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Research Article

Profiling of Acute and Chronic Hepatitis B Virus Infections among Outpatients in Kebbi State, Nigeria

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Abstract

Background and Objective: Nigeria is classified as an area of high endemicity for hepatitis B virus infection. This study sought to provide an up-to-date assessment of acute and chronic hepatitis B virus infections and risk factors associated with viral transmission among outpatient in Kebbi state, Nigeria. **Materials and Methods:** Blood samples were obtained for the qualitative detection of HBsAg; Anti-HBc and IgM anti-HBc. Demographic data were collected by using a questionnaire. Acute and chronic HBV infections were interpreted base on CDC clinical case definition. Descriptive statistics were used to analyze the result. **Results:** Of the 2565 participants, 503 (19.6%) were diagnosed with HBV infection. Total 417 (16.3%) had acute, while 86 (3.4%) had a chronic infection. Two-third of acute (75.1%) and chronic (70.9%) infections were in males. The infection was more prevalent in adults (acute: 51.1%, chronic: 44.2%) (Median age 29.5). The highest prevalence of chronic infections was observed among married participants (41.9%). Participants who had a history of HBV vaccines had the lowest prevalence (acute: 10.1%, chronic: 3.5%). The risk of HBV infection was 7.8 times more likely to be higher in the age group 40-59 years (OR 7.8, 95% CI 5.6-10.9), 4.2 times higher in the age group 20-39 years (OR 4.2, 95% CI 3.1-5.6). Participants who had previous records of blood transfusion were 24.4 times likely to have HBV infection (OR 24.4, 95% CI 19.8-30.0). Those with the previous history of STIs were 5.1 times (OR 5.1, 95% CI 4.2-6.3) likely to come with HBV infection. **Conclusion:** This study shows that people diagnosed with acute and chronic infection in Kebbi state, were predominantly adult males, with a history of sexually transmitted infection, who had no history of HBV vaccine. Therefore, screening for HBsAg, anti-HBc and IgM anti-HBc within the population is vital for early diagnosis of both acute and chronic HBV infections and national immunization programs remain the best strategy to reduce the burden of the disease.

Key words: Acute infection, chronic infection, vaccine, risk factors

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Infection with Hepatitis B virus (HBV) often results in chronic hepatitis¹. An estimated 250 million people out of one-third of the world population infected with the virus are living with chronic hepatitis B infection². The virus is endemic throughout the world and its prevalence varies across different geographical zones. The average prevalence of HBV infection among adults in Africa and the Pacific region was 6.15%¹. The prevalence among the general population was 3.3% in the Middle East, 2.0% in South-East Asia and 1.6% in Europe³. The lowest Hepatitis B prevalence is reported in the region of the Americas, where 0.7% of the population is infected. Studies have shown that 8% of the people living in endemic areas are chronic HBV carriers. The highest prevalence of chronic HBV was in tropical regions where 15% of the total populations of adults are infected^{4,5}.

In Nigeria, 13% of the population had the serological marker of HBV-related disease and an estimated 23 million people (nearly one in every 8 persons) are at risk of HBV infection and considered the highest in Sub-Sahara Africa^{4,6,7}. The combined prevalence of HBV in Nigeria was 13.6%, among blood donors⁸ was 14.0 and 14.1% for pregnant women attending antenatal clinics⁹, 11.5% for children, 14.0% among healthy adults^{4,8} and 16.0% for studies evaluating adults and children⁶. The prevalence varied between 12-17% depending on the screening and diagnostic method used. In Kebbi state, the prevalence of HBV among blood donors was 16.6%, while an estimated 12.7% was observed among pregnant women¹⁰.

There has been a downward trend in the prevalence of HBV infection around the world largely due to immunization and improved health-care practices^{3,4}. In Nigeria, despite a successful HBV vaccination program among children, there is unsatisfactory screening and vaccination coverage among adults due to a lack of awareness among the general populace. Data for chronic viral hepatitis are not routinely collected by the authorities concern and chronic hepatitis infection remains largely underreported. The study profiled the distribution of acute and chronic HBV infections in a healthy population in Kebbi state, Nigeria.

