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Epidemiological Assessment of Seroprevalence and Associated Risk Factors of Hepatitis B Virus Infection among Blood Donors at Infectious Diseases Hospital Kano, Nigeria

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Abstract

Background: *Hepatitis B virus infection is a major public health problem worldwide that affects billions of people. Most people are unaware of their infection with viral hepatitis and unknowingly transmit the infection to other people, so it is a silent epidemic due to its highly asymptomatic nature. The aim of the study was to assess the Seroprevalence and associated risk factors of hepatitis B virus (HBV) infections among blood donors at infectious diseases hospital (IDH) Kano, Nigeria.* ***Methodology:*** *A cross sectional study was conducted at the blood bank of Infectious Diseases Hospital (IDH) Kano, Nigeria from August, 2019 to September, 2019. Data was collected using a pretested structured questionnaire. Descriptive analysis was performed to obtain the frequency distribution of the variables* ***Results****: The result shows that 341 participants responded to the questionnaire. 7.3% of the study subjects were positive for HBsAg. 67.4% of the respondents had heard about the hepatitis B virus infection. 66.3%, 57.5% and 58.4% of the respondents in the study reported the presence of fever, loss of appetite and headache as the main symptoms of hepatitis B virus infections. 58.7%, 41.1%, 38.4% and 46.6% of the participants perceived blood transfusion, unprotected sexual intercourse, mother to fetus and use of unsafe needles or sharps as the main mode of transmission of hepatitis B virus infection.* ***Conclusion:*** *Therefore, it is concluded that the Epidemiological Assessment of Seroprevalence and Associated Risk Factors of Hepatitis B Virus Infection Among Blood Donors at Infectious Diseases Hospital (IDH) Kano, Nigeria is relatively low. Therefore, Health education, routine immunization, effective and periodic screening for HBV is recommended. Furthermore, accurate information on risk factors for HBV transmission should be provided.*

Keywords: *Hepatitis B virus, Seroprevalence, Blood donors, Kano, Nigeria*

Introduction

Hepatitis B is a viral infection of the liver caused by the hepatitis B virus (HBV). The presence of the hepatitis B surface antigen (HBsAg+) indicates an acute (i.e., less than 6 months) or chronic HBV infection. Hepatitis B e-antigen (HBeAg+) positivity is associated with active viral replication, high HBV DNA viral load, and higher infectivity. In the absence of HBsAg, the existence of HBV core antibodies (anti-HBc IgG) may indicate that an individual was previously infected with HBV. The presence of HBV surface antibodies (anti-HBs) indicates that the individual has achieved immunity to HBV following an infection or from vaccination. HBV is transmitted through contact with the blood or bodily fluids of an infected individual. In countries with high HBV prevalence, perinatal transmission of infection from mother to neonate at the time of delivery is common (WHO, 2017).

HBV remains an important global public health concern despite the existence of an effective vaccine and antiviral agents. Globally, in 2015, chronic HBV (measured by seroprevalence of HBsAg) was estimated to affect 3.5 percent of the population (approximately 257 million individuals) including an estimated 65 million women of childbearing age. The highest prevalence rates reported by the World Health Organization (WHO) occur in the African (6.1%) and Western Pacific regions (6.2%), with recent modeling estimates finding higher prevalence for specific sub- regions (Polaris,

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2016). Based on population, the largest number of individuals living with chronic HBV are in the Western Pacific region and the smallest number in the Americas (Polaris, 2016).

Of the five different types of hepatitis viruses (A, B, C, D, and E), hepatitis B virus (HBV) infects the liver more than other viruses. HBV is a DNA virus that replicates in the liver cells and causes acute and chronic infections of the liver. It is a major cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma. Most people are unaware of their infection with viral hepatitis and unknowingly transmit the infection to other people, so it is a silent epidemic due to its highly asymptomatic nature (Franco et al, 2012, WHO, 2012, WHO, 2014).

About 80% of countries, including all countries in the African region, have recognized viral hepatitis to be an urgent public health issue. Most persons who become chronic carriers of HBV live in Asia and Africa. Nigeria, part of Africa, has significant hepatitis B transmission in both children and adults, displaying around 6–12% hepatitis B surface antigen (HBsAg) pre- valence. It also displays 12% of hospital admissions and 31% of mortality on medical wards due to acute viral hepatitis, chronic viral hepatitis, cirrhosis of the liver, and hepatocellular carcinoma (Azage, 2015, FMOH, 2005, WHO, 2013).

