the outcome for the mother and the infant with a more rapid clinical and immunological progression [18,19]. Although, most perinatal and horizontal transmission of HBV occur in areas of greater endemicity as most infections are acquired in the first 5 years of life around Asia and Africa geographic regions [20]. It is estimated that 25% of infected children will die of HBV related chronic liver disease in adulthood [21].

The clinical presentation of non-specificity and the chronic course makes the early diagnosis of HBV difficult [20,21]. Thus, there may be a silent or latent epidemic of HBV among women Living with HIV/AIDS which still remains unclear and thereby no intervention plan to scrub such menace.

Although different studies on prevalence of HBV infection in Nigeria have been previously carried out in different part of the country, there is paucity of published data on the prevalence of hepatitis B virus amongst HIV infected women in Abuja, the capital city of Nigeria. Therefore, it is of great significant to investigate the proportion and frequency of HBV co-infection among HIV infected women attending care at National Institute for Pharmaceutical Research and Development (NIPRD) Abuja in order to understand and develop profound interventions aimed at management, preventing, care and treatment in view of its growing public health importance. Thereby, providing a window of opportunity for patient education and behavioral modification by counselling and improved management of HBV co-infection in HIV infected women to achieve better outcome and ART usages. Hence, this study investigated on the prevalence of HBV among HIV infected women in Abuja commencing care and management on ART.

2. MATERIALS AND METHODS

2.1 Study Area and Design

The cross-sectional study was carried out at the NIPRD Abuja from May 2017 to March 2019 among HIV infected women on their first visit to our health facility seeking for antiretroviral therapy (ART) commencement.

Abuja is the Federal Capital City of Nigeria. The city is lying between latitude 8.25^{o}N and 9.20^{o}E of the equator and longitude 6^{o} 45$^{'}$ N and 7^{o} 39$^{'}$ E and located at the centre of the country with an area of approximately 7,315 km², of which the actual city occupies 275.3 km^{2}. It is found in the Savannah area with moderate climatic weather conditions. The capital city is located at the north of the confluence of the River Niger and Benue River [22].

The NIPRD, Abuja is one of the HIV care and treatment centre, highest medical research and referral institution in Nigeria charged with the responsibility to conduct research into disease of public health significant. Although, with the Federal Government of Nigeria programme in 2002 on ART commencement, care and treatment; the facility was selected principally to provide the research backup and referral centre serving a large population in the heart of Abuja and its environs for the national HIV programme implementations. Presently, the facility provides free comprehensive care, treatment and support for over 6,646 HIV patients. Patients are recruited into the HIV treatment programme following HIV confirmations or a referral from the HIV Counseling and Testing Centre (HCT), Virology laboratory of NIPRD, Abuja or transfer from other government recognized HIV treatment centres in the country.

2.2 Study Populations

The study populations included all HIV infected women seeking to commence ART treatment, who agreed and signed an informed consent to participate in the study. A total of 1, 386 HIV infected women were recruited in our laboratory, Human Virology unit of Microbiology and Biotechnology Department, NIPRD, Abuja for the study.

2.3 Selection Criteria

2.3.1 Inclusion criterion

HIV infected women seeking for ART commencement in NIPRD facility during the period of data collection (May 2017 to March 2019) and consented to participate in the study were included.

2.3.2 Exclusion criterion

HIV infected women who did not consent to participate in the study were excluded.

2.4 Research Questionnaire

A well-researched structured self-administered questionnaire was developed to collect baseline socio-demographic characteristics of all patients who consented. The questionnaire was pre-tested on a total of 25 HIV infected woman in our health facility. The necessary modification and corrections made following the pre-test results.

The socio-demographic variants include age, present place of stay, educational status, occupational status, marital status, ever tested for HBV, history of previous blood transfusion, alcoholism and phone numbers.

2.5 Samples Collection

A total of 1,386 blood samples were collected from HIV infected women seeking for ART commencement. About five millilitres (5mL) of venous blood were carefully drawn from the veins of each patient into a well labeled Ethylene Diethyl Tetracetic Acid (K2 EDTA) tube for CD4+ count and haematological assay as required for ART commencement baseline parameters. After the assay, the blood samples were centrifuged at 4,000 revolutions per minutes (rpm) for 10 minutes in order to obtain a clear supernatant plasma. The plasma was aliquoted into cryovials and stored in the -40^{o}C freezer until ready for serological screenings for HBV.