MATERIALS AND METHODS

Study area and population: The state is located in the northwestern part of Nigeria. The state has borders with Sokoto and Zamfara states to the East, Niger state to the South, Benin Republic to the West and the Niger Republic to the North. The state occupies an area of about 36,229 km²

with an estimated population of about 3.9 million. The inhabitants are distributed between four emirates in urban and rural areas. The study was carried out in four major cities of the four emirate regions in the state. Two thousand five hundred and fifty six outpatients were recruited in four major General Hospitals for 24 months from August, 2017-2019. The hospitals are government own hospitals providing secondary health care and serving as referral hospitals to over three million people residing in the 21 Local Government Councils in the state. The recruited patients were at the hospitals to see a physician for different complain/diseases.

Data collection: The study was conducted for a period of 24 months from August, 2017-2019. Data were collected by using a paper-based administered questionnaire (adopted with minor modification) containing 25 structured questions⁴. The individual variables collected were demographic characteristics, previous history of HBV infection, vaccine history, sexually transmitted diseases and surgical history, blood transfusion, as well as knowledge about the mode of transmission. Blood samples were collected after the interviews.

Blood collection: Under aseptic technique, 5 mL of venous blood was collected into a plain vacuum blood collection tube. The blood was allowed to clot and retract at room temperature. Sera were separated by centrifugation at 3000 rpm for 5 min. The supernatant sera were used for the analysis. Two hundred and fifty six samples were tested for Hepatitis B surface antigen (HBsAg) by using rapid diagnostic kits (ACON Hangzhou Biotech Co., Ltd). Positive HBsAg samples were tested for and Hepatitis B core antibodies (Anti-HBc and IgM anti-HBc) using HBcAb and HBc IgM ELISA (CTK Biotech, U.S.A.) accordingly, to identify different phases of HBV infection. The laboratory test results for individuals were linked to individual questionnaire information. Acute and chronic hepatitis B infections were interpreted base on CDC 2012 clinical case definition. A positive HBsAg, Anti-HBc and IgM anti-HBc test were considered evidence of acutely HBV infection. A positive HBsAg, Anti-HBc and negative IgM anti-HBc test were considered evidence of chronic HBV infection. Being negative for all markers meant participant was susceptible to HBV infection.

Statistical analysis: Data obtained from the questionnaire and laboratory blood analyses were entered into a database and transferred to a statistical package (SPSS) for windows version 21 (IBM Inc., Chicago, IL, USA). Descriptive statistics

were used to summarize demographic and clinical characteristics of all the participants. The prevalence of acute and chronic HBV infections were estimated and presented along with percentages. Associations between two or more variables were assessed by using chi-square or Fisher exact test. Univariate and multivariate logistic regression analysis were used to examine the association of variables with HBV infections. Results were presented in terms of Odds Ratios (OR) and associated 95% confidence intervals (CIs) and p-value set at 0.05.

Ethical considerations: Verbal informed consent was obtained from all subjects before data collection. For minors, the legal guardian's consent was obtained. The project was approved by the Kebbi state Ministry of Health Ethics and Research Committee, Gwadangwaji Secretariat, Birnin Kebbi, Nigeria.

RESULTS

Of the total participants, 1013 (39.5%) were between 10-19 years old, 993 (38.7%) were 20-39 years old and 269 (10.5%) were 40-59 and 290 (11.3%) were older than 60 years (Table 1). From the study, 1485 (57.9%) were male and 1080 (42.1%) were female. Most of the participants resided in Gwandu emirate 709 (27.6%), whereas the region with the lowest participant was Argungu emirate 571 (22.13%). Those that had at least completed primary school were 27.1 compared to others (35.7%). Of the participant, 1450 (56.6%) were self-employed or government employees. Among the eligible participant, 1267 (49.4%) were singles and 145 (5.7%) were widows (Table 1).