HBV is reported to be 50–100 times more infectious than HIV; it can survive for several weeks even in dried blood (Ekanem et al, 2013, Negero et al, 2011). Blood is the most important vehicle for its transmission. Semen, tears, and saliva are also possible vehicles for its transmission. Percutaneous contact with infected blood, unprotected sexual contact, infected mother-to-infant, unsafe blood transfusion, sharing razors, toothbrushes, needles, and syringes, tattooing, and body piercing are some modes of HBV transmission. (Balew et al, 2014, Franco et al, 2012, WHO, 2012).

Because of common routes of transmission, frequent co-infection of viral hepatitis and HIV is common. An estimated 5–25% of people living with HIV are also infected with HBV (2–4 million). The mean HIV/HBV co- infection in 20 sub-Saharan African countries was reported as 15% (Manyazewal et al, 2014). Some hospital-based studies documented 3.9–14% HBsAg prevalence among HIV patients, which is intermediate to high prevalence, in Nigeria (Bezabeh et al, 2015, Negero et al, 2011). HIV-infected individuals are more likely to develop chronic hepatitis B than are HIV-negative individuals after infection with hepatitis B in both groups. HIV accelerates the progression of HBV-related liver disease. Cirrhosis is more common in co-infected cases than in HBV mono-infected cases. HIV/HBV co-infected men are also more likely to die of liver-related causes compared to those mono-infected with HBV (Pittman et al, 2014). Approximately, 10% of the 40 million HIV-positive individuals in the world have chronic hepatitis B infection (Thio, 2009). Their co-infection is reported as high as 10–20% in countries where HBV infection is either endemic or intermediate to high (Thio, 2009). HBV constitutes a major public health challenge in sub-Saharan Africa from different infections in HIV patients (Hamza et al, 2013).

The introduction of HBV vaccines to prevent HBV infection in the 1980s is to be considered the major achievement (Franco et al, 2012). The introduction of highly active antiretroviral treatment (ART) for treatment of HIV infection has decreased morbidity and mortality from HIV infection. However, the management of HIV/HBV co-infection has become increasingly important since the management of the co-infected patient is complex, as the presence of one infection can affect the management of the other in a number of ways (Bezabeh et al, 2015, Brito and Alhyraba, 2008, Thio, 2009).

Since several antiviral agents have activity against HIV or HBV alone or HIV and HBV co-infection, the issues of HIV and HBV drug resistance must be considered when selecting therapeutic regimens. When stopping ART regimens in patients with HIV/HBV due to treatment failure, toxicity, or other reasons, agents with anti-HBV activity may be stopped together although the patient is positive for HBV. This causes a hepatitis flare reaction which is an elevation of amino-transferases to more than 10 times the upper limit of normal and more than twice the baseline value during the natural course of a chronic HBV infection. So, clinicians need to be mindful for this problem in HIV patients before stopping ART regimens containing agents effective against HBV (Brito and Alhyraba, 2008, Pittman et al, 2014).

Africa is considered a high endemic area with 7– 26% prevalence of HBsAg, and Ott et al. [Ott et al, 2012], revealed that the highest endemic areas are in sub-Saharan Africa. However, Andre [André, 2000] revealed that infection in areas including Kenya, Zambia, Ivory Coast, Liberia and Sierra Leone, Tunisia has an intermediate endemicity. Meanwhile, in countries such as Egypt, Algeria and

Morocco, low endemicity has been reported [Rosa et al, 2015]. According to Kiire [Kiire, 1990], Africa has the second largest number of individuals with chronic HBV infection, approaching 58 million with over 90% of the population in some countries in western Africa including Senegal and Gambia being exposed to and become infected with HBV during their lives [Edmunds et al, 1996]. Hepatitis B virus infection has been reported to be hyper-endemic mostly in some sub-Saharan countries such as Nigeria, Gabon, Namibia, Burkina Faso and Cameroon [Rosa et al, 2015]. They further revealed that the prevalence of HBsAg is higher in rural areas compared to urban areas. In addition, they observed a greater risk for males becoming HBV chronic carriers, with a male to female ratio ranging from 1:1 to 3:1 and increasing with age. In some unrelated studies in Senegal, Zambia, Ethiopia, Tanzania, Ghana, South Africa, Nigeria and Zimbabwe, the rates of HBeAg-positive cases found in HBsAg positive pregnant women were 1.6% [Diop-Ndiaye et al, 2008], 2.2% [Kapembwa et al, 2011], 4.7% [Kabato and Weldearegay, 2016], 8.8% [Matee et al, 2006], 12.3% [Ofori-Asensor et al, 2016], 13.4% [Attia et al, 20123], 13.6% [Musa et al, 2015], and 17.1% [Mzingwane and Mamvura, 2014], respectively.

