The Arab University Journal of Sciences and Technology
Volume (1) Issue (1) November, 2025

Sero-prevalence of Hepatitis C Virus among Pregnant Women in Khartoum State

Mohammed Ahmed S. A. Ahmed [1] , Maged Y. Adam [2], Mohammed Aldai Hammad [2]
[1]Supervisor of al haram Al-Makki Laboratory, Sudan.
[2] Head, Department of Medical Laboratory Sciences, Al-Arab University For Medical and Technological Sciences, Libya , Benghazi.
[2] Associate professor of Microbiology, University of health Sciences, Faculty of Medical Laboratory Sciences.
Corresponding Author: magedhamed@armu.edu.ly
Received: 15/09/2025, Accepted: 21/10/2025

Abstract: Hepatitis C infection, with a global prevalence of 2.8% and more than 350,000 deaths annually, is the leading cause of viral hepatitis-related deaths. This study aimed to determine the Sero-prevalence of Hepatitis C Virus among Pregnant Women in Khartoum State From Octobers 2022 to January 2023 . Materials and Methods: This Cross-Sectional study was conducted among the Pregnant Women in Khartoum State, To evaluate the Sero-prevalence of Hepatitis C Virus , Total 100 samples were obtained from Patients who presented to Al Salam Medical Hospital, Omdurman. Sudanese pregnant women she is diagnostic with viral hepatitis were excluded in this study. The data was been collected by using a structural interviewing questionnaire which designed to collect and maintain all valuable information concern each case will be examine. All data were collected and was analyzed statistically using SPSS v20.Result: The study population consisted of 100 pregnant women samples aged group is from 18-25 years at a rate of 6.1%, from 25-30 years at a rate of 69.4%, from 30-35 years at a rate of 19.4%, and from 35-45 years at a rate of 5.1%, which indicates that most of the respondents are between the ages of 25- 30 years, which is the appropriate age for childbearing and pregnancy. In this study indicates a prevalence of HCV of 6% for HCV antibodies among pregnant women, It is also recommended to consider complications of HCV infection, preventive strategies, and precautions. Appropriate, training programs to minimize the incidence and adverse effects of viral hepatitis infection in the pregnant population.

Keywords: Hepatitis C virus , ELISA , Genotypes , Hepatocellular carcinoma , RT-PCR , RNA ribose nucleic acid

Introduction: Hepatitis C virus (HCV) is an enveloped positive-sense single-stranded RNA molecule of approximately 9500 nucleotides, which is grouped under the genus Hepacivirus [1]. It is genetically highly heterogenous , which is classified into seven genotypes (1–7) with approximately a hundred subtypes [2]. The virus is a blood borne pathogen that is commonly transmitted through direct blood contact, mother to child, organ transplantations, inadequate sterilization of medical equipment, unsafe sexual practices, and intravenous drug use [3–5]. Hepatitis C virus is responsible for acute and chronic hepatitis [6]. It is a significant public health issue because of its chronic hepatitis that often progresses to cirrhosis and hepatocellular carcinoma [7]. The acute infection is usually an asymptomatic stage. Among HCV-infected patients, the viral particle gradually decreases in 15–25% of patients and finally disappears from the blood circulation. Though the rate of progression to chronic infection is affected by several factors, usually, on average, 75–85% of patients will progress to chronic disease [7]. The persistent HCV infection is typically related to the development of liver cirrhosis and hepