International Journal of African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 6, Issue 1, 2023 (pp. 53-62)
www.abjournals.org

SEROPREVALENCE AND SOCIODEMOGRAPHIC CHARACTERISTICS FOR HEPATITIS C INFECTION IN NORTH CENTRAL NIGERIA

Emmanuel Isa Bigwan[1], Saleh A. Ado[2] and Helen I. Inabo[2]

[1]Department of Medical Laboratory Science, College of Health Sciences, University of Jos, Nigeria. E-mail: emabigwan@gmail.com.

[2]Department of Microbiology, Faculty of Life Sciences, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

Cite this article:

Bigwan E.I., Ado S.A., Inabo H.I. (2023), Seroprevalence and Sociodemographic Characteristics for Hepatitis C Infection in North Central Nigeria. African Journal of Biology and Medical Research 6(1), 53-62. DOI: 10.52589/AJBMR-2CIIKVVS

Manuscript History

Received: 1 Feb 2022

Accepted: 27 Feb 2023

Published: 18 March 2023

ABSTRACT: *Hepatitis C virus infection is a concern for global health because it increases the risk of hepatocellular cancer, liver fibrosis, and mortality from liver disease. No safeguarding vaccination is yet accessible. The study's objectives were to identify the sociodemographic characteristics and the seroprevalence of the hepatitis C virus in the study area. A cross-sectional study was conducted by collecting blood samples from 1511 participants which were analysed for anti-HCV using a third-generation ELISA Kit. Data were analysed using SPSS version 23.0. p-values < 0.05 were considered significant. An overall 5.2% of the 1511 samples analysed were seropositive. Males had a seroprevalence of 7.1%, whereas females had a seroprevalence of 3.9% (p=0.01). The lowest seroprevalence was among the divorced and widowed, who had no detectable anti-HCV (p=0.007). Singles had the highest seroprevalence at 7.1%. Seroprevalence was highest (5.9%) among those with tertiary education and lowest (2.7%; p=0.461) among those with primary education. The highest seroprevalence was 6.9% among unemployed people, whereas the lowest was 3.4% among farmers (p=0.414). The highest seroprevalence was seen in monogamists (6.1%), with polygamists having none (p = 0.05). The seroprevalence was highest in non-alcoholics at 5.5% and lowest in alcoholics at 4.1% (p=0.407). Smokers had the lowest seroprevalence, at 3.2%, whereas non-smokers had the highest, at 5.3% (p=0.462). It is imperative to act quickly to prevent liver disease morbidity and mortality given the seroprevalence of 5.2% of HCV, which is of considerable public health concern.*

KEYWORDS: HCV, infection, seroprevalence, socio-demographic data, liver disease.

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

International Journal of African Journal of Biology and Medical Research
ISSN: 2689-534X
Volume 6, Issue 1, 2023 (pp. 53-62)

www.abjournals.org

INTRODUCTION

Hepatitis C virus (HCV) is a member of the Flaviviridae family. It is a positive sense, single-stranded RNA Virus. When it causes acute hepatitis, there is a high risk of developing a chronic infection. The progression of chronic HCV infection to severe liver diseases, such as cirrhosis and hepatocellular cancer, is possible[1].

Globally, an estimated 58 million people are thought to have chronic hepatitis C virus infection, and each year, 1.5 million new cases are reported. Also, 3.2 million children and adolescents are estimated to have a chronic hepatitis C virus infection. According to the WHO, cirrhosis and hepatocellular carcinoma accounted for the majority of the 290,000 hepatitis C-related deaths in 2019. Over 95% of people with hepatitis C can be cured with antiviral drugs, but access to diagnosis and treatment is poor [2].

The most common routes for the spread of the blood-borne hepatitis C virus are drug injection and the sharing of injection supplies, as well as the reuse or inadequate sterilisation of medical supplies, particularly syringes and needles, in healthcare facilities. Although these methods of transmission are uncommon, HCV can be passed from a mother with the disease to her unborn child or through sexual activities that expose people to blood. Hepatitis C prevention mostly relies on lowering the risk of viral exposure in healthcare settings and in higher-risk populations because there is presently no vaccine against it [2]. Mother-to-child transmission [3] and percutaneous treatments like tattooing and body piercing [4] are other ways that HCV can be transmitted.