2.6 Serological Screening

All the plasma samples were screened for HBV infection based on the immunochromatographic technique (ICT). Serological diagnosis was carried out using Rapid diagnostic tests (RDTs), for HBV infection the SD BIOLINE (Standard Diagnostic (SD) Inc., Korea) one step HBV test kit was used for detection of HBV infection. The immunochromatographic rapid test is a qualitative detection of antibodies specific to HBV in blood with a sensitivity of 100% and specificity of 99.4%. The screening was carried out according to manufacturer's instructions found on the standard operation procedure insert.

The sero-positive samples to HBsAg detected by RDTs screening were further confirmed by another rapid ELISA which is according to manufacturer's specifications.

2.7 Data Analysis

The data were analyzed using frequency distribution Table and figure. Each entry in the Table contains the frequency or count of the occurrences of values within a particular group or interval, and in this way, the Table and figure summarizes the distribution of values in the sample or variable. Statistical package for social science SPSS (version 20.0), (Chicago, Illinois) was used in other statistical analysis. Data like patients socio-demographic characteristics was summarized using simple frequency Tables. Level of significance was determined at P value < 0.05 at 95% Confidence interval.

3. RESULTS

A total number of 1,386 HIV infected women were included in this study with age ranged from 15 to 44 years (mean age of 37.0) that came for care at NIPRD ART clinic. Out of the total number of women recruited and screened for HBV infection, 114 (8.2%) tested positive while 1,272 (91.8%) tested negative. The highest prevalence of 2.2% was observed in 25 – 29 age group, followed by 1.7% amongst age groups 20 – 24 and 35 – 39. The lowest prevalence of 0.4% was observed in 15 – 19 age group. The age group 25 - 29 years were most represented with frequency (39.8%) and also had the highest prevalence (2.2%) of HBV infection. There was no co-infection of HIV and HBV observed in this study. The age distribution and HBV results of screened study patients are shown in Fig. 1.

3.1 Socio-demographic Characteristics of the 1,386 HIV Infected Women in NIPRD, Abuja

Table 1: depicts the sociodemographic characteristics of the study participant. It was observed that the prevalence of HBV varied according to age and marital status of the women in the NIPRD ART clinic. Of the 1,386 patients, 941 (67.9%) were married, 151 (11%) were single, 42 (3%) were divorcees or separated while 252 (18.2%) were widowers. The study population were more of rural settler's patients than urban settlers (65% vs 35%). Only 11% of the subjects had no formal education. Majority of the women (50.1%) had secondary level of education and followed by primary education (23.5%). Also, majority of the women were unemployed (43.5%). The blood transfusion and alcohol consumption were only observed among 8.9% and 10.6% respectively.

4. DISCUSSION

The major objective of the study was to determine the hepatitis B prevalence rate in HIV infected women seeking care and treatment on antiretroviral drugs (ARDs) between May 2017 to March 2018, and also to evaluate the endemicity of HBV among HIV infected women in NIPRD, Abuja. The viral hepatitis infection classification of high endemicity as defined by WHO is HBsAg greater than 7% in an adult population [23]. The

Table 1. Socio-demographic characteristics of HIV infected women studied (n = 1,386) in NIPRD, Abuja

Characteristics	Frequency	Percentage (%)
Educational status		
No formal education	153	11
Primary	326	23.5
Sec. school	694	50.1
Tertiary	213	15.4
Marital status		
Single	151	10.9
Married	941	67.9
Widowed	252	18.2
Divorced	42	3
Occupational status		
Civil servant	223	16.1
Self employed	430	31
Unemployed	603	43.5
Student	130	9.4

Residence		
Rural	901	65
Urban	485	35
Blood transfusion		
Yes	123	8.9
No	1,263	91.1
Alcohol consumption		
Yes	147	10.6
No	1,239	89.4

Note: No Patients have evidence of been previously screened for HBV infection

prevalence of HBV 8.2% obtained in this study depicts that Abuja and its environs in the north central region, Nigeria is endemic to this infection.