In this study, 503 (19.6%) were diagnosed with HBV infection. The 417 (16.3%) had acute HBV infection, while 86 (3.4%) had a chronic infection (Table 2). About two-third of acute infection (75.1%) and chronic infections (70.9%) were diagnosed in males. In all the regions studied singles had a higher prevalence of acute HBV infections (36.7%) followed by married individuals (30.7%). While, the highest prevalence of chronic HBV infections was observed among married participants (41.9%) than singles (33.7%) (Table 2).

Participants who had a history of HBV vaccines (acute: 10.1%, chronic: 3.5%) had the lowest prevalence of HBV infections compare to those who received no vaccine. The prevalence of HBV infection was very high among STIs individuals (acute: 66.4%, chronic: 61.6%). A larger proportion

Table 1: Sociodemographic characteristics of acute and chronic HBV infection in Kebbi state (n = 2565)

Category	Frequency	Percentage
Age		
10-19	1013	39.5
20-39	993	38.7
40-59	269	10.5
60+	290	11.3
Gender		
Male	1485	57.9
Female	1080	42.1
Geographical areas		
Argungu Emirate	571	22.13
Gwandu Emirate	709	27.6
Yauri Emirate	609	23.7
Zuru Emirate	676	26.7
Educational level		
Primary school	695	27.1
Post primary	614	23.9
A-level and above	341	13.3
Others	915	35.7
Careers		
Govt employee	699	27.3
Self employed	751	29.3
Others	1114	43.4
Marital status		
Single	1267	49.4
Married	839	32.7
Widowed	145	5.7
Divorced	313	12.2

of participants with the previous history of minor surgical procedures had a prevalence of acute HBV infections (17.0%) and chronic HBV infection (15.1%). The prevalence of acute and chronic HBV infection in those with the previous history of blood transfusion was acute: 25.9%, chronic: 57.0% (Table 2).

The risk of HBV infection was 7.8 times more likely to be higher in the age group 40-59 years (OR 7.8, 95% CI 5.6-10.9), 4.2 times higher in the age group 20-39 years (OR 4.22, 95% CI 3.1-5.6) compared to the age group 10-19 years (Table 3). Male participants were 2.1 times at higher risk for HBV infection than females (OR 2.1, 95% CI 1.7-2.6). Widows were 4.56 times likely to be at risk of HBV infection (OR 4.5, 95% CI 3.4-6.2), married 1.4 times higher (OR 1.4, 95% CI 1.1-1.6) compare to singles. Participants who had previous records of blood transfusion were 24.4 times likely to have HBV infection (OR 24.4, 95% CI 19.8-30.0). Those with the previous history of STIs were 5.1 times likely to come with HBV infection compares to those who had no prior exposure (OR 5.1, 95% CI 4.2-6.3) (Table 3).

In multivariable logistic regression analysis, participants with 60+ years were 1.1 times like to have acute HBV infection compared with other age groups (OR 1.1, 95% CI 0.7-1.8). Male

Table 2: Prevalence of HBV infections by sociodemographic characteristics in Kebbi state (n = 2565)