In Nigeria, the prevalence of HBV infection has been found to be high and this places the country among the group of countries endemic for HBV infection [Henrietta and Maryam, 2016]. Gabriel and Austin [Gabriel and Austin, 2013] reported that about 18 million Nigerians are currently infected with hepatitis B virus. Between 2000 and 2013, (Musa et al, 2015) obtained a pooled prevalence of 13.6% for adults and 11.5% for children from a study they conducted in Nigeria. Similarly, some investigators found a high HBV prevalence of 25.7% among blood donors [Bada et al, 1996], 23.4% among surgeons [Belo, 2000] and infants 16.3% [Sadoh and Sadoh, 2013 59].

Accurate estimate of the prevalence of these viruses in a particular population is very important to monitor the safety of the blood supply and plan effective preventive strategies. Therefore, the aim of the study was to assess the Seroprevalence and associated risk factors of Hepatitis B virus infections among blood donors at infectious diseases hospital (IDH) Kano, Nigeria.

Methodology

Study Design and Area: A cross sectional study was conducted at the blood bank of Infectious Diseases Hospital (IDH) Kano, Nigeria from August, 2019 to September, 2019. Infectious Diseases Hospital (IDH), Kano is a government owned specialized secondary health facility serving a population of about 1.5 million and having a patronage of about 300/day. It is a referral centre located along France road in Kano metropolis. The hospital caters for all infectious diseases' cases such as HIV, TB, Hepatitis, gastroenteritis, cholera, etc.

Sample size determination

In this study, manual calculation of the sample size using Morgan and Krejcie (1970) formula was used for sample size determination as stated below:

$$\mathbf{S= X^2NP\ (1\text{-}P) \div d^2\ (N\text{-}1) + X^2P\ (1\text{-}P)}$$

Where:

S = Required sample size

$\mathbf{X^2}$ = The table value of the chi-square at desired confidence **(3.841)**

N = Study Population size (**3000)**

P = Population proportion assumed to be **0.50** since this would provide maximum sample size

$\mathbf{d^2}$= Degree of accuracy of the result expressed as proportion **0.050**

$$\frac{3.841\times3000\times0.5\times0.5}{0.0025\times2999+3.841\times0.5\times0.5}$$

$$\frac{2880.75}{8.45775} = 341$$

Hence **341** participants

Inclusion and exclusion criteria: All blood donors who donated blood at Infectious Diseases Hospital (IDH) Kano, Nigeria from August, 2019 to September, 2019 were eligible for this study. Individuals who satisfy the blood donation screening's criteria: age between 18 and 45 years, body weight over 50 kg, normal body temperature, hemoglobin level, blood pressure and absence of signs

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of an acute infection, no history of infectious and chronic diseases, donate blood. Those blood donors who did not meet the criteria for blood donation stated in the inclusion criteria were excluded from the study.

Data collection: Data from each study participant were collected after taking written informed consent. Structured questionnaire-based interviews of the study participant were used to collect necessary socio- demographic information of blood donors, gender, age, and residence, types of donor, occupation and marital status.

Specimen collection and processing

From each blood donor about 5ml of venous blood was collected following standard operational procedures by a trained Medical Laboratory Technician (MLT) from each study subject. The blood specimen for the HBsAg test was allowed to clot at room temperature and serum was separated by centrifugation at 5000 rpm for 5 min. All blood samples were screened for Hepatitis B surface antigen (HBsAg) based on established screening procedures according to manufacturer's recommendations at the Blood bank of Infectious Diseases Hospital (IDH) Kano, Nigeria. The collected serum specimen was tested for HBsAg using an advanced quality one-step rapid test kit according to the manufacturer's guidelines (China, 2016).

Laboratory testing method

Sample testing for HBsAg was done using an advanced one- step HBsAg test which is 98.89% sensitive and 98.87% specific (China, 2016). This is a colloidal gold enhanced immunoassay for the determination of HBsAg in human whole blood, serum, or plasma. Goat anti-HBsAg antibody is immobilized in the test region on a nitrocellulose membrane. During the assay, the specimen was allowed to react with the colored conjugate (antibody–colloidal gold conjugate); the mixture then migrated chromatographically on the membrane by capillary action. An HBsAg-positive specimen produced a distinct color band in the test region, formed by the specific antibody–HBsAg-colored conjugate complex. Absence of this colored band in the test region suggested a negative result. A colored band in the control region served as procedural control regardless of the test result. For each run of the test internal quality controls was performed.

