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Seroprevalence of Hepatitis B and C virus infections among pregnant women attending antenatal care in a secondary health facility in Northern Nigeria

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Abstract
Objective: Viral hepatitis is a major global public health challenge with Hepatitis B virus (HBV) and Hepatitis C virus (HCV), particularly leading to chronic diseases in several millions of people together they are the most common cause of liver cirrhosis, liver cancer and deaths related to viral hepatitis. They can be spread by mother-to-child transmission at birth. Despite the significant health burden it places on pregnant women and their infants, the infection has been given little attention in Nigeria and some low- and middle-income countries, and routine screening during antennal care are not done for most pregnant women. This study assessed the seroprevalence of Hepatitis B and C viral infections among pregnant women.
Methods: The study was cross-sectional involving a three-year retrospective review of laboratory results of the pregnant women who accessed antenatal care in the health facility. Data extraction was done manually from facility registers and analyses were done using IBM SPSS.
Results: Laboratory results of HBV and HCV for 706 pregnant women were reviewed. The seroprevalence of HBV and HCV was 11.6% and 6.5% respectively while the seroprevalence of viral hepatitis was 18.1%.
Conclusion: The high seroprevalence of viral hepatitis in this study further supports the importance of adopting global best practices to prevent the spread of the infection via mother-to-child transmission. We, therefore, re-emphasize the importance of screening for HBV and HCV as routine investigations in pregnant women**.**

Keywords: Hepatitis B virus, Hepatitis C Virus, mother-to-child-transmission, Nigeria, Seroprevalence

Plain English Summary

Hepatitis B virus and Hepatitis C virus cause chronic diseases in several millions of people and together they are the most common cause of liver cirrhosis, liver cancer and deaths related to viral hepatitis. They can be spread from mother to child transmission during birth. Despite the significant health burden it places on pregnant women and their infants, the infection has been given little attention in Nigeria and some low- and middle-income countries, and routine screening during antennal care are not done for most pregnant

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women. This study assessed the seroprevalence of Hepatitis B and C viral infections among pregnant women by reviewing the laboratory results of women who attended antenatal care in a secondary healthcare facility from 2018 to 2020. The seroprevalence of Hepatitis B and C viruses was found to be high in this study and this finding supports the importance of adopting global best practices by healthcare workers in order to prevent the spread of the infection by mother-to-child transmission. We, therefore, re-emphasize the importance of screening for HBV and HCV as routine investigations in pregnant women who are attending antenatal care.

Background

Viral hepatitis is a major global public health challenge with Hepatitis B virus (HBV) and Hepatitis C virus (HCV), particularly leading to chronic disease in several millions of people; together they are the most common cause of liver cirrhosis, liver cancer and deaths that are related to viral hepatitis (1, 2). About 354 million people globally are living with hepatitis B or C virus (1) and the infection is responsible for about 1.4 million deaths which is greater than the death of about 1.2 million from HIV infection annually, making it to be among the leading causes of death globally (3).

HBV is most commonly spread by mother-to-child transmission (MTCT) at birth or through horizontal transmission, especially from an infected child to an uninfected child during the first 5 years of life following exposure to infected blood, and in adulthood, through sex with an infected partner (4). About 296 million people were living with chronic HBV infection with about 820,000 deaths (4). There is a safe and effective vaccine against HBV with 98%-100% protection (2). However, in the absence of any preventive interventions, the risk of MTCT of HBV for mothers with high HBV viral load or are Hepatitis B envelop Antigen (HbeAg)-positive ranges from 70% - 90% while in HBeAg negative individuals the risk is 10% - 40% (2).

About 58 million people have chronic HCV infection globally, and in 2019, about 290 000 people died from HCV infection (5). HCV is transmitted through the skin when exposed to infected blood, from mother-to-child transmission (MTCT) and by sharing contaminated objects. The rate of MTCT is about 5%. The infection has a strong association with cholestasis and preterm birth. Children who are infected during the perinatal period develop cirrhosis at an earlier age than those who acquire HCV as adolescents. Pregnant women who have cirrhosis have a higher risk of poor maternal and neonatal outcomes than those without cirrhosis (5, 6).

