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Seroprevalence of Hepatitis B and C Viruses among Eligible Blood Donors in a Tertiary Healthcare Facility in Nasarawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author PAA designed the study, managed the analyses and literature searches. Author OBV performed the statistical analysis and wrote the first draft of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

The prevalence of blood borne viral infections such as Hepatitis B and C viruses is a public health problem. Screening blood donors is needed to prevent further spread of such infections. The current study aimed to evaluate the seroprevalence of hepatitis B and C viruses among eligible blood donors in a tertiary healthcare facility in Nasarawa State, Nigeria. A cross-sectional survey was conducted on eligible blood donors attending the Heamatological Unit of Federal Medical Centre, Keffi, Nigeria. One hundred blood donors were screened for ABO blood groups using white plain tile. Hepatitis B and C seromarkers were further screened using a rapid test kits (ACON Laboratories Inc, USA). Informed consent and completed self-administered questionnaires on their socio-demographics and exposure to some possible risk factors were obtained. A general prevalence of infections with hepatitis B and C viruses in the study population was 21.0%. The prevalence of HBV was 14.0% while HCV was 7.0% and no blood donor was coinfected with the 2 viruses. However, in this study, gender, age, marital status, occupation, blood group and history of

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blood transfusion had no statistically significant association with Hepatitis B and C viral infections ($p > 0.05$). The 21.0% infection rate reported in this population is a cause for alert because it means there is a high viral reservoir in the area. Measures such as more sensitive techniques, immunization and health education must be advocated in the study area.

Keywords: HBV; HCV; blood donors; Keffi; seroprevalence.

1. INTRODUCTION

Infection with hepatitis B virus (HBV) and hepatitis C virus (HCV) are major global health problems [1]. It is estimated that about 350 million people are chronically infected with HBV and about 200 million people are infected with HCV worldwide [1,2]. Thus, infection with these viruses is associated with increased death rate as the infection may enhance development of serious liver diseases such as liver cirrhosis, liver failure and hepatocellular carcinoma (HCC) [3]. Serological markers for hepatitis of HBV and HCV should be screened in blood banks routinely to be sure that the viruses are not present in the blood. Due to their mode of transmission, [4] it has made the provision of safe blood difficult and the screening of blood necessary [4]. Individuals with hepatitis have high risk of liver cirrhosis and hepatocellular carcinoma. HBV and HCV have similar routes of transmission namely through blood and blood products, intravenous drug abuse, unsafe injections and unprotected sexual intercourse [5]. In Nigeria, 12% of the total populations are chronic carriers of HBV [6].

Chronic hepatitis C is a progressive disease that leads to death through hepatocellular carcinoma and also predisposes to renal cell carcinoma. In Nigeria, HCV infection is still endemic and the prevalence of hepatitis C and its mode of transmission among Nigerians are unidentified, but latest studies across the country among blood donors showed a prevalence ranging between 0.4% and 12.3% of HCV infection [4]. Although the transfusion of blood and its product is a recognized risk factor of acquiring HBV and HCV, it represents a non-alternative life-saving therapy used to reduce morbidity and save thousands of lives every year [2]. In the developing countries, transmission of infection from donors to recipients is increasingly recorded with HBV and HCV due to the lack of the routine serological tests for donors [7]. To address that, routine serological tests for transfusion-transmissible infections (TTIs), including HBV and HCV, were recommended by World Health Organization (WHO) to reduce the transmission of these infections [8,4]. The donor tests results could be used as an indicator of a safe blood supply and also used to evaluate the hepatitis B and C virus prevalence rates among blood donors that help health providers to understand the epidemiology of such an infection in the community [1,6].

The implementation of the blood donor screening system led to a significant decrease in the prevalence of hepatitis B and C viruses. Moreover, educating the donors about the mode of transmission of the viruses has made them alerted to avoid the risk factors. However, the effect of HBV vaccination on the infection among blood donors is not remarkable, since most of the donors did not get HBV vaccine in their childhood [9,7].

There is paucity of data on the seroprevalence of hepatitis among eligible blood donors in Nasarawa State, Nigeria. This study was therefore undertaken to evaluate the seroprevalence of HBV and HCV infections among eligible blood donors. Such information will be relevant for initiating guidelines for disease management, control and prevention policies.

2. MATERIALS AND METHODS

2.1 Study Area and Population

The area of study for this research was Keffi. It is approximately 68 Km from Abuja, the Federal Capital Territory and 128 Km from Lafia, the capital of Nasarawa State. Keffi is located between latitude 8 5'N of the equator and longitude 7 8'E and situated on an altitude of 850 M above sea level [10].

The study population was made up of 100 consented eligible blood donors randomly selected from both sexes. Blood was collected only from those that fulfilled the criteria of being eligible donors. For the purpose of this study, such as ≥ 50 Kg in weight, physically healthy and aged ≥ 18 years. Socio-demographic information of the blood donors was obtained through structured questionnaire. Such information includes; age, sex, occupation, history of blood transfusion.