Since the majority of earlier studies only covered a small area, they might not have provided a better picture of the illness there. The study uses the major tertiary health facilities to cover three states within the study area because there are few large-scale, multicenter, representative studies on the burden of HCV in the region. The purpose of this study was to ascertain the sociodemographic information and seroprevalence of the hepatitis C virus in the study area.

MATERIALS AND METHODS

The cross-sectional study was conducted in parts of North Central Nigeria between May 2012 and March 2013. Plateau, Nasarawa, and Benue were the three states included in the study area. The majority of the study's participants were adult patients, blood donors, and expectant mothers who attended antenatal clinics at tertiary healthcare facilities in the chosen study sites.

Before starting the work, we received ethical clearance from the respective Research Ethics Institutional Review Boards of the selected hospitals (the Federal Medical Centers in Keffi, Nasarawa State, Makurdi, and Benue State, as well as Jos University Teaching Hospital in Plateau State).

The study included all of the participants who provided their consent and tested HIV-negative. The study did not include any participants who did not provide their consent or who were HIV positive.

Each patient had their cubital vein venipuncture using sterile, disposable needles and syringes to get five millilitres of blood aseptically collected in an anticoagulated tube. Before the study began, written informed consent was obtained, and socio-demographic information was

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

gathered using self-administered structured questionnaires. Before the examination, samples were divided into individual vials and stored at -20°C.

Using a third-generation ELISA kit made by Autobio Diagnostics, China, all of the samples were tested for HCV antibody (anti-HCV) in accordance with the manufacturer's instructions. The results acquired were then subjected to statistical analysis using the statistical program SPSS version 23.0. At a 95% confidence level, Pearson chi-squares were taken into consideration. Statistics were considered significant for P values under 0.05.

RESULTS

Figure 1 illustrates the 5.2% of the 1511 samples examined in this investigation that contained anti-HCV antibodies. Table 1 summarises the seroprevalence of anti-HCV in relation to key sociodemographic factors. A statistically significant connection (p = 0.01) was found between seroprevalence and gender, with males having a greater seroprevalence (7.1%) than females (3.9%). The highest seroprevalence was found in single people (7.1%), followed by married people (4.6%), and the lowest seroprevalence was found in divorced and widowed people (no detectable anti-HCV in their samples) (p = 0.007).

