



**INTERNATIONAL JOURNAL OF SCIENCE FOR GLOBAL SUSTAINABILITY**  
**Seroprevalence of Hepatitis B Virus e Antigen among Blood Donors in  
 Kaduna State, Nigeria**

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Received on: August, 2020

Revised and Accepted on: September, 2020

Published on: October, 2020

**ABSTRACT**

Hepatitis B which is a necro-inflammatory liver disease of variable severity and continues to be a major health problem worldwide despite efforts to curtail its spread especially in developing countries. Four hundred and fifty (450) consenting blood donors residing in Kaduna state were recruited for this study. Two (2mls) of the donor's blood was collected and screened for HBsAg using RDT kits. Positive samples were further screened for HBeAg and HBeAb using ELISA kits. Data were analyzed using SPSS (20.0) for statistical significance at  $p \leq 0.05$ . The prevalence obtained for HBsAg among the 450 blood donors was 14.2% with 45.3% being males while 54.7% were females. 26.6% were positive for HBeAg while 15.6% were positive for HBeAb. Age group 17-26 years had the highest prevalence of 37.5%. The finding of this study reflects a pool of individuals who may be highly infectious and serve in sustaining viral transmission and evolution in the study area.

**Keywords:** Sero-prevalence, e antigen, hepatitis b, blood donors, cirrhosis

**1.0 INTRODUCTION**

Hepatitis B virus (HBV) is a common cause of liver disease throughout the world. Cirrhosis, liver failure and hepatocellular carcinoma develop in 15-40% of chronically infected hepatitis B virus individuals (Rufai *et al.*, 2014). More than 300 million people worldwide are chronically infected with hepatitis B virus (HBV). The lifetime and mortality risks resulting from hepatitis B infection in these regions are estimated at about 60 and 25% respectively (Ofori-Asenso *et al.*, 2016). In the West African sub-region, sero-prevalence levels ranging from 3 to 22% have been reported among blood donors (Tong *et al.*, 2013). Despite the decrease in global HBV infection, the use of serological markers for blood donor screenings is still important, since HBV remains a great risk for blood transfusion patients (Kwon and Lee, 2011; Candotti and Allain, 2009) Considering the very short generation time for a virus, and the high error rate associated with the reverse transcription step of HBV replication, decades of HBV infection are probably equivalent to million years of human evolution. The virus is hundred times more infectious than human immunodeficiency virus

(HIV) and unlike HIV; it can live outside the body in dried blood for longer than a week (Rufai *et al.*, 2014). Hepatitis B virus is responsible for 50-80% of Hepatocellular carcinoma cases worldwide. HBV is transmitted through blood and other body fluids, including semen and saliva.

In Nigeria, vertical transmission remains a major route of Hepatitis B virus infection. Primary (vaccines and post-exposure prophylaxis) and secondary prevention of HBV transmission by appropriate sexual and sanitary practices are not yet optimal in the country yet measures for early detection (serological, molecular) and treatment of infected pregnant women is not a practice (Aba and Aminu, 2016). Hepatitis B e antibody is a soluble viral protein. It is found early in the course of acute hepatitis B and disappears soon after ALT peaks. Persistence of HBeAg beyond 3 months after the onset of illness is unusual and may suggest progression to chronic infection.

In patients with chronic hepatitis B, the presence of positive HBeAg usually indicates a high level of viral

replication and thus infectivity. HBeAg is positive in the immune tolerant phase and in the early immune clearance phase. HBeAg seroconversion is the disappearance of HBeAg and appearance of hepatitis B e antibody (anti-HBe). Most patients enter the inactive HBsAg carrier state after HBeAg seroconversion (Thomas *et al.*, 2012).

The most important selective force during the natural course of HBV infection appears to be the immune response. The development of anti-HBe antibody in hepatitis B patients usually correlates with reduction of HBV viremia, consequently, escape mutants of anti-HBe are selected. The detection of these specific HBV variants may indeed be useful for the identification of those patients requiring preventive and appropriate treatment and a more intensive follow-up strategy for early detection of liver cancer.

HBeAg is important in detecting asymptomatic super carriers and those in the replicative phase of hepatitis B infection since high titres of HBeAg, HBsAg and DNA polymerase are found in their blood. HBV may also be demonstrable in their blood. Very minute amount of serum or blood from such carriers can transmit the infection. This study was designed to determine the prevalence of HBeAg among asymptomatic HBsAg positive prospective blood donors in Kaduna state, Nigeria.