There is no effective vaccine against hepatitis C (5) so prevention includes reducing the risk of exposure to the virus among women within the reproductive age to avoid MTCT. Although Antiviral medicines can cure more than 95% of persons infected with HCV, access to diagnosis and treatment is low (5), and these antiviral drugs are also contraindicated in pregnancy (7, 8) making prevention of MTCT difficult. Due to the associated high risk of maternal, fetal, and neonatal complications from HCV infection (9), prenatal diagnosis of HCV will be of benefit to both the mother and child, as the baby will be initiated to care early if positive and the mother will be managed appropriately to limit the complications.

However, despite the significant health burden it places on pregnant women and their infants, the infection has been given little attention in Nigeria and some low- and middle-income countries (LMIC), and routine screening for viral hepatitis during ANC is not done for most pregnant women (10). This may be due to a lack of awareness by the healthcare workers on the benefits of screening for viral hepatitis in pregnant women and the low socioeconomic status of the pregnant women resulting in an inability to pay for the screening. So, this study assessed the screening of pregnant women for viral hepatitis and the seroprevalence of HBV and HCV infections among pregnant women to inform policy on viral hepatitis prevention.

Methods

Study Area

This study was done at Jengre Seventh-day Adventist (SDA) Hospital, a secondary healthcare facility in the Bassa local government area of Plateau state, Northern Nigeria. The hospital serves as a referral centre for all other primary healthcare and private facilities within the area and neighbouring states. The hospital runs ANC once a week and screening for HBV and HCV are done as routine laboratory investigations for women at their booking visits since 2018. HBV and HCV tests were done using rapid diagnostic test kits to detect the presence of Hepatitis B virus surface antigen (HBsAg) and HCV antibodies respectively. A total number of 1252 pregnant women visited the booking clinic within the period studied, with an average of about 8 women per clinic.

Study Design
The study was cross-sectional. It involved a three 3-year retrospective review of laboratory results (from 2018 to 2020), Data collection was from the laboratory records and this was done between May and October 2021.

Study Population
The study population was pregnant women attending the antenatal clinic in the Jengre Seventh-day Adventist Hospital who had HBV and HCV requested and the results available, however, those with incomplete results were discarded.

Data Collection
Four categories of registers were used for data collection and these included the ANC visit register, the ANC register, the laboratory request register, and the laboratory result register. The ANC register is domiciled at the ANC and contained the name, age, and address of the patients and the result of their laboratory investigations (HBV, HCV, and HIV results). The ANC visit register is domiciled in the medical records unit of the outpatient department which is the first point of call for the patients at every visit to the hospital, and it contained the name, age, address of the patients and also the nature of the visit (first or follow-up). The laboratory request register captured the sociodemographic characteristics of the patient (name, address, date of sample collection and age), and the investigations to be carried out. The laboratory result register contained the sociodemographic characteristics already listed and the results of the laboratory investigations. These registers were utilized to ensure quality control and to get any relevant record missing in any of the registers. The results and other information were abstracted manually using a form.

Data Extraction
Data collection was done using a data abstraction form which captured information on the age of the client, month/year of the visit to the laboratory, and the result of laboratory tests (HBV, HCV, HIV, HBV and HCV multimorbidity, HBV/HIV comorbidity, HCV/HIV comorbidity, and triple morbidity with HIV/HBV/HCV). Data collection was completed over six months.

Data Analysis
Data were processed and analyzed using SPSS version 23, manufactured by International Business Machines Corporation, Armonk, New York, United States of America. Mean and standard deviation was used to summarize the age of the participants. Frequencies were presented using numbers and percentages. Bivariate analysis was done to determine the association between independent variables (age and HIV status) and dependent variables (HBV and HCV). At a 95% confidence interval, a p-value less than 0.05 was considered to be statistically significant.

Result
A total of 706 (56.4%) women had their results reviewed. These were those who had complete information including results for HBV and HCV, from combining the four registers used for data abstraction. Five hundred and forty-six (43.6%) women did not have complete information on the registers, either they were not screened or they were screened but the results were not documented in the registers.
The ages of the women ranged from 15 to 46 years with an average age of 27.05± 6.03 years. The modal age group was 25-35 years with 326 (46.2%) participants, table 1.