2.2 Sample Collection

After obtaining a verbal informed consent from each participant, about 5ml of blood sample was collected by vein puncture from all the enrolled subjects in a sterile plain universal container and was transported to the Laboratory of Innovative Biotech Ltd, Keffi, Nigeria for separation. The blood was allowed to clot for 30 minutes and centrifuged at 3000 rpm for 5 minutes. A Pasteur pipette was used to harvest and dispense each resultant serum into a new, labeled plain tube and stored at -20℃ until ready for use.

2.3 Ethical Approval

Approval for this study was obtained from the Ethical Review Committee on Human Research, Federal Medical Centre, Keffi, Nigeria.

2.4 HBsAg Detection

A rapid *in vitro* diagnostic kit which is a qualitative sandwich immunoassay was used to screen the sera for HBsAg. The test kit (one step strips, ACON, USA) utilizes a combination of monoclonal and polyclonal antibodies to detect HBsAg in serum. The test procedure and result interpretation were carried out according to the manufacturer's instructions.

2.5 Anti-HCV Detection

A rapid *in vitro* diagnostic kit (HCV one step strip, ACON, USA) was used for the detection of anti-HCV in serum. This kit uses recombinant proteins and synthesized peptides derived from core and structural regions of HCV for the detection of anti-HCV in serum. The test procedure and result interpretation were carried out according to the manufacturer's instructions.

2.6 Determination of ABO Blood Group

Three spots of Blood from each participant were made on the white plain tile and a drop of each antiserum A, B and D was applied to each spot respectively. The mixture was further stirred with a plastic stirrer in each case and rocked for sometimes. Signs of Agglutination were observed showing red pigment. Antisera D were used to determine the Rhesus factor whether positive or negative.

2.7 Statistical Analysis

The prevalence of viral infection was determined and expressed as a percentage. This was further subjected to Chi-square statistical test to determine the statistical relationship between prevalence and the studied risk factors. A value of $p \leq 0.05$ was accepted as statistically significant.

3. RESULTS

One hundred blood donors consented were recruited for this study. Among them were 91 (91.0%) males and 9 (9.0%) females. The overall seroprevalence of hepatitis in this blood donor population was 21.0%. Of these, 14.0% were reactive to HBsAg and 7.0% to anti-HCV, while none of the blood donors reported a coinfection with the 2 viruses. Males had a higher infection rate of HBsAg while females had a higher infection rate of anti-HCV respectively. When stratified by age, HBsAg case was highest among blood donors above 51 years while anti-HCV was highest among lower age groups. Infection rates with blood group as a risk factor were more for HBV than HCV, and likewise blood transfusion ($p > 0.05$).

4. DISCUSSION

The seroprevalence of hepatitis carriage among eligible blood donors in this study was 21.0%. This is higher than findings of 17.8% in a study among blood donors in Ogbomoso [6] 0.7% in Kano, [11] 0.98% in Iraq [1] and 0.054% in Ethiopia [7].

HBsAg the seromarker used for HBV detection in this study was found in 14.0% of the study population. This prevalence is lower than findings of 14.52% in Ogbomoso [6] but higher than findings of 13.6% [12] 10% in Abeokuta [3] 6.7% in Port Harcourt [13] and 11.1% in Kano [11] among blood donors. Reports from other countries found 11.2% in Cameroun, [5] 4.7% and 3.9% in Ethiopia [2,7] 7.0% in Tanzania [9] 0.78% in Iraq [1] and 0.58% in India [8]. These differences in prevalence might among other reasons be as a result of the sample size adopted for the study, geographical location of the study and sensitivity of laboratory protocols used for screening.

Table 1. Seroprevalence of hepatitis B and C viruses among eligible blood donors in Federal Medical Centre, Keffi, Nigeria with respect to possible risk factors

Risk factors	No. examined	HBV positive (%)	HBV negative (%)	p value	HCV positive (%)	HCV negative (%)	p value
Gender							
Male	91	13 (14.3)	78 (85.7)	0.8180	6 (6.6)	85 (93.4)	0.6423
Female	9	1 (11.1)	8 (88.9)		1 (11.1)	8 (88.9)	
Age (Years)							
< 20	10	1 (10.0)	9 (90.0)		1(10.0)	9 (90.0)	
21-30	36	4(11.1)	32 (88.9)		4(11.1)	32 (88.9)	
31-40	27	2(7.4)	25 (92.6)	0.5111	2(7.4)	25 (92.6)	0.5926
41-50	20	5(25.0)	15 (75.0)		0(0.0)	20 (100.0)	
>51	7	2(28.6)	5 (71.4)		0(0.0)	7 (100.0)	
Marital status							
Single	36	3(8.3)	33 (91.7)	0.5360	3(8.3)	33 (91.7)	0.4422
Married	50	9(18.0)	41 (82.0)		2(4.0)	48 (96.0)	
Divorced	14	2(14.3)	12 (85.7)		2(14.3)	12 (85.7)	
Occupation							
Students	20	2(10.0)	18 (90.0)		4(20.0)	16 (80.0)	
Farmers	8	1(12.5)	7 (87.5)		0(0.0)	8 (100.0)	
Unemployed	9	0(0.0)	9 (100.0)	0.7471	0(0.0)	9 (100.0)	0.1692
Artisans	40	7(17.5)	33 (82.5)		1(2.5)	39 (97.5)	
Civil servants	23	4(17.4)	19 (82.6)		2(8.7)	21 (91.3)	
Blood group							
A+	26	5(19.3)	21 (80.7)		2(7.8)	24 (92.2)	
B+	24	1(4.2)	23 (95.8)		4(16.7)	20 (83.3)	
AB+	7	1(14.3)	6 (85.7)		0(0.0)	7 (100.0)	
O+	29	3(10.3)	26 (89.7)		0(0.0)	29 (100.0)	
A-	6	2(33.3)	4 (66.7)	0.4828	1(16.7)	5 (83.3)	0.4794
B-	3	0(0.0)	3 (100.0)		0(0.0)	3 (100.0)	
AB-	1	0(0.0)	1 (100.0)		0(0.0)	1 (100.0)	
O-	4	2(50.0)	2 (50.0)		0(0.0)	4 (100.0)	
History of blood transfusion							
Yes	42	6(14.3)	36 (85.7)	0.9515	4(9.5)	38 (90.5)	0.4339
No	58	8(13.8)	50 (86.2)		3(5.2)	55 (94.8)	