## 2.0 METHODS

### 2.1 Study Design

The study was a cross-sectional study carried out on 450 asymptomatic consenting blood donors at blood donation units of selected hospitals in Kaduna state to investigate HBeAg and HBeAb between November 2013 and July 2014. Each participant completed a standard questionnaire, which included demographic information, history of blood donation, history of unprotected sex, number of sexual partners and other parameters. Consent of the blood donors within the age of 18 years and above residing in Kaduna state, comprising both male and female populations was sort by filling and signing of the consent form by the participant.

### 2.2 Ethical Issue

Ethical clearance was obtained from the Research and Ethics Committee of Kaduna State Ministry of Health, Kaduna.

### 2.3 Sample Collection

Five (5) mls of blood was collected from each donor into a sterile container free of anticoagulant or preservative. The blood sample allowed to clot and centrifuged at room temperature at 3000rpm for 20minutes. The serum was transferred into a sterile screw capped vial and stored at freezing temperature until analyzed.

### 2.4 Laboratory Investigations

All 450 serum samples were screened for HBsAg using a rapid diagnostic test kit (Fastep Polymade, USA). All samples found to be positive for HBsAg were further tested for HBeAg and HBeAb using ELISA kits (AccuDiag). The sandwich ELISA kit is a solid-phase simultaneous sandwich immunoassay, which employs specific monoclonal antibodies and polyclonal antibodies. Protocol for the measurement was done according to the manufacturer's instruction and reading was done at O.D. of 450 nm with an ELISA plate reader. The tests were validated and results were interpreted according to the manufacturer's instruction.

## 3.0 DATA ANALYSIS

Data collected were subjected to descriptive and inferential statistical analysis using SPSS version 20. The differences were considered to be statistically significant when p value obtained was <0.05.

## 4.0 RESULTS

The sero-positivity rate of HBeAg and HBeAb was categorized according to age groups as presented in Table 1.

**Table 1: Distribution of Hbe Ag and Hbe Ab seropositivity according to Age groups.**

Age group (yrs)	Prevalence of serological markers	
	HBe Ag	HBe Ab

	No. examined	Positive (%)	Positive (%)
17-26	24	9 (37.5)	1 (4.2)
27-36	26	6 (23.1)	3 (11.5)
37-46	10	2 (20.0)	2 (20.0)
47-56	2	0 (0.0)	2 (100.0)
≥57	2	0 (0.0)	2 (100.0)
Total	64	17	10
p-value		0.041	0.0001

The highest prevalence of 37.5% (9/24) for HBeAg was found among blood donors within age group 17-26 years; blood donors within age group 27-36 years had the lowest prevalence of 20.0% (2/10) while no HBeAg was detected among blood donors within age group 47-56 years and ≥57 years. The difference in the distribution of HBeAg marker across the age groups was statistically significant ( $\chi^2=9.992$ ,  $df=4$ ,  $p=0.041$ ).

Blood donors within age group 47-56 years and ≥57 years all had HBeAb while blood donors within age group 17-26 years had the lowest prevalence of 4.2% (1/24) for HBeAb. The difference in the distribution of HBeAb was statistically significant ( $\chi^2=201.15$ ,  $df=4$ ,  $p=0.0001$ ).

Table 2 describes the Prevalence of HBsAg among blood donors based on some risk factors. On family history, none of the respondents with family history is HBsAg positive, while 64 representing 15.7% out of the 407 respondents without family history are HBsAg positive with p-value of 0.05 indicating existence of association between individual's HBsAg and family history with Hepatitis B. Eight (8) 7.6% out of 105 people having p-value of 0.027 of the respondents who admitted to have donated blood previously are HBsAg positive while 56 (16.2%) are negative for HBsAg. For blood transfusion 12 (20.0%) out of 60 respondents are HBsAg positive but 51 (13.1%) among the 390 respondents are negative to the test. The p-value of 0.150 shows

relationship between blood transfusion and Hepatitis B. On sex partner as a risk factor, those without sex partners who are HBsAg positive represent 35 (16.8%) out of 208 responses received. Twenty nine 29 (12.8%) of the 226 respondents tested having a p-value of 0.125 are positive which clearly indicate association between individuals Hepatitis B status and sex partners while none (0.00%) among the 16 multiple sex partners are negative to the test. On a similar note, only 2 (1.5%) among the 39 respondents affirmative to the use of condom were positive and 62 (15.1%) with p-value of 0.049 also show association between condom use and Hepatitis B positivity.