Table 1. Sociodemographic characteristics of the pregnant women

Variables	Frequency (Percentage)
Age Group (years)	
≤ 25	316 (44.78)
25-35	326 (46.18)
> 35	64 (9.07)
Mean age (years) (*SD)	27.05 ±6.03
HIV Status	
Positive	55 (7.79)
Negative	651 (92.21)
Number of women tested/year	
2018	238 (33.7)
2019	202 (28.6)
2020	266 (37.7)

*SD- standard deviation

The seroprevalence of HBV and HCV in the study population over the three years was 11.6% and 6.5% respectively, while the total seroprevalence of hepatitis b and c was 18.1%%. HBV and HCV had their highest prevalence in 2019 with a prevalence of 15.8% for HBV and 9.4% for HCV. The prevalence of HBV and HCV co-infection was 0.14% with a co-infection rate of 1.2% (1/82). HBV and HIV co-infection was found among 0.8% of the clients with a co-infection rate of 7.3% {6/82}), while HCV and HIV co-infection was found among 0.7% of the clients with a co-infection rate of 10.9% (5/46). None of the women had triple morbidities (HBVHCV/HIV) Table 2.

Table 2. Results of the laboratory tests review

Year of test	**2018**	**2019**	**2020**	**Total**
Number of clients	238	202	266	706
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	**Frequency (%)**
Hepatitis B				
Positive	24 (10.1)	32 (15.8)	26 (9.8)	82 (11.6)
Negative	214 (89.9)	170 (84.2)	180 (90.2)	624 (88.4)
Hepatitis C				
Positive	11 (4.6)	19 (9.4)	16 (6.1)	46 (6.5)
Negative	227 (95.)	183 (90.6)	250 (9.9)	660 (93.5)
HIV				
Positive	19 (8.0)	24 (11.9)	12 (4.5)	55 (7.8)
Negative	219 (92.0)	178 (88.1)	254 (95.5)	651 (92.2)
Hepatitis B and C co-infection				
Yes	1 (0.4)	0 (0)	0 (0)	1 (0.14)
No	237 (99.6)	202 (100)	266 (100)	705 (99.86)
Hepatitis B and HIV co-infection				
Yes	2 (0.8)	2 (1.0)	2 (0.6)	6 (0.8)
No	236 (99.2)	200 (99.0)	264 (99.4)	700 (99.2)
Hepatitis C and HIV co-infection				
Yes	3 (1.3)	2 (1.0)	0 (0)	5 (0.7)
No	235 (98.7)	200 (99.0)	266 (100)	701 (98.3)
Hepatitis B and C and HIV co-infection				
Yes	0 (0)	0 (0)	0 (0)	0 (0)
No	238 (100)	202 (100)	266 (100)	706 (100)

There was no statistically significant association between age and HBV or HCV infections. There was also no statistically significant association between the HIV status of the women and their HBV or HCV results, Table 3.

Table 3. Factors associated with HBV and HCV infections

Variable	**Negative**	**Positive**	**Total**	**X^2**	**P-value**
		HBV			
Age group					
≤ 25	283 (89.6)	33 (10.4)	316	2.3793	0.3043
26-35	282 (86.5)	44 (13.5)	326		
> 35	58 (92.1)	5 (7.9)	63		
HIV					
Negative	574 (88.3)	76 (11.7)		0.0303	0.8619
Positive	49 (89.1)	6 (10.9)			
		HCV			
Age group					
≤ 25	293 (92.7)	23 (7.3)	316	0.5622	0.7549
26-35	307 (94.2)	19 (5.8)	326		
> 35	60 (93.7)	4 (6.3)	64		
HIV					

Negative	610 (93.7)	41 (6.3)	652	0.2720	0.6020
Positive	50 (93.5)	5 (6.5)	55		

Discussion

This study accessed the results of pregnant women screened for HBV and HCV to determine the seroprevalence among them. We found that the prevalence of HBV was 11.6% and HCV was 6.5% within the years studied.

The seroprevalence of hepatitis b and c viruses in this study is higher than that of 6.25% in Ethiopia and 8.1% in the western part of Nigeria This may be attributed to the lower sociocultural status of these women, polygamous marriage practices, cultural practices like tribal marks, and early marriages practices in the setting where this study was conducted (11, 12).

Also, the seroprevalence of HBV was found to be higher than the findings from studies done in other parts of Nigeria and other LMICs where the seroprevalence ranged from 4.6%-9.7% (11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22), but lower than the finding in Angola of 25.7% seroprevalence (23). A similar study in Central Nigeria also found a high prevalence of 19.5% and this may be due to the exclusion of women who had been vaccinated for HBV from the study (24).