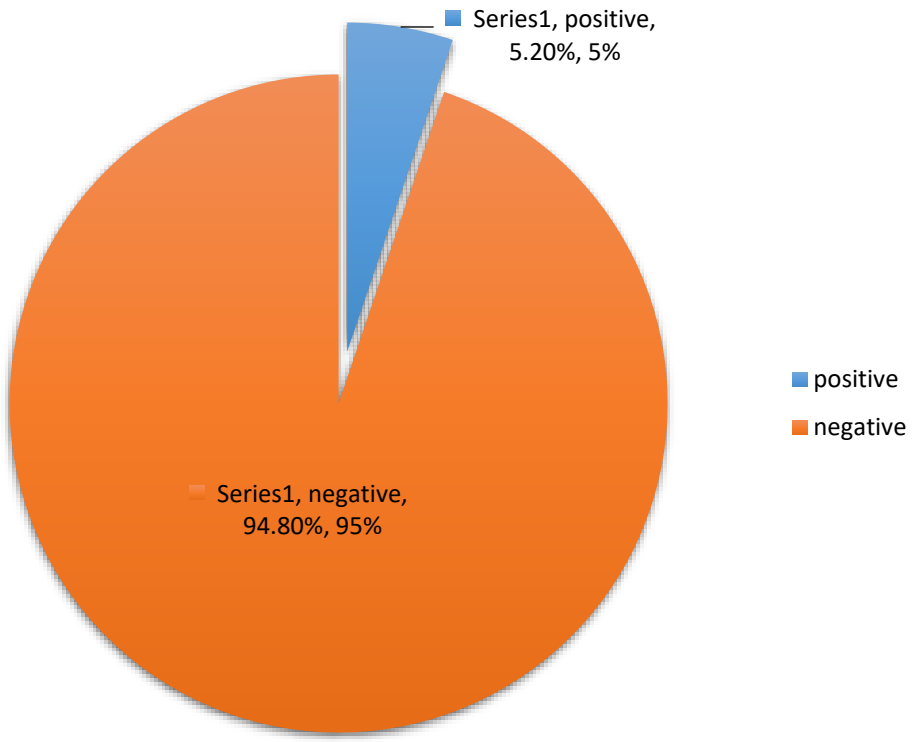

Figure 1: Distribution of anti-HCV in the study population.

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

The highest seroprevalence was found among those with a tertiary educational level, at 5.9%, followed by those with a secondary level, at 5.3%, and the lowest, at 2.7% (p=0.461) among those with a primary level. With regard to occupational status, the seroprevalence of anti-HCV revealed that the unemployed (students/applicants) had the highest seroprevalence with 6.9%, followed by civil servants, health workers, other groups, business owners, and farmers with 5.9%, 4.7%, 4.5%, 3.9%, and 3.4%, respectively(p=0.05).

Furthermore, according to Table 1's seroprevalence of anti-HCV in relation to their types of marriage, 5.6% of the 710 samples screened from married participants were anti-HCV seropositive. The highest seroprevalence was 6.1% in monogamous individuals, while the virus was completely absent in polygamous individuals (p=0.05).

According to this study's analysis of the seroprevalence of anti-HCV in alcoholics and non-alcoholics, the non-alcoholics had the highest prevalence of 5.5% and the alcoholics had the lowest at 4.1% (p=0.407). The difference in anti-HCV seroprevalence between smokers and non-smokers revealed that non-smokers had a seroprevalence of 5.3% compared to smokers' 3.2% (p=0.462).

Table 1: Distribution of anti-HCV among patients in relation to socio-demographic characteristics

Characters	**No. Screened**	**No. positive (%)**	**χ^2**	**DF**	**P-Values**
Sex					
Male	623	44(7.1)			
Female	888	35(3.9)	6.582	1	0.010
Marital status					
Single	352	25(7.10)			
Married	1134	52(4.6)			
Divorced	7	0(0.0)			
Widowed	12	0(0.0)			
Separated	6	2(33.3)	14.053	4	0.007
Educational status					
Non- formal	91	4(4.4)			
Primary	148	4(2.7)			
Secondary	625	33(5.3)			
Tertiary	647	38(5.9)	2.579	3	0.461
Occupational status					
Farmer	88	3(3.4)			
Civil servant	307	18(5.9)			
Business	431	17(3.9)			
Unemployed	418	29(6.9)			
Health worker	43	2(4.7)			
Others	223	10(4.5)	5.012	5	0.414

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

Type of marriage					
Polygamy	59	0(0.0)			
Monogamy	651	40(6.1)	3.842	1	0.050
Alcoholism					
Alcoholics	219	9(4.1)			
Non- alcoholics	1292	70(5.4)	0.647	1	0.421
Cigarette smoking					
Smokers	62	2(3.2)			
Non- smokers	1449	77(5.3)	0.523	1	0.470

DISCUSSION

HCV was detected in 5.2% of the overall study's participants. The results of earlier research conducted across the nation support this one. According to studies, the seroprevalence of HCV was reported to be 3.1% in Bauchi [5], 6.0% in Keffi [6], 6.9% in Gombe [7], and 7.8% in Niger [8]. HCV prevalence in this study region, however, is higher than that in Lagos (0.1% and 0.7%, respectively) [9, 10]. Variations in sample size and sociodemographic, cultural, and behavioural factors that affect the likelihood of contracting HCV infection could be the cause for the discrepancy.

The results of this study's analysis of the seroprevalence of HCV in relation to marital status revealed that the highest seroprevalence was found in unmarried individuals, followed by married individuals, and the lowest seroprevalence was found in divorced and widowed individuals, who had no detectable anti-HCV in their blood samples ($p = 0.007$). Anti-HCV prevalence was shown to be higher in singles than in married people in a study of sickle cell anaemia patients in Benin City, Nigeria [11].

