Research Article

The Seroprevalence of Hepatitis C Virus (HCV) among Blood Donors at the National Blood Transfusion Service, North Central Zonal Centre, Jos, Plateau State, Nigeria

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Abstract | Hepatitis C virus (HCV) infection is a significant global health concern, and blood transfusion is a potential transmission route. This study aimed to determine the seroprevalence of HCV among blood donors at the National Blood Transfusion Service in Jos, Nigeria. A cross-sectional study was conducted among 189 blood donors selected using systematic random sampling. HCV screening was performed using the ARCHITECT Anti-HCV assay, and demographic data were collected using a structured questionnaire after obtaining informed consent. The overall seroprevalence of HCV was 5.3%. Males aged >50 years had the highest seroprevalence (18.2%), while females aged 31-40 years had the highest seroprevalence (16.7%). A statistically significant association was found between HCV seropositivity and increasing age (p=0.004). These findings highlight the importance of HCV screening among blood donors and emphasize the need for public education on HCV risk factors to promote preventive measures.

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Introduction

Hepatitis is the inflammation of the liver, commonly caused by a viral infection, which can be acute or chronic, symptomatic or asymptomatic (Rosen, 2011). Hepatitis C is a major viral disease of the liver caused by the hepatitis C virus (HCV), which is a significant global health concern (CDC, 2022; Stanaway *et al*., 2016). Viral hepatitis, in general, is a prevalent infection with variable causes that can lead to chronic liver disease. Persistent HCV infection is associated with cirrhosis and hepatocellular carcinoma (Nasir *et al*., 2017). Consequently, HCV-related liver mortality is rising, and viral hepatitis collectively accounts for a higher percentage of global infectious disease mortality than HIV (Lanini et al., 2016).

HCV is a member of the *Flaviviridae* family and is a single-stranded, positive-sense RNA virus approximately 10,000 nucleotides long. It

is a bloodborne pathogen with well-documented transmission routes, including transcutaneous, mucosal, and perinatal modes. However, many patients do not report a recognizable source of infection. Globally, the prevalence of HCV infection varies, with Egypt reporting the highest incidence. The WHO estimates that up to 3% of the world's population has been infected with HCV, amounting to over 170 million chronic carriers (Armstrong *et al*., 2000).

HCV infection is primarily transmitted parenterally and causes hepatic inflammation. Acute HCV infection often goes unnoticed, with most individuals remaining asymptomatic or experiencing mild symptoms. Approximately 60–85% of HCV antibody-positive individuals develop chronic infection, 10–20% progress to cirrhosis, and 1–5% may develop hepatocellular carcinoma within 20–30 years (Shepard *et al*., 2005). Risk factors for HCV transmission include intravenous drug use, dental procedures, prior abortions, surgeries, tattooing, unprotected sex with multiple partners, blood transfusions, hemodialysis, healthcare employment, and being born to an HCV-infected mother (Kumar *et al*., 2007).

Treatment for HCV infection is often inaccessible due to high costs, leaving public health interventions as the most effective prevention strategy. These include screening blood and blood products, adhering to universal precautions, promoting health awareness, and encouraging the use of barrier contraceptives and disposable medical equipment. The low and middle income countries should integrate HCV prevention, screening, treatment, and strategic information into HIV/AIDS programmes for financial, infrastructural, and health workforce efficiencies (Suthar and Harries, 2015).

Materials and Methods

Study area, design, and population

The study was conducted at the National Blood Transfusion Service, North Central Zonal Centre, Jos, Plateau State. Located in Nigeria's Middle Belt, Plateau State spans an area of 26,899 square kilometers and has a population of approximately 3.5 million people, comprising over 40 ethnic groups predominantly engaged in farming. This was a cross-sectional study, and participants were selected using systematic random sampling. The study focused on male and female blood donors at the Department of Haematology/Blood Bank, National Blood Transfusion Service, North Central Zonal Centre, Jos.

Inclusion, exclusion criteria, and questionnaire administration

Participants were required to be within the age range of 18–65 years, weigh at least 50 kg, and have not donated blood within the past 2 months. Participants who declined consent, did not meet age, and those who were ill were considered ineligible for blood donation were excluded. A structured questionnaire and consent forms were administered to participants to collect demographic data.

Sample size and collection and detection of anti-HCV antibody

The sample size was calculated based on a reported prevalence rate of 14.36% (Bigwan *et al*., 2016), and 189 samples were collected. Five milliliters of blood were aseptically collected into EDTA containers, centrifuged at 3000 rpm for 5 minutes, and the plasma stored at -20 ˚C. The ARCHITECT Anti-HCV assay was used to detect HCV antibodies. Pretreatment reagents and samples were mixed, and the reaction was measured using chemiluminescence relative light units (RLUs).