Data analysis

Data were analyzed using Statistical Package for Social Science (SPSS) software version 16.0 at that time with the help of the Statistician. The descriptive statistical method was used to analyze frequencies and percentages.

Results

A total of 341 respondents were interviewed, giving 100% response rate. Among all, 91(26.7%) of respondents were 31-35 years of age. Of the study subjects, 223 (65.4%), were married. The socio-economic characteristics of the study showed that, among all respondents, 221(64.8%) of respondents attended formal education, among this 145(42.5%) of respondents were primary school completed, 76(22.3%) of respondents were secondary school and above completed, while 120(35.2%) of respondents reported that they were took informal education (were illiterate and only read and write).Similarly, results of occupational status of respondents indicated, 150(44%) of respondents were farmers, 46 (13.5%) were Government employee, 70(20.5%) were Merchants and 75(22%) were Students (Table 1).

Table 1. Socio demographic characteristics of the participants (n=341)

Characteristics	Frequencies (n=341)	Percentages %
Gender		
Males	341	100
Ages		
20-25	60	17.6
26-30	70	20.5

31-35	91	26.7
36-40	72	21.1
41+	48	14.1
Marital Status		
Married	223	65.4
Single	118	34.6
Education		
Illiterate	75	22
Can read and write	45	13.2
Primary	145	42.5
Secondary and above	76	22.3
Occupation		
Students	75	22
Farmers	150	44
Government employee	46	13.5
Merchants	70	20.5

Knowledge of the respondents towards hepatitis B virus infection

From a total of three hundred and fourty one (341) respondents' majority 210 (61.6%) knew that hepatitis B is caused by Virus. Concerning transmission majority 200 (58.7%), 140 (41.1%), 131 (38.4%), 159 (46.6%), of the respondents have answered hepatitis B virus infection is transmitted through blood transfusion, unprotected sexual intercourse, mother to fetus, and use of unsafe needles or sharps respectively. Regarding sign and symptom most of 226 (66.3%), 196 (57.5%), 199 (58.4%) of the respondents have answered fever, loss of appetite and headache. Concerning the way of prevention 120 (35.2%) received hepatitis B Vaccination and about 221 (64.8%) have not received **(Table 2).**

Table 2. Knowledge of the respondents towards Hepatitis B Virus Infection (n=341)

Characteristics	**Frequencies (n=341)**	**Percentages (%)**
Have you ever heard about hepatitis B virus infection?		
Yes	230	67.4
No	90	26.4
Don't know	21	6.2
Hepatitis B is caused by a virus		
Yes	210	61.6
No	80	23.5
Don't know	51	14.9
Hepatitis B can be transmitted through blood transfusion		
Yes	200	58.7
No	63	18.5
Don't know	78	22.9
Hepatitis B can be transmitted through unprotected sexual intercourse		
Yes	140	41.1
No	156	45.7
Don't know	45	13.2

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Hepatitis B can be transmitted from mother to fetus		
Yes	131	38.4
No	125	36.7
Don't know	85	24.9
Hepatitis B can be transmitted through use of unsafe needles or sharps		
Yes	159	46.6
No	106	31.1
Don't know	76	22.3
Fever the symptom of Hepatitis B Virus infection		
Yes	226	66.3
No	115	33.7
Loss of appetite symptoms of Hepatitis B Virus infection		
Yes	196	57.5
No	145	42.5
Head ache, symptoms of Hepatitis B Virus		
Yes	199	58.4
No	142	41.6
How serious do you think being infected with hepatitis B virus is compared to HIV?		
Less serious than HIV	89	26.1
As serious as HIV	157	46.0
More serious than HIV	60	17.6
I don't know	35	10.3
Have you ever heard about hepatitis B vaccination?		
Yes	155	45.5
No	186	54.5
How effective do you think hepatitis B vaccination is in protecting someone against hepatitis B virus infection?		
Not effective	19	5.6
Slightly effective	102	29.9
Very effective	190	55.7
I don't know	30	8.8
Have you ever received hepatitis B vaccination?		
Yes	120	35.2
No	221	64.8
An individual can be infected by both Hepatitis B and HIV		
Yes	140	41.1
No	99	29.0
Don't know	102	29.9
Hepatitis B infection can lead to liver		

cancer		
Yes	166	48.7
No	96	28.2
Don't know	79	23.2
Hepatitis B infection can lead to cirrhosis (scarred liver		
Yes	190	55.7
No	90	26.4
Don't know	61	17.9
A person can be infected with hepatitis B and not have any symptoms of the disease		
Yes	180	52.8
No	104	30.5
Don't know	57	16.7