The rapid HBAgs antibody testing for HBV infection was used in this study, which are useful and powerful tool for screening infections at the point of care and treatment. This testing easily identifies individuals infected with these viruses so as to proffer quick preventive services, additional investigations, care and treatment immediately. The screened individuals are therefore, notified of their infection results or status, allowed to make informed decisions about their health care and other alternatives for treatment. Health talks on how to take steps to limit hepatitis associated infection prognosis for example as vaccinations against HBV, alcohol consumptions and how to reduced risk of transmission to others should be stressed [24]. The sensitivity and specificity of rapid testing has been queried by some researchers [25]. However, it also remains unconfirmed whether HIV serostatus affects test effectiveness [25]. Nonetheless, other researchers [26] concluded that HBAgs rapid diagnostic test is among the most accurate assay for screening for HBV infection in HIV infected persons in a Sub-Saharan Africa setting.

Liver related diseases has continued to remains a significant modifier of health in persons infected with HIV [27]. The negative effects of HIV infection with prognosis of HBV infection are well documented with high rates of higher hepatitis viral load, viral persistence and a more rapid prognosis to liver related challenges like cancer, fibrosis and hepato-cellular carcinoma in co-infected persons [7]. Unfortunately, in the most developing countries like Nigeria. Screening for HBV is not routine at the commencement assessment of HIV positive persons. In this study, none of study patients have evidence of been previously screened for HBV infection.

The finding from this study prevalence rate of 8.2% for HBV infection among women in Abuja, is lower than prevalence rate of 11 to 20% observed by other researchers in Nigeria [28,29], Malawi [30] and Senegal [31] among HIV infected adults. This may likely reflect burden of HBV infections in the studied HIV patient

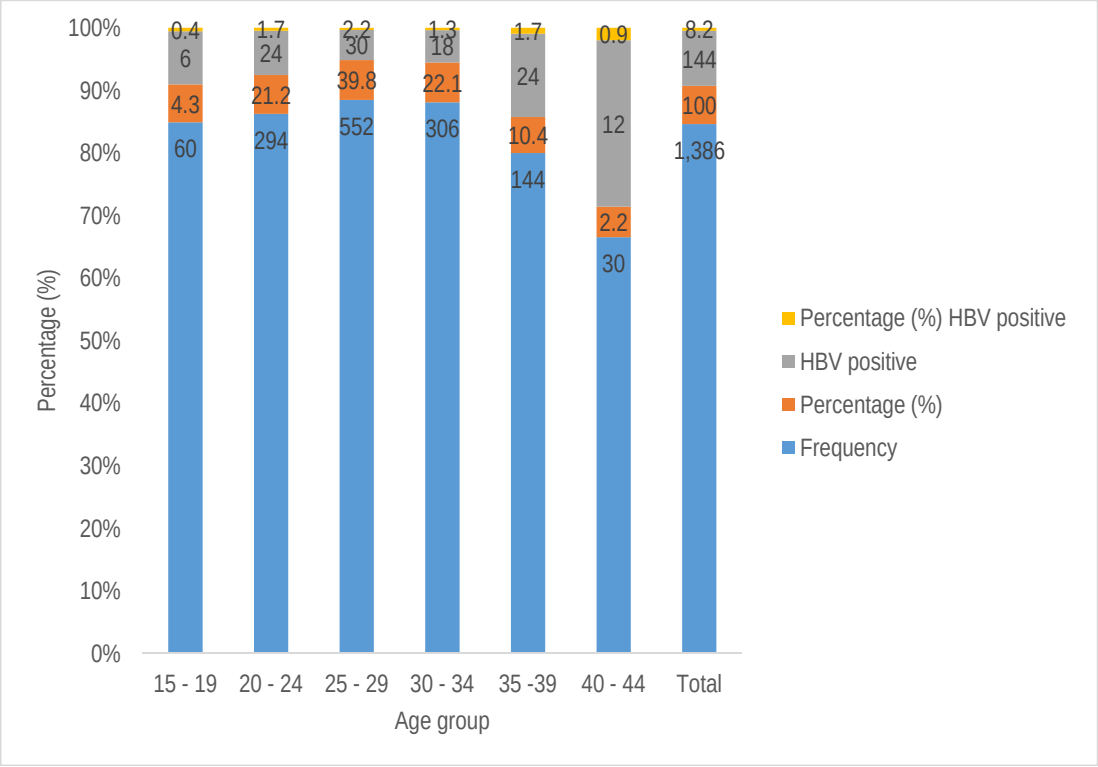

Fig. 1. Age distribution and HBV results of the study patients (n = 1,386) at NIPRD, Abuja

population. There are no recent publications or studies that have authenticated these findings. This prevalence found in this study was higher than the 2.9%, 2.5% and 1.53% observed among women in Port Harcourt, South-south Nigeria [32], Iran [33] and amongst Afghan women attending government maternity hospitals in Kabul [34] respectively. These may be due to variations in sample size and type of population studied.