Statistical analysis

Data collected were stored in Microsoft Excel (Microsoft Corporation, USA) and were analyzed using Statistical Package for Social Sciences software (version 22.0. IBM Corp., NY, USA). Percentages and proportions along with a 95% confidence interval were calculated for variables. Relationships between categorical variables were assessed using the Chi-square test, with a significance level set at $p < 0.05$.

Results

Prevalence of HCV according to age and sex

The seroprevalence of HCV among blood donors in the study population based on age and sex revealed that males aged >50 years had the highest seroprevalence of 18.2% (2), followed by the age group 21–30 years with a seroprevalence of 6.5% (2). In contrast, the age group ≤20 years had no detectable antibodies (0.0%). The age group 31–40 years had the highest seroprevalence of 16.7%, while females in the age group ≤20 years also showed no detectable HCV antibodies (0.0%). It was observed that the prevalence

of active HCV infection increased significantly with an increase in age (p=0.004) as presented in Table 1.

Table 1: *Prevalence of HCV in relation to age group and sex.*

Characteristics	No examined (%)	No.Positive (%)	P value
Age group (Year)			
≤ 20	4 (2.1)	0(0.0)	0.004
21-30	40 (21.2)	2(5.0)	
31-40	78 (41.3)	3(3.8)	
41-50	54 (28.6)	3(5.7)	
>50	13 (6.9)	2(15.4)	
	189	10(5.3)	
Sex			
Male	159 (84.0)	8(5.0)	0.717
Female	30 (16.0)	2(6.7)	

Assessment of risk factors that aid the transmission of hepatitis C infection

As shown in Table 2, participants with a history of blood transfusion showed no significant association with HCV infection (p= 0.4390). Conversely, participants whose relatives had died of HCV had a significantly higher likelihood of infection (p = 0.0140). Participants with family members living with HCV (p = 0.4390) and those who had been hospitalized (p = 0.1380) showed no significant association with HCV infection. However, participants who had undergone surgeries had a significant association with HCV infection (p = 0.0001), as did those who had traveled outside Nigeria (p = 0.0140).

Demographical characteristics of participants in the study with hepatitis C positive infection

The seroprevalence of HCV among blood donors based on marital status (Table 3) showed that married participants had a slightly higher seroprevalence of 5.4% (6) compared to single participants, who had a seroprevalence of 5.3% (4). No antibodies for HCV were detected in divorced participants or widows. There was a significant association between marital status and HCV infection (p = 0.0150).

We observed eighty-four (84.0%) among the male participants and 16.0% females (Table 1). In terms of occupation, farmers had the highest prevalence 9.1% (1), followed by civil servants 8.8%, (6). Participants involved in business and other occupations had lower seroprevalence rates, and no significant association was observed (p = 0.1200).

Table 2: *Assessment of risk factors that aid the transmission of hepatitis C infection.*

Risk factors	No. examined	No. positive (%)	X^2	P-value
Blood transfusion				
Yes	3	1(33.3)	0.599	0.4390
No	186	9(4.8)		
Relative died of HCV				
Yes	3	1(33.3)	5.986	0.0140**
No	186	9(4.8)		
Member of the family living with HCV				
Yes	5	1(20)	0.599	0.4390
No	184	9(4.8)		
Hospitalized				
Yes	90	3(3.33)	2.196	0.1380
No	99	7(7.1)		
Surgeries performed				
Yes	23	1(4.3)	27.803	0.0001**
No	176	9(5.1)		
Travelled outside before				
Yes	34	0(0)	5.982	0.0140**
No	155	10(6.5)		

Table 3: *Demographical characteristics of participants in the study with hepatitis C positive infection.*

Variable	No. examined (%)	No. positive	X^2	P-value
Marital status				
Single	75	4(5.3)	10.462	0.0150**
Married	112	6(5.4)		
Divorced	1	0(0.0)		
Widow	1	0(0.0)		
Occupational status				
Farmer	11	1(9.1)	10.890	0.1200
Civil servant	68	6(8.8)		
Business	46	1(2.2)		
Other	64	2(3.1)		
Level of education				
Primary	1	0(0.0)	13.098	0.0010**
Secondary	67	4(6.0)		
Tertiary	118	6(5.1)		
None	3	0(0.0)		

For educational level, participants with a secondary education had the highest seroprevalence 6.0% (4), while those with tertiary education showed a prevalence of 5.1% (6). No antibodies for HCV were

detected in participants with primary or no formal education. This result showed a significant association between educational level and HCV infection (p = 0.0010).

Discussion

The present study revealed a 5.3% overall prevalence of Hepatitis C Virus (HCV) infection, indicating that approximately 53 out of every 1,000 individuals in the study area were infected. This finding is consistent with previous reports, including a 5.2% prevalence among blood donors in North Central Nigeria (Bigwan *et al*., 2016) and a 5.3% prevalence in Sub-Saharan Africa (CDC, 2022). The circulation of HCV infection among the study population poses a significant risk of hepatocellular carcinoma development if left unscreened or untreated. The finding was higher than a previous estimate of HCV among the general population in Ethiopia (0.82%, 1.5% and 3.1%), and 1.2%, (Sierra Leone), 2.7% in Congo (Tognon et al., 2020). This observed finding is higher than earlier report of 3.3% among blood donors in Kano (Muttaka et al., 2019), and 2,8% among general population in Makurdi, Nigeria (Achinge et al., 2013). This suggests that blood donors could be considered a high-risk group due to incentives associated with blood donation at some centers. This was also confirmed by the use of voluntary blood donations by unemployed and students donors in exchange for a meal and transport fee (Tognon et al., 2020).