Characteristics	Acute (N = 417 (16.3))	Chronic (N = 86 (3.4))	Total positive (N = 503 (19.6))	HBV negative (N = 2062 (80.4))	p-value
Age					
10-19 Years	42 (10.1)	19 (22.1)	61 (12.1)	952 (46.1)	0.000
20-39 Years	213 (51.1)	38 (44.2)	251 (49.9)	742 (36.0)	
40-59 Years	105 (25.2)	22 (25.6)	127 (25.2)	142 (6.9)	
60+ Years	57 (13.6)	7 (8.1)	64 (12.7)	226 (11.0)	
Sex					
Male	313 (75.1)	61(70.9)	374 (74.4)	1111 (53.9)	0.000
Female	104 (24.9)	25 (29.1)	129 (25.6)	951 (46.1)	
Regions					
Argungu	81 (19.4)	19 (22.1)	100 (19.9)	471 (22.9)	0.000
Gwandu	95 (22.8)	16 (18.6)	111 (22.1)	598 (29.0)	
Yauri	113 (27.1)	27 (31.3)	140 (27.8)	469 (22.7)	
Zuru	128 (30.7)	24 (28.0)	152 (30.2)	524 (25.4)	
Marital status					
Single	153 (36.7)	29 (33.7)	182 (36.2)	1086 (52.1)	0.000
Married	128 (30.7)	36 (41.9)	164 (32.6)	675 (32.7)	
Widowed	87 (20.8)	8 (9.3)	95 (18.9)	50 (2.4)	
Divorced	49 (11.8)	13 (15.1)	62 (12.3)	251 (12.2)	
Education level					
Primary school	27 (6.5)	15 (17.4)	42 (8.3)	653 (31.7)	0.000
Post primary	223 (53.5)	18 (20.9)	241 (47.9)	373 (18.1)	
A-level and above	101 (24.2)	36 (41.9)	137 (27.3)	204 (9.9)	
Others	66 (15.8)	17 (19.8)	83 (16.5)	832 (40.3)	
HBV vaccination					
Yes	42 (10.1)	3 (3.5)	45 (8.9)	100 (4.8)	0.000
No	375 (89.9)	83 (96.5)	458 (91.1)	1304 (95.2)	
History of blood transfusion					
Yes	108 (25.9)	49 (57.0)	157 (31.2)	561 (27.2)	0.000
No	309 (74.1)	37 (43.0)	346 (68.8)	1501 (72.8)	
History of surgical procedures					
Yes	71 (17.0)	13 (15.1)	84 (16.7)	247 (22.0)	0.000
No	346 (83.0)	73 (84.9)	419 (83.3)	1815 (88.0)	
History of STIs					
Yes	277 (66.4)	53 (61.6)	330 (65.6)	367 (17.8)	0.000
No	140 (33.6)	33 (38.4)	173 (34.4)	1695 (82.2)	

Table 3: Association between risk factors and HBV infection among study participant

Characteristics	Frequency	Total HBV positive		OR (95% CI)	p-value
		N = 503	%		
Age					
*0-19 Years	1013	61	6.0	1.0	<0.0001
20-39 Years	993	251	25.3	4.22 (3.13-5.62)	
40-59 Years	269	127	47.2	7.80 (5.62-10.9)	
60+ Years	290	64	22.1	3.66 (2.52-5.32)	
Sex					
Male		374	25.2	2.11 (1.70-2.61)	<0.0001
*Female	1080	129	11.9	1.0	
Regions					
Argungu	571	100	17.5	1.11 (0.88-1.52)	0.0001
*Gwandu	709	111	15.7	1.0	
Yauri	609	140	22.9	1.52 (1.11-1.89)	
Zuru	676	152	22.5	1.35 (1.09-1.90)	
Marital status					
*Single	1267	182	14.3	1.0	<0.0001
Married	839	164	19.5	1.42 (1.11-1.66)	
Widowed	145	95	65.5	4.56 (3.43-6.17)	
Divorced	313	62	19.8	1.30 (1.00-1.90)	