Additionally, a survey of potential blood donors in Ibadan, Nigeria, found that singles had the highest rates while married people had the lowest [12]. In contrast to these results, a study among the adult population in Egypt found that the prevalence was highest among those who had previously been married, followed by those who were married, and the lowest among those who were single [13]. These discrepancies could be the result of risky habits or behaviours connected to different marital statuses in different regions, which could either protect or expose various populations to the illness.

In this study, the prevalence according to gender revealed that the prevalence is substantially higher in males than in females ($p = 0.01$). This is consistent with past research that showed a higher incidence in men than in females [14–16]. However, a higher frequency in females than in males was noted in a comparable study in Ibadan, South-Western Nigeria [12]. These variations in the prevalence of the disease according to gender may be caused by regional differences in practices or behaviours specific to each sex that may put people at risk for infection.

According to this study, people with tertiary education had the highest seroprevalence, followed by those with secondary education, and those with primary education had the lowest seroprevalence. The outcome, however, did not reveal any connection ($p=0.461$). According to a survey of blood donors in South-Western Nigeria, those with a university education had the highest levels, followed by those with secondary education, while those with no formal education or who follow the Quran had the lowest levels [12].

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

These groups' exposure to certain risk factors or behaviours that can predispose them to the infection may be the cause of the higher seroprevalence observed among people with tertiary and secondary education. According to a comparable study conducted in northern India, the incidence of anti-HCV had no discernible relationship to one's level of literacy [17]. On the other hand, research on the general population in the Central Region of Yemen revealed that postgraduate participants had the lowest and uneducated participants had the highest seroprevalence of HCV antibodies. It was determined that the difference was statistically significant ($p > 0.001$) [18]. More research is required to determine whether or not the study area's educational status significantly influences the infection's prevalence.

In this study, the seroprevalence of HCV revealed that farmers had the lowest seroprevalence and that the unemployed, who are primarily students and job candidates, had the highest seroprevalence ($p = 0.414$). Similar research on sickle cell anaemia in Benin City found that the employed had the highest prevalence, followed by students, while the jobless had the lowest prevalence [11]. Additionally, a poll of Egyptian individuals found that the poorest people had the highest incidence while the richest people had the lowest prevalence. This demonstrated that people in the richest quintiles had significantly lower chances of contracting HCV [13]. Health workers in this study exhibited a higher seroprevalence than non-health workers when occupational status was divided into those working in the field and those not in the field. According to a prior study conducted in Lokoja, Nigeria, health workers had a greater seroprevalence than non-health workers [19], which is consistent with the current finding. The highest seroprevalence among health professionals may be due to occupational risks they faced while performing their duties.

Out of all the samples of married participants in this study that were analysed according to their form of marriage, Monogamous people showed the highest seroprevalence, while polygamous people were all seronegative. Nevertheless, a non-significant difference was seen in the results ($p = 0.05$). According to a study carried out in Calabar, Nigeria, monogamous marriages showed detectable anti-HCV levels while polygamous marriages did not [20]. Most of the time, it is believed that sexual transmission of HCV is uncommon, and some studies have revealed that the risk of HCV transmission in heterosexual or monogamous partnerships is extremely low or perhaps nonexistent [21–23].

In this study, the seroprevalence of HCV was compared between alcoholics and non-alcoholics; the results showed that the non-alcoholics had the highest seroprevalence and the alcoholics had the lowest ($p = 0.647$). This finding is consistent with one from a prison study in Nasarawa State, North Central Nigeria, which discovered that non-alcoholics had a higher prevalence of anti-HCV than alcoholics [24]. The Centers for Disease Control and Prevention advised delaying treatment for individuals who consume excessive amounts of alcohol until these behaviours had been stopped for at least six months [25]. According to a study conducted in the United States, drinking alcohol and not having health insurance were the two major factors contributing to poor health outcomes for people with HCV who were born between 1945 and 1965. In the birth cohort study, 57.8% of anti-HCV-positive individuals who self-reported alcohol usage said they typically drank two or more alcoholic beverages per day [26]. The CDC advises anyone who has been diagnosed with HCV infection to get the right care, including HCV-directed clinical preventative services such as screening for alcohol use, hepatitis A and hepatitis B vaccination, and medical monitoring of disease. To assist in making treatment selections, recommendations are offered [27]. After taking into account several variables, such as the stage of the disease, the hepatitis C genotype, comorbidities, therapy-

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

related adverse effects, and the benefits of the proposed course of treatment, the patient and the healthcare professional should decide on the course of treatment [28].