**Table 2: Prevalence of Hbs Ag among blood donors based on some risk factors**

Risk factor	HBsAg Positivity			
	No. Examined	Positive (%)	p-value	OR
Family History of HBV				
Yes	43	0 (0.0)	0.005	0.0
No	407	64 (15.7)		
Donated blood			0.027	0.45
Yes	105	8 (7.6)		
No	345	56 (16.2)		
Blood transfusion				
Yes	60	12 (20.0)	0.150	1.66
No	390	51 (13.1)		
Sex partners				
None	208	35 (16.8)	0.125	
Single	226	29 (12.8)		
Multiple	16	0 (0.0)		
Condom use				
Yes	39	2 (5.1)	0.049	1.0
No	411	62 (15.1)		
Total	450	64 (14.2)		

Of the 450 blood donors screened during the study, majority were females 263 (58.4%) while males were 187 (41.6%) with a male to female ratio of 1:1.4. The Mean±SD was 28.1±9.9.

The percentage prevalence for HBsAg among the 450 blood donors screened was 14.2% (64/450) of which 45.3% were males and 54.7% were females. 17 (26.6%) of the 64 HBsAg positive blood donors were also positive for HBeAg of which 55.6% were males and 44.4% were females ( $p=0.26$ ) while 10 (15.6%) were positive for HBeAb.

The presence of HBeAg in a blood sample usually indicates active viral replication and/or liver damage (WHO, 2020). The prevalence of 26.6% recorded in this study is higher than 8.2% and 13.3% in Lagos state, Nigeria and Accra,

## 5.0 DISCUSSION

Ghana respectively (Akinbami *et al.*, 2012). The finding of this study reflects a pool of individuals who may be highly infectious and serve in sustaining viral transmission and evolution in the study area. This finding also indicates that 17 of the 64 HBsAg positive blood donors are either replicative patients or at a risk of liver damage. This places potential blood recipients from these infected donors at a very high risk of contracting hepatitis B infection through occult means, suggesting that the future burden of liver cancer or hepatocellular carcinoma (HCC) associated with HBV is likely to be higher in the study area.

The prevalence of 15.6% for Hepatitis B e antibody (HBeAb) in this study is higher than 8.9% obtained by in Ile-Ife, Osun state (Japhet *et al.*, 2011) among blood donors positive for HBsAg. This finding indicates that these blood donors might be at a stage of convalescence where acute infection is resolving since HBeAb is used to monitor acute infections in those who have recovered from acute hepatitis B infection (WHO Guidelines, 2020). Anti-HBe will be present along with anti-HBc and anti-HBs.

This study also revealed that with advancing age, spontaneous sero-conversion takes place leading to a

reduction in the frequency of HBeAg (Table 1) and an increase in HBeAb.

This study also revealed that with advancing age, spontaneous sero-conversion takes place leading to a reduction in the frequency of HBeAg (Table 1) and an increase in HBeAb.

As presented on table 2, the study was able to establish an association between family history of hepatitis B and HBsAg positivity. Blood donors who claimed to have family history of hepatitis B infection had no HBsAg and this could be that they are more cautious of the disease than those with no family history of hepatitis B. This finding is similar to that of Lavanya *et al.* (2012) in India where a very slight increase of 0.4% prevalence was observed among those with family history of HBV infection.

## 6.0 CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion

This study could confirm the possibility of ‘occult’ or ‘cryptic’ hepatitis B infection within the study area as the blood donors who were positive for HBsAg and HBeAg did not know their status prior to being recruited for the study.

These blood donors are mostly super carriers of hepatitis B or replicative patients since HBeAg was highly detected in their blood without them having any knowledge of such.

The study found an association between family history of HBV, blood donation and condom use with hepatitis B infection which suggest that these risk factors might be contributing to the high endemicity of the infection in the study area.

### 6.2 Recommendations

1. There should be a policy by the government that will make it compulsory for all newborns in the country irrespective of their status to be vaccinated against the infection 12 hours after they are born.
2. Correct and consistent condom use should be promoted among sexually promiscuous age groups through campaigns in tertiary institutions and brothels. Integrated action to eliminate discrimination and gender violence and to increase

access to medical and social services for vulnerable persons should be encouraged.

3. There should be regular screening for hepatitis B while the government should provide free treatment for infected persons just as it applies for people living with HIV/AIDS.

### 7.0 ACKNOWLEDGEMENTS

The authors wish to express their gratitude to Mr. Ibrahim Muhammed of the University Health Services, Ahmadu Bello University, Zaria and all other laboratory personnel of the Department of Microbiology, Ahmadu Bello University, Zaria, who have contributed to the laboratory analysis part of this research.

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