Table 3: Continue

Characteristics	Frequency	Total HBV positive		OR (95% CI)	p-value
		N = 503	%		
Education level					
Primary school	695	42	6.04	0.14 (0.09-0.20)	<0.0001
Post primary	614	241	39.3	0.91 (0.67-1.24)	
A-level and above	341	137	40.2	0.94 (0.68-1.30)	
*Others	915	83	9.1	1.0	
HBV Vaccination					
Yes	803	45	5.6	0.22 (0.16-0.30)	<0.0001
*No	1762	458	26.0	1.0	
History of blood transfusion					
Yes	718	157	21.9	24.4 (19.8-30.0)	0.073
*No	1847	346	18.7	1.0	
History of surgical procedures					
Yes	331	84	25.4	1.33(1.01-1.82)	0.005
*No	2234	419	18.8	1.0	
History of STIs					
Yes	697	330	47.3	5.11(4.24-6.30)	<0.0001
*No	1868	173	9.3	1.0	

*Reference value

Table 4: Multivariate analysis of association of some risk factors and acute and chronic HBV infection among participant

Characteristics	Acute OD (95% CI)	Chronic OD (95% CI)
Age		
*10-19 Years	1.0	1.0
20-39 Years	1.0 (0.7-1.6)	0.4 (0.3-0.9)
40-59 Years	1.0 (0.7-1.7)	0.63 (0.3-1.1)
60+ Years	1.1 (0.7-1.8)	0.4 (0.1-0.9)
Sex		
Male	1.5 (1.1-2.0)	0.8 (0.5-1.4)
*Female	1.0	1.0
Marital status		
*Single	1.0	1.0
Married	0.9 (0.7-1.3)	1.4 (0.8-2.3)
Widowed	1.1 (0.8-1.6)	0.5 (0.2-1.2)
Divorced	0.9 (0.6-1.4)	1.3 (0.6-2.7)
HBV vaccination		
Yes	1.1 (1.1-2.0)	0.4 (0.1-1.2)
*No	1.0	1.0
History of blood transfusion		
Yes	0.8 (0.6-1.0)	2.9 (1.8-4.7)
*No	1.0	1.0
History of surgical procedures		
Yes	1.0 (0.7-1.4)	0.9 (0.5-1.7)
*No	1.0	1.0
History of STIs		
Yes	1.0 (0.8-1.4)	2.0 (1.2-3.2)
*No	1.0	1.0

*Reference value

individuals had higher odds of acute HBV compared to females (OR 1.5, 95% CI 1.1-2.0). Widows were 1.1 times likely to be at risk of acute HBV infection (OR 1.1, 95% CI 0.8-1.6). Participants who are married had 1.4 times greater odds of chronic HBV (OR 1.4, 95% CI 0.8-2.3) and divorced 1.3 times greater odds of chronic HBV (OR 1.3, 95% CI 0.6-2.7) (Table 4).

Individuals with a previous history of receiving blood transfusion had 2.9 times the odds of chronic HBV infection compared to their HBV negative counterparts (OR 7.8, 95% CI 1.8-4.7), while those who had contracted STIs before had 2.0 times greater odds for chronic HBV infections (OR 2.0, 95% CI 1.2- 3.2) (Table 4).

DISCUSSION

Hepatitis B virus infection has been one of the major viral infection of great public health importance in Nigeria. Despite high prevalence on acute HBV infection, chronic HBV infections were under reported. This study provided an up-to-date assessment of both acute and chronic Hepatitis B virus infections and risk factors associated with viral transmission among outpatient in Kebbi state, Nigeria. The study showed that two third of the population diagnosed with acute and chronic infection in Kebbi state, were predominantly adult males, with a history of sexually transmitted infection, who had no history of receiving HBV vaccine.

In this study, the prevalence of HBV infection among outpatients in Kebbi state was 19.6% higher than that previously documented among prospective blood donors and pregnant women in the state (16.6%)¹⁰. This prevalence is also higher than the 14.0% recorded in Sokoto among patients visiting Specialist Hospital, Sokoto¹⁰, asymptomatic individuals in Nigerian Universities (16.7%)¹¹ and among pregnant (7.9%) and non-pregnant women (7.6%) attending Aminu Kano Teaching Hospital, Kano¹². The prevalence is also higher among asymptomatic sexually active youths in a rural