In this study, the seroprevalence of anti-HCV among smokers and non-smokers revealed that the non-smokers had the highest seroprevalence while smokers had the lowest (p = 0.523). The results of this investigation are analogous to those of a study conducted among blood donors in Kano, Nigeria, which found that 3.4% of non-smokers were positive for the virus and no evidence of anti-HCV in smokers (p = 0.566) [29]. Although there was no correlation between smoking and the seroprevalence of HCV in this study, there is still a need to educate the public about the dangers of smoking in terms of disease progression in those with hepatocellular carcinoma (HCC). A study from China, however, found a substantial association between HCV infection and smoking [30], which runs counter to these conclusions. The odd ratio of death from HCC for smoking was found to be 9.60 (1.50–61.35) and 1.71 (0.58–5.08) among anti-HCV positive and negative individuals, respectively, in a study that assessed the interaction of the hepatitis C virus and cigarette smoking on death from hepatocellular cancer in a Japan collaborative cohort study [31].

CONCLUSION

According to this study, the total seroprevalence of HCV in the studied area was 5.2%. Only the married status, gender, and forms of marriage revealed significant relationships with the seroprevalence of HCV among the demographic and socioeconomic factors taken into account in this investigation. There is a need for ongoing routine population screening, education campaigns about infection prevention and control, and support from both governmental and non-governmental organisations in the effort to eradicate the infection in the research area.

Limitations

This study did not use polymerase chain reaction (PCR) analysis to identify HCV RNA in all the samples collected because of financial constraints. This might have provided a clearer picture of the HCV prevalence in the study.

Acknowledgments

We are grateful for the support provided by the workers of these institutions and the approval to conduct the study among the participants in all the healthcare facilities used in the study area. During this study, the Tertiary Education Trust Fund Grant (TETFund) provided financial assistance, which is also acknowledged.

Competing interests

The authors declared no competing interests.