From a total of 341 study participants, 220 (64.5%), 228 (66.9%), 183 (53.7%), and 140 (41.1%) had a history of hospital admission, blood transfusion, surgical procedure, and sharing sharp materials, respectively. 131 (38.4%) had family members with HBV infection. Those who had a history of tattooing, tooth extraction and circumcision were 158 (46.3%), 174

(51.0%), and 245 (71.8%), respectively. 318 (93.3%) had more than one sexual partner, as shown in **(Table 3).**

Table 3. Route-associated risk factors of HBV infection among blood donors (n=341)

Characteristics	**Frequencies (n=341)**	**Percentages (%)**
History of hospital admission		
Yes	220	64.5
No	121	35.5
History of blood transfusion		
Yes	228	66.9
No	113	33.1
History of surgical procedure		
Yes	183	53.7
No	158	46.3
History of sharing sharp materials		
Yes	140	41.1
No	201	58.9
Family history of HBV		
Yes	131	38.4
No	210	61.6
History of tattooing		
Yes	158	46.3
No	183	53.7
History of tooth extraction		
Yes	174	51.0
No	167	49.0
History of Circumcision		
Yes	245	71.8
No	96	28.2
History of multiple sexual partners		

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Yes	318	93.3
No	23	6.7
History of unsafe therapeutic injection		
Yes	164	48.1
No	177	51.9

From a total of 341 study participants, 25(7.3%) had a positive test results and 316 (92.7%) had a negative test result **(Table 4).**

Table.4. Serological test result for blood donors recruited at Infectious Diseases Hospital (IDH), Kano, Nigeria

Variables	**Status**	**Number (%)**
HBsAg	Positive	25 (7.3%)
	Negative	316 (92.7%)

Discussion

In the present study, 7.3% of subjects were positive for HBsAg. Nevertheless, this finding is higher than the seroprevalence rate reported in India (2.2%), (Pahuja et al, 2007) Turkey (1.38% and 1.8%), (Afsar et al, 2008, Karaosmanoglu et al, 2012) Libya (1.28%), (Khmmaj et al, 2010) Iran (1.07%), (Ghavanini and Sabri, 2000) Kosovo (4.2%) (Hajrullah and Skender, 2009) and Egypt (4.3%) (El-Gilany and El-Fedawy, 2006) .The socio- cultural difference may be the possible factors for these differences. The finding of the present study is lower to previous studies conducted in Uganda (8.3%), (Bwogi et al,2009) in Vietnam (8.4%), (Huy et al, 2014) in Myanmar (8.7%), (Zaw et al, 2013) and in Taiwan (7.8%) (Sun et al, 2014) among HIV- infected patients.

However, the prevalence of HBsAg was found lower compared to 14% in Shashemene (Negero et al, 2011) and 19% in Bahir Dar (Birku et al, 2015) in Ethiopia among HIV-infected patients. It was also similarly lower compared to studies conducted in different areas in Nigeria among HIV patients; 26.5% in Gombe, (Jibrin and Jibrin, 2004) 20% in Nsukka, (Uju et al, 2013) 12.1% in Uyo, (Ekanem et al, 2013) and 12.3% in north- western Nigeria. (Hamza et al, 2013) It was also lower than studies done in Sudan (11.7%), (Mudawi et al, 2014) in Iran (35.5%), (Davarpanah et al, 2015) and in India (19.5%) (Antala and Joshi, 2010) .The high prevalence of HBV in these studies compared to our study might be due to the more advanced diagnostic tools they used like the HBV DNA real-time PCR and HBsAg ELISA technique, but in our study we used only a one-step rapid HBsAg serological kit.

Conclusion

The prevalence of HBsAg among blood donors at Infectious Diseases Hospital (IDH) Kano, Nigeria is relatively low compared to what was reported from other countries and various parts of the Nigeria. Therefore, health care associated risk prevention and health education among population should be considered as the main interventions that might help reducing the spread of this blood-borne infection. Efforts to strengthened routine immunization, effective and periodic screening for HBV should be adopted in the state with the aim of preventing spread of HBV infection and providing timely treatment to those already infected.

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