Similarly, the anti-HCV detection in this study was 7.0%. It is in consonance with the report of Ejiofor et al. [4] who reported that hepatitis C virus infection is increasing in Nigeria, from 4.7% to 5.0% in Ilorin, to 5.3%-6.6% in Enugu, to 11% in Ibadan and 20% in Benin but higher than reports of 3.23% in Ogbomoso [6] 1.8% in Kano [13]. Similar studies from other countries recorded lower rates than the present study. It was 0.2% in Iraq [1] 0.52% in Ethiopia [7] and 1.2% in Tanzania [9]. Genetic diversity, sample size variation and socio-cultural condition may be possible factors for this outcome.

Gender was not found to be associated with the viral prevalence. HBV infection was higher in males than females while HCV infection was higher in females than males. This report is in contrast with a similar study in Ethiopia which reported a higher HBV and HCV in males [7].

The age stratification in this study did not show any significant association in age specific prevalence ($p > 0.05$). HBsAg was detected highest among blood donors that were above 51 years old and lowest among blood donors of 31-40 years old respectively. This is in contrast with a similar report in India which 18-30 years old had the highest prevalence of HBV infection [8].

HCV infection among blood donors was highest among those aged 21-30 years (11.1%) and lowest in those aged 41-50 and above 51 years (0.00%). However, its high prevalence among this age bracket is hinged on the promiscuous nature of adults in this age group. Such was also suggested in a similar study in Nigeria [12].

Similarly the viral infections were not associated with marital status ($p > 0.05$). Both HBV and HCV were highest in divorced. This might be connected with the fact that both viruses are mainly sexually transmitted and risky behavior could have enhanced the transmission among the divorcees. This is in contrast with a similar study in Cameroun [5].

With reference to occupation, artisans and students recorded the highest prevalence in HBsAg and anti-HCV respectively. There was no statistically significant association between viral infections and occupation ($p > 0.05$). There is no obvious reason for this outcome. This study did not correlate with the report of Nwobegahay et al. [5] which reported that unemployed had the highest prevalence of the viral infections.

There was no statistically significant association between blood group and the viral infections ($p > 0.05$). HBsAg was highly reactive in blood group O^- (50.0%) while it was least reactive in blood group B- and AB-. This might be connected to the fact that blood group O is a universal donor and blood not screened for the viruses will be donated during emergencies. For anti-HCV, it was highly reactive in blood group A- and B+ (16.7%) and least reactive in blood group B-, AB+, O+, AB- and O- (0.00%). This might be connected with the fact that blood donors donate blood based on the demand of a particular blood group. Blood group O had selective advantage of their availability over other blood groups. This finding is in agreement with Anwar et al. [14] findings in Pakistan who reported same in O- blood group for HBsAg but contrast for anti-HCV among blood donors [14].

This study found that blood donors that had had a blood transfusion were more reactive for HBsAg and anti-HCV. Although, association with viral infection and blood transfusion was not statistically significant ($p> 0.05$). Other researchers have made the same observations in Nigeria [13] and Ethiopia [2].

5. LIMITATION OF THE STUDY

The authors had some limitations in the course of this study such as challenge in sample selection and limited sample size.

6. CONCLUSION

The present study has shown a high burden of HBV (14.0%) and HCV (7.0%) among blood donors in the study area although none of the studied risk factors was associated with the viral infections. But this is an indicative that a substantial percentage of blood donors harbor Transfusion-Transmissible Infections (TTIs) such as Hepatitis B and C viruses. Therefore strict selection of blood donors and comprehensive screening of donors' blood for Hepatitis B and C viruses using sensitive techniques must be employed. This will ensure the safety of Blood for recipients. These two infections (HBV and HCV) are gradually eroding the Nigerian population, thus to curb them, healthy and moral behaviors as well as health education should be encouraged to reduce their transmission and keep the blood banks and the ordinary Nigerian Citizen safe.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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