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

REFERENCES

1. Kim, C.W., & Chang, K.M. (2013). Virology and life cycle. *Clinical and Molecular Hepatol*ogy,19(1):17 25.doi:10.3350/cmh.2013.19.1.17.Epub2013Mar 25.
2. WHO (2022). Hepatitis C. https://www.who.int/news-room/fact-sheets/detail/hepatitis-c 3-8-2022 accessed.
3. Benova, L., Mohamoud, Y.A., Calvert, C., & Abu-Raddad, L.J. (2014). Vertical transmission of hepatitis C virus: systematic review and meta-analysis. *Clinical Infectious Dis*eases,59(6):765–73.
4. Jafari, S., Copes, R., Baharlou, S., Etminan, M., & Buxton, J. (2010). Tattooing and the risk of transmission of hepatitis C: a systematic review and meta-analysis. *International Journal of Infectious Dis*eases,14(11): E928–E40.
5. Alkali, M., Okon, K.O, Jibrin, Y.B., Umar, S., & Toyin, A. (2018) Community-Based Seroprevalence of HBV and HCV Infection in Bauchi State, Nigeria. *Gut Gastroenterology,* 1: 001-006.
6. Oti, B.V., Pennap, G.R., & Ngari, H.R. (2018). HBsAg and Anti-HCV Prevalence among Pregnant Women Accessing Antenatal Care in a Tertiary Healthcare Facility in Central Nigeria. *Hepatology and Pancreatic Science,* 2: 110. doi:10.4172/ 2573-4563.1000110
7. Isaac, W.E., Ajani, A., Jalo, I., Alkali, Y., Oyeniyi, C., Okolie, H., Saidu, A., Jibrin, B., Aremu, J., Kudi, A., Danlami, H., & Charanchi, M. (2019). Hepatitis C in Adults and Children: A Cross-Sectional Review from a Tertiary Hospital, Northeast Nigeria during the Period 2008-2015. *Journal of Infectious Diseases and Epidemiology*,5:096. doi.org/10.23937/2474-3658/1510096.
8. Iduh, M.U., Kuta, F.A., Abalaka, M.E., & Shitu, K.O. (2018). Seroprevalence of Hepatitis C Virus Amongst Patients Attending Five Selected Hospitals in Niger State, Nigeria. *Journal of Biomedical Research and Clinical Practice,1(3).*
9. Odukoya, O.O., Odeyemi, K.A., Odubanjo, O.M., Isikekpei, B.C., Igwilo, U.U., Disu, Y.M., Roberts, A.A., Olufunlayo, T.F., Kuyinu, Y., Ariyibi, N., Eze, U.T., Awoyale, T., Ikpeekha, O., & Odusanya, O.O. (2022). Hepatitis B and C Seroprevalence among Residents in Lagos State, Nigeria: A Population-Based Survey. *Nigerian Postgraduate Medical Journal,* 29:75-81.
10. Oshun, P.O., & Odeghe, E. (2019). Prevalence of Hepatitis C virus and HIV among adults presenting for health screening in Lagos**.** *African Journal of Clinical and Experimental Microbiology,* 20 (2): 143 – 149 https://www.afrjcem.org
11. Nwannadi, I.A, Alao, O.O., Bazuaye, G.N., Omoti, C.E., & Halim, N.K. (2012).Seroprevalence of Hepatitis C Virus Antibody in Sickle Cell Anaemia Patients in Benin-City, Nigeria. *Gomal Journal of Medical Sci*ence, 10(1): 15-18.
12. Afolabi, A.Y., Abraham, A., Oladipo, E.K., & Fagbami, A.H. (2012). Hepatitis C virus in Potential Blood Donors in Ibadan, Nigeria. *Global Advanced Research Journal of Microbiology,* 1(9):155-159.
13. Sangha, J., Fatma El-Zanaty, A., & El-Sayed, N. (2009). Risk Factors for Hepatitis C Infection in a National Adult Population: Evidence from the 2008 Egypt DHS.http://iussp2009.princeton.edu. Accessed on 23rd October 2013.
14. Udoze, A.O., Okonko, I.O., Donbraye, E., Sule, W.F., Fadeyi, A., & Uche, L.N. (2009). Seroprevalence of Hepatitis C Antibodies Amongst Blood Donors in Ibadan, Southwestern Nigeria. *World Applied Sciences Journal,* 7 (8):1023-1028.