Furthermore, this study found a seroprevalence for HCV which is lower than the global prevalence of 8% (25) but higher than the prevalence found in studies done in the USA of 4% (25) and Spain of 0.26% (15) and parts of Africa which ranged from 1.3%-1.6% (11, 12, 18, 26, 27).

The high prevalence levels of HBV and HCV found in this study may be attributed to low levels of HBV vaccination for HBV, poor awareness of the routes of transmission of hepatitis, low level of education of the women, highly risky sexual behaviours, and rural setting which characterized the environment where this study was conducted.

The prevalence of HBV/HCV co-infection was found to be 0.14% and this finding was similar to the finding of 0.15% in another study done in Nigeria. This supports the fact that HBV and HCV have similar routes of transmission (12,27) and similar interventions and strategies can be applied in their preventions for both person-to-person transmission and MTCT. Also, HBV and HCV co-infection rate was 1.2% and this was similar to the 1.4% found in Ethiopia (11).

Though this study found that there were HBV/HIV and HCV/HIV co-infections respectively, there was however no statistically significant association between the HIV status of the participants and their HBV or HCV infections respectively. Also, there was no statistically significant relationship between age and HBV and HCV infections respectively. This was similar to the findings in a study done in Tanzania (16).

Co-infection of HBV/HIV was 0.8% in this study and this was lower than but closely similar to the finding of 1.4% in a study done in Ethiopia (11). In addition, the co-infection for HCV/HIV in this study was 0.7% and this was also similar to the findings of a survey done in Nigeria with co-infection of 0.6% (26). Furthermore, the prevalence of HIV in this study was 7.8% which was closely related to findings of 5.2% from a study conducted in Jos, Nigeria (28). These findings also corroborate the fact that viral hepatitis and HIV have similar routes of transmission and similar control measures can be applied for their prevention.

Limitations of this study

This study was retrospective cross-sectional and there were missing data but this was however minimized by combing the various registers from the various units. Only rapid tests for HBV and HCV were done. Further investigations should have been done to confirm the presence of active infections among those who tested positive.

Conclusions.

A high prevalence of seropositive pregnant women found in this study further supports the importance of adopting global best practices in order to prevent the spread of viral hepatitis infection. Therefore, there is a dire need for routine screening of women during antenatal care in all healthcare facilities in Nigeria, to identify women with chronic infections who serve as a reservoir for person-to-person transmission and MTCT of the viruses.

List of abbreviations

ANC- antenatal clinic
EDTA- ethylenediaminetetraacetic acid
HBV- hepatitis B virus
HBeAg- hepatitis B envelop antigen
HCV- hepatitis C virus
HIV- Human Immune Deficiency Virus
LMIC- low-and-middle-income-countries
MTCT- maternal-to-child-transmission
SDA- Seventh-day Adventist

Declarations

Ethics approval, and Consent to Participate

Written permission was sought and obtained from the Institutional Review Board of the SDA Hospital Jengre (JSDAH/IRB/003/2021-01) before commencing this study. All methods in this study were performed in accordance with the guidelines and regulations of the approving institution. Pregnant women who access ANC care in SDA Hospital Jengre are counselled and requested to give anticipatory consent for future research. In order to ensure confidentiality, documents used for data collection were stored in a locked file cabinet and personal identifiers removed from study documents as soon as data collection was completed.

Consent for publication
All the authors gave consent for the publication of the work under the creative commons Attribution-Non-Commercial 4.0 license.

Availability of data and materials
The data generated and analyzed in this study are available from the corresponding author upon reasonable request.

Competing interests
All authors do not have any competing interests.

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The authors provided the funding for this study.

Authors' contributions
AC was involved in the conception, design of the work, analysis and interpretation of data, and drafting of the work. LUH was involved in the design of the work, interpretation of data, and drafting of the work. AT was involved in the design of the work, analysis and interpretation of data, and drafting of the work. OAO was involved in the interpretation of data and satisfactorily revised the work. AA was involved in the interpretation of data and satisfactorily revised the work. OA was involved in the conception and design of the work and satisfactorily revised the work. All the authors read and approved the final manuscript.

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