This value is, however lower than the 11.0% observed by [35], among women in Makurdi, North-central Nigeria as well as than the 11.6% observed by [36] and 12.6% detected [37] among women in Maiduguri, North-eastern Nigeria, and a rural community in North-central Nigeria, respectively. The prevalence obtained in this study was also lower than the 13.8% observed by [38] among Senegalese women in Dakar. The 63.3% reported by [16] in Jos, North Central Nigeria for Nigerian women. These observed variations in the prevalence of HBV in women may be due to differences in lack of awareness, low socioeconomic conditions, an unhygienic environment, cultural practices, sexual behaviour and practices in low resource settings. The differences in the geographical distribution among the regions and variations in the test methods used to detect HBV infection as reported from literature may also cause the variations.

One of the sociodemographic characteristics considered in this study was the age of the patients. We found that the highest prevalence (2.2%) of HBV infection was observed in the 25 – 29 age group followed by the 20 − 24 and the 30 − 34 age groups. This is consistent with the highest HBV infection prevalence rate observed in the 25–29 age group in a comparable study in Ibadan, Nigeria [39], and it may be due to the fact that this age range falls within the sexually active age group and hence are more at high risk of having a sexual contact with an infected person [40]. This may affect the high prevalence of HBV infection observed in this age group. The majority of the women (50.1%) tested in study had secondary education. This may be due to the fact that where this study was carried out (NIPRD) was located in a rural area of Abuja i.e Idu, Karmo, Tashe, Gwawa, Jiwa, Zauda, Saburi, Dei- Dei etc.

Finally, there were some limitations in this study. The diagnosis and qualification of HBV co-infections were based on the detection of HBsAg antibodies by use of rapid test kit and confirmation by another rapid ELISA. None of molecular technique testing was conducted and hence, the absence of HBV RNA as described in 10 to 50% of anti HBV antibody positive persons in some related studies was not confirmed [41]. Data on some known high risk factors for acquiring hepatitis, particularly sexual history and practices, was lacking in part of data collected. The observations/findings in this study cannot be generalised as they only insight the prevalence among HIV infected women in our region as compared with studies in other parts of the country.

5. CONCLUSION

This study revealed a high prevalence of HBV infection amongst HIV infected women, which compares well with the findings reported by the World Health Organization that Nigeria have is highly endemic for viral infection. This support why the study was carried out among HIV infected women in our HIV management, care and treatment Hospital at NIPRD, Abuja, due to its paramount important to the health sector.

It is therefore, recommended that HBV screening should be part of guidelines on routine clinical investigations care services to be provided for all HIV infected women, despite reported to be HBV positive as it can influence management. Health talks and education on prevention, awareness, risk, care and management of the infection and widespread coverage of the HBV immunization of the population should be encouraged.

CONSENT

The patients were enrolled after they were sufficiently counseled on the objectives, risk and importance of the study. Written consents were obtained and all relevant confidentiality was kept throughout and after the study period.

Only the principal investigator held the results of blood samples tested. The patients were informed of their HBV test results as desired and the test results were delivered to individuals in a sealed form. The patients found positive were further counseled and linked to care in addition to the HIV treatments at the institute research clinic (NIPRD).

ETHICAL APPROVAL

Ethical clearance and approval for the study was obtained from the Institutional Review Board (IRB) of National Institute for Pharmaceutical Research and Development (NIPRD), Abuja in accordance with the code of ethics for biomedical research involving human subjects. The confidentiality, anonymity and privacy of all participants were guaranteed at all levels of this study. Written consent was given by participant.