Out of these participants, majority were males (84.0%), and this was in agreement with earlier finding by Muttaka et al. (2019), suggesting that higher male ratio could be due to cultural and women perspective that females don't donate blood during menstruation and pregnancy.

Notably, the prevalence rate in this study is lower than the 12.3% and 11% rates reported in earlier studies (Halim and Ajayi, 2000; Ndako *et al*., 2009). Conversely, the prevalence rate is higher than those reported in countries such as the United States (0.3%) (Dodd *et al*., 2002), Greece (0.5-2%) (Christos *et al*., 2016), and Iran (0.18%) (Kourosh *et al*., 2017). These disparities may be attributed to variations in awareness and implementation of preventive measures, diagnostic kit sensitivity and specificity, healthcare service quality, and viral transmission rates. Additionally, differences in testing methodologies and regulatory frameworks may have contributed to the observed differences (Thakral et al., 2006).

The analysis of HCV seroprevalence concerning risk factors in this study yielded significant findings. Notably, a substantial proportion (33.3%) of individuals who had a family member die from HCV were found to be seropositive, and this association was statistically significant (P = 0.014). This elevated risk may be attributed to exposure to infected bodily fluids through shared use of contaminated sharp objects (Muhibi *et al*., 2019). Furthermore, the study revealed a strong association between HCV seroprevalence and history of surgical procedures (P = 0.0001), highlighting the potential role of medical interventions in HCV transmission.

Interestingly, the study found that individuals who had not traveled outside the country had a higher HCV seroprevalence rate of 6.5%, with a significant association observed (P = 0.0140), implying that travel may decrease the risk of HCV infection, possibly due to increased awareness and adoption of preventive measures while traveling. In contrast, other examined risk factors did not demonstrate a significant association with HCV seroprevalence (P > 0.05), possibly due to improved health practices and increased awareness about hepatitis C transmission risks.

Furthermore, the study found a significant association between marital status and HCV prevalence (P = 0.0150). Specifically, married participants had a higher HCV prevalence rate of 5.4%, whereas divorced and widowed individuals had no detectable prevalence. This disparity may be attributed to the larger sample size of married participants compared to the smaller representation of divorced and widowed individuals.

The prevalence of HCV among blood donors with a level of education shows a high prevalence of 6.0% among participants with secondary education and 5.1% among those with tertiary education. The data indicates that a significant proportion of artisans and traders possess secondary education, and have achieved a level of economic stability that enables them to adopt lifestyles that may increase their vulnerability to certain risks that could predispose them to infections compared to individuals with other educational backgrounds, p, 0.001).
Farmers also had a high prevalence of the infection

concerning occupational status, followed by civil servants. The high prevalence among farmers may be a result of a lack of awareness of the transmission of hepatitis C infection. An earlier study reported a high prevalence amongst the employed (36.4%), followed by students (33.7%), and the least among the unemployed (29.7%), which differs from this finding (Nwannadi *et al*., 2012). However, there was no significant association with occupational status.

Study limitation

This study's sample was small, and the findings are specific to the Jos Regional Blood Transfusion Center and may not be broadly applicable. Additionally, several limitations were noted. The antibody-based test used for HCV detection may have missed individuals in the window period, potentially underestimating the true prevalence. Furthermore, the lack of resources prevented the detection of HCV RNA and genotyping, which would have provided more detailed insights into the virus's characteristics.

Conclusion

Our study revealed a notably high seroprevalence of HCV among blood donors in Jos, North Central Nigeria. The dominance of male participants, including all HCV-reactive donors, suggests a gender disparity in blood donation willingness. Enhancing public awareness, education, and perception of blood donation can encourage more female participation. Implementing rigorous donor selection and sensitive screening tests will improve blood safety and reduce the transmission risk of HCV and other transfusion-transmitted infections. The persistent or rising trend of HCV seroprevalence over the years necessitates prompt action to align with the World Health Organization's goal of eliminating hepatitis C as a public health threat by 2030.

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Author's Contribution

All Authors contributed equally to the manuscript.

Ethical approval

Ethical approval was obtained from the Ethical Committee of the National Blood Transfusion Service, North Central Zonal Centre, Jos, Plateau State (Ethical Clearance Ref No: NBTS/EC/EA/57). Informed consent was obtained from each participant at the time of blood donation.

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Conflicts of interest

The authors have declared no conflict of interest.

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