community of Ebonyi state¹³. However, this study is lower than 20.8% recorded among voluntarily blood donors in Plateau (20.8%)¹⁴ and in primary school pupils in rural Hawal valley, Borno state, Nigeria (44.7%)¹⁵. The results showed an increase in HBV prevalence in the state, which remains a hyper-endemic area. The distribution of HBV infection based on age showed that those between 20-39 years had a higher prevalence. The distribution concerning gender showed that males were more prevalent than the female. This result agreed with the result of Yakubu *et al.*¹¹, who reported the prevalence of 23.4 and 13.1%, respectively, for males and females in Kebbi state. Slight variations in HBV infections were observed in four regions of the state. These variations may be attributed to the difference in community settings and the socio-economic status of the regions^{4,16}.

It was also apparent that the prevalence of chronic HBV infection in this study was extremely low when compared to an estimated national survey of 12.1% in Nigeria^{4,17}. The prevalence increased proportionally with age, gender and regions because of increased exposure to the virus by a significant proportion of the number of unimmunized children in the past and their social activities^{4,7}. Despite the high prevalence of acute infection among singles, the prevalence of chronic HBV infections was higher among married. This could be attributed to the role of sexual transmission and blood transfusion in HBV infection in this population¹⁶. Whereas, the prevalence of chronic HBV infection among adults is an indication of asymptomatic carriers who were misdiagnosed or had never been screened from early childhood^{16,18}.

Logistic regression analysis revealed two distinct patterns of risk factors were observed among males, aged between 20 and 39 years. The results showed increasing age, being male, with the previous history of blood transfusion, sexually transmitted infection and never received HBV vaccine were common risk factors associated with an increased rate of HBV infection. The odds of HBV infections were highest among adults and the odds were greatly elevated by STD, blood transfusion and lack of vaccine coverage among the groups. These findings demonstrated the relationship between the prevalent rate of HBV infection and associated risk factors in the study area^{6,19,20}.

Individuals diagnosed with chronic infection were married and predominantly within the reproductive age group compared with teenagers and the elderly. This study seems to supported the view that vertical transmission is a major contributory factor to chronic HBV infection in endemic areas^{7,18}. Males are more likely to be infected with HBV compared to their female, because of behavioral differences

between the male and female gender²⁰. The risk of chronic HBV infection is proportional to the prevalence of HBV infection in the two regions of the southern part of the state. The regions had the highest odds of prevalent chronic HBV infections than the remaining two emirates regions, because of low socio-economic status and access to health care facilities^{4,18}. The only risk factor assessed but not statistically significant was the history of minor surgical procedures indicated minor surgical procedures did not influence HBV prevalence in the state. This may be due to improved health-care practices in the study area^{20,21}.

Logistic regression analysis revealed that increasing age, being male, widowed, with the previous history of blood transfusion, sexually transmitted infection and never received HBV vaccine were common risk factors associated with an increased rate of HBV infection. The odds of acute and chronic HBV infections were highest among adults and the odds were greatly elevated by STD, blood transfusion and lack of vaccine coverage among the groups. These findings demonstrate the relationship between the prevalent rate of HBV infection and associated risk factors in the study area^{4,19,20}.

CONCLUSION

It can be concluded that screening for HBsAg, anti-HBc and IgM anti-HBc within the population is vital for early diagnosis of chronic HBV infections. This study shows that people diagnosed with acute and chronic infection in Kebbi state were predominantly adult males, both married and singles, with a history of sexually transmitted infection and unvaccinated with HBV vaccine. The findings highlighted the need for a systemic approach to significantly reduce HBV infections.

SIGNIFICANCE STATEMENT

This study provided an up to date records of prevalence of acute and chronic HBV infection and its associated risk factors in Kebbi state, Nigeria. The outcome of the study will help the public health expert and policy makers in designing programs and strategies that could be used to control the spread and transmission of the viral infection in the study population.

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