The patients were recruited after they were sufficiently counseled on the objectives, risk and importance of the study. It is only the principal investigator held the results of blood samples tested for the virus. The patients were individually and privately informed of their HBV test results as desired and the test results were delivered in a sealed form. The patients found positive were further counseled and linked to care in addition to the HIV treatments at the institute research clinic (NIPRD).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Federal Ministry of Health. 2011 National HIV Sero-prevalence Sentinel survey, Technical report. Pp 1-53.
2. Federal Ministry of Health. 2010 National HIV Sero-prevalence Sentinel survey,Technical report. pp 5-25.
3. Federal Ministry of Health. 2015 National HIV Sero-prevalence Sentinel survey,
4. Technical Report. Pp 5-19.
5. Krajden M, McNabb G, Petric M. The laboratory diagnosis of hepatitis B virus. Can J Infect Dis Med. 2005; 16(2): 65-72.
6. Doo EC, Ghany MG. Hepatitis B virology for clinicians. Med Clin North Am. 2010; 14(3):397- 408.
7. Lavanchy D. Hepatitis B virus epidemiology, disease burden, treatment, and current andemerging prevention and control measures. J Viral Hepat. 2004;11(2): 97-107.
8. Milazzo L, Antinori S. Hepatitis virus and HIV interactions. Lancet Infect Dis. 2014;
9. 14(11): 1025-1027.
10. Xie J, Han Y, Qiu Z. Prevalence of hepatitis B and C viruses in HIV-positive patients inChina: a cross-sectional study. J Int AIDS Soc. 2016; 19(1): 20659.

11. Matthews PC, Beloukas A, Malik A. Prevalence and Characteristics of Hepatitis BVirus (HBV) Coinfection among HIV-Positive Women in South Africa and Botswana.PLoS One. 2015; 10(7): e0134037.
12. WHO. Global hepatitis report, 2018
13. Wilcox. RD. Hepatitis B co-infection in pregnancy. HIV Clinician. 2010; 22(1): 5-6.
14. Nwokedi EE, Epopees MA, Dutse AI. Human immunodeficiency virus and hepatitis Bvirus co infection among patients in Kano, Nigeria. Niger J Med. 2006;15(3):227- 9.
15. Lesi OA, Kehinde MO, Oguh DN, Amira CO. Hepatitis B and C virus infection in Nigerian patients with HIV/AIDS. Niger Postgrad Med J. 2007; 14(2):129-33.
16. Balogun TM, Emmanuel S, Ojerinde EF. HIV, Hepatitis B and C viruses? co-infectionamong patients in a Nigerian tertiary hospital. The Pan African Medical Journal.2012; 12:100.
17. Denue BA, Ajayi B, Abja AU, Bukar AA, Akawu C, Ekong E, Alkali MB. A surveyof Hepatitis B and C virus prevalence in Human immunodeficiency virus positive patientsin a Tertiary health institution in North Eastern Nigeria. International Journal of Medicineand Medical Sciences. 2012; 4(1):13-18.
18. Imade GE, Sagay AS, Ugwu BT, Thacher TD, Ford RW. Seroprevalence of HepatitisB and Human Immunodeficiency Virus infections in pregnant women in Nigeria. Journalof Medic in the tropics. 2004; 6(2):15-21.
19. Joint United Nations Programme on HIV/AIDS. Report on the global AIDS epidemic.Geneva, Switzerland: UNAIDS 2010; http://www. unaids.org/globalreport/Global_report. htm.
20. Graham CS, Baden LR, Yu E, Mrus JM, Carnie J, Heeren T, Koziel MJ. Influence ofhuman immunodeficiency virus infection on the course of hepatitis C virus infection: Ameta-analysis. Clin Infect Dis. 2001; 33(4):562-569.
21. Sulkowski MS, Thomas DL, Mehta SH, Chaisson RE, Moore RD. Hepatotoxicityassociated with nevirapine or efavirenz containing antiretroviral therapy: Role of hepatitisC and B infections. Hepatology. 2002; 36(1):512-513.
22. Zimmerman RK, Ruben FL, Ahwesh ER. Hepatitis B Virus Infection, hepatitis B vaccine and hepatitis B immune globulin. J Fam Pract. 1997; 45(4):295-315.
23. Thio CL, Seaberg EC, Skolasky R Jr, Phair J, Visscher B, Munoz A, Thomas DL. HIV-1, Hepatitis B virus, and risk of liver-related mortality in the Multicenter Cohort Study(MACS). Lancet. 2002; 360(9349):1921-1926.
24. Henry O, The Free Online Encyclopaedia. 2008. 5th Edition, New York.
25. Uneke CJ, Ogbu O, Inyama PU, Anyanwu GI, Njoku MO, Idoko JH. Prevalence ofhepatitis-B surface antigen among blood donors and human immunodeficiency virus-infected patients in Jos, Nigeria. Mem Inst Oswaldo Cruz. 2005; 100:13-6.
26. Centers for Disease Control and Prevention (CDC). Testing for HCV infection: an updateof guidance for clinicians and laboratorians. MMWR Morb Mortal Wkly Rep. 2013;62(18): 362- 365.
27. Hoffmann CJ, Charalambous S, Martin DJ. Hepatitis B virus infection and response to antiretroviral therapy (ART) in a South African ART program. Clin Infect Dis. 2008; 47(11): 1479-85.
28. Franzeck FC, Ngwale R, Msongole B. Viral hepatitis and rapid diagnostic test basedscreening for HBsAg in HIV-infected patients in rural Tanzania. PLoS One. 2013; 8(3): e58468.
29. Soriano V, Barreiro P, Sherman KE. The changing epidemiology of liver disease in HIV patients. AIDS Rev. 2013; 15(1): 25-31.
30. Otegbayo JA, Taiwo BO, Akingbola TS. Prevalence of hepatitis B and C seropositivityin a Nigerian cohort of HIV-infected patients. Ann Hepatol. 2008; 7(2): 152-6. Adewole OO, Anteyi E, Ajuwon Z. Hepatitis B and C virus co-infection in Nigerianpatients with HIV infection. J Infect Dev Ctries. 2009; 3(5): 369-75.
31. Nyirenda M, Beadsworth MB, Stephany P. Prevalence of infection with hepatitis B andC virus and coinfection with HIV in medical inpatients in Malawi. J Infect. 2008; 57(1): 72-7.
32. Diop-Ndiaye H, Touré-Kane C, Etard JF. Hepatitis B, C seroprevalence and deltaviruses in HIV-1 Senegalese patients at HAART initiation (retrospective study). J Med Virol. 2008; 80(8): 1332-6.
33. Obi RK, Umeh SC, Okurede OH, Iroagba II. Prevalence of hepatitis B virus infectionamong pregnant women in an antenatal clinic in Port Harcourt, Nigeria. Afr J Clin ExpMicro. 2006; 7:78-82.