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

15. Olokoba, A.B., Salawu,F.K., Danburam, A., Desalu, O.O., Olokoba, L.B.,Wahab, K.W.,Badung, L.H., Tidi, S.K., Midala, J. , Aderigbe, S., Abdulrahman, M.B., Babalola, O.M., & Abdukarim, A. (2009). Viral Hepatitides in Voluntary Blood Donors in Yola, Nigeria.*European Journal of Science Research,* 31(3):329-334.
16. Vardas, E., Sitas, F., Seidel, K., Casteling, A., & Sim, J. (1999). Prevalence of hepatitis C virus antibodies and genotypes in asymptomatic, first-time blood donors in Namibia. *Bulletin of the World Health Orgorganisation,* 77(12):965-972.
17. Kumar, A., Sharma, K.A., Gupta, R.K., Kar, P., & Chakravarti, A. (2007). Prevalence & risk factors for hepatitis C virus among pregnant women. *Indian Journal of Medical Res*earch, 211-215.
18. Rajesh, N.G., & Sadiq, K.A. (2012). Seroprevalence and Risk Factors for Hepatitis C Virus Infection among General Population in Central Region of Yemen. Hindawi Publishing Corporation. *Hepatitis Research and Treatment*.1-4. Article ID 689726, doi: 10.1155 /2012/689726.
19. Sule, W.F., Odama, L.E., Daniel, A.L., Faneye, A.O., & Okonko, I.O. (2009). Prevalence of Anti-Hepatitis C Virus Antibodies in Patients Attending Federal Medical Centre, Lokoja, Kogi State, Nigeria. *World Applied Sciences Journal,*7(3):371-377.
20. Mboto, C.I., Andy, I.E., Eni, O.I., & Jewell, A.P. (2010). Prevalence, Sociodemographic Characteristics and Risk Factors for Hepatitis C Infection among Pregnant Women in Calabar Municipality, Nigeria. *Hepatitis Monthly*.2010; 10(2): 116-120.
21. Gordon, S.C., Patel, A.H., Kulesza, G.W., Barnes, R.E., & Silverman, A.L. (1992). Lack of evidence for the heterosexual transmission of hepatitis C. *American Journal of Gastroenterology,* 87(12):1849-51.
22. Vandelli, C., Renzo, F., Romanò, L., Tisminetzky, S., De Palma, M., Stroffolini, T., Ventura, E., & Zanetti, A. (2004). Lack of evidence of sexual transmission of hepatitis C among monogamous couples: results of a 10-year prospective follow-up study. *American Journal of Gastroenterology,* 99(5):855-9.
23. Karmochkine, M., Carrat, F., Dos Santos, O., Cacoub, P., & Raguin, G. (2006). A case-control study of risk factors for hepatitis C infection in patients with unexplained routes of infection. *Journal of Viral Hepatitis,* 13(11):775-82.
24. Adoga, M.P., Banwat, E.B., Forbi, J.C., Nimzing, L., Pam, R., Gyar, S.D., Agabi, Y.A., & Agwale, S.M. (2009). Humanimmunonodeficiency virus, hepatitis B virus and hepatitis C virus: seroprevalence, co-infection and risk factors among prison inmates in Nasarawa State, Nigeria.Journal of infection in Developing Countries, 3(7): 539-47.
25. Centers for Disease Control and Prevention (1998). Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related disease. *Morbidity and Mortality Weekly Reports. 47:* 1-39.
26. Smith, B.D., Patel, N., Beckett, G.A., Jewett, A., & Ward, J.W. (2011). Hepatitis C virus antibody prevalence correlates and predictors among persons born from 1945 through 1965, United States, 1999–2008[Abstract]. *American Association for the Study of Liver Diseases,* San Francisco, CA 2011.
27. Ghany, M., Nelson, D., Strader, D., Thomas, D., & Seeff, L. (2011). An update on treatment of genotype 1 chronic hepatitis C virus infection: 2011 practice guideline by the American Association for the Study of Liver Diseases. *Hepatology,* 54:1433–44.

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS

28. Centre for Disease Control and Prevention (2012). Recommendations for the Identification of Chronic Hepatitis C Virus Infection Among Persons Born During 1945–1965**.**Recommendations and Reports.*Morbidity and Mortality Weekly Report.* 61 (4).
29. Bala, J.A., Kawo, A.H., Mukhtar, M.D., Sarki, A., Magaji, N., Aliyu, I.A., & Sani, M.N. (2012). Prevalence of hepatitis C virus infection among blood donors in some selected hospitals in Kano, Nigeria.*International Research Journal of Microbiology*, 3(6): 217-222. Available online http://www.interesjournals.org/IRJM.
30. Chuang, S.C., Lee, Y.C., Hashibe, M., Dai, M., Zheng, T., & Boffetta, P. (2010). Interaction between Cigarette smoking and hepatitis B and C virus on the risk of liver cancer: a meta-analysis. *Cancer Epidemiology, Biomarkers and Prevention*,19(5):1261-8.
31. Fujita, Y., Shibata, A., Ogimoto, I., Kurozawa, Y., Nose, T., Yoshimura, T., Suzuki, H., Iwai, N., Sakata, S., & Tamakoshi, A. (2006). The effect of interaction between hepatitis C virus and cigarette smoking on the risk of hepatocellular carcinoma. *British Journal of Cancer*, 13; 94(5):737-9.

Article DOI: 10.52589/AJBMR-2CIIKVVS
DOI URL: https://doi.org/10.52589/AJBMR-2CIIKVVS