34. Sahaf F, Tanomand A, Montazam H, Sany AA. Seroprevalence of Hepatitis C, Hepatitis B and HIV and co-infection among pregnant women: a retrospective study in2006 at Malekan city, Iran. Res J Med Sci. 2007; 1:138-41.
35. Todd CS, Ahmadzai M, Atiqzai F, Miller S, Smith JM, Ghazan SA. Seroprevalenceand correlates of HIV, Syphilis, and hepatitis B and C virus among intrapartum patientsin Kabul, Afghanistan. BMC Infect Dis. 2008; 8:119.
36. Mbaawuaga EM, Enenebeaku MN, Okopi JA, Damen JG. Hepatitis B virus (HBV) infection amongpregnant women in Makurdi, Nigeria. Afr J Biomed Res. 2008; 11:155‐9.
37. Harry TO, Bajani M D, Moses AE. Hepatitis B Virus infection among blood donorsand pregnant women in Maiduguri, Nigeria. East Afr Med J. 1994; 71: 596-7.Jombo GTA, Egah DZ, Banwat EB. Hepatitis B Virus infection in a rural Settlementof Northern Nigeria. Niger J Med. 2005; 14:425-8.
38. Roingeard P, Diouf A, Sankale JL, Boye C, Mboup, Diadhiou F. Perinatal transmission of hepatitis B virus infection in Senegal, West Africa. Viral Immunol. 1993;6:65-73.
39. Imade GE, Sagay AS, Ugwu BT, Thacher TD, Ford RW. Seroprevalence of Hepatitis Band HIV infections in pregnant women in Nigeria. J Med Trop. 2004; 6:15-21.
40. Anaedobe CG, Fowotade A, Omoruyi CE, Bakare RA. Prevalence, sociodemographic features and risk factors of hepatitis B virus infection among pregnant women in Southwestern Nigeria. Pan Afr Med J. 2015; 20:406.
41. Edris A, Nour MO, Zedan OO, Mansour AE, Ghandour AA, Omran T. Seroprevalence and risk factors for hepatitis B and C virus infection in Damietta Governorate, Egypt. East Mediterr Health J. 2014; 20:605‐1.
42. Brandão NA, Pfrimer IA, Martelli CM,Turchi MD. Prevalence of hepatitis B and C infection and associated factors in people living with HIV in Midwestern Brazil. Braz J Infect Dis. 2015; 19(4): 426-30.
43. UNAIDS. Press release on Nigeria New Survey on HIV, 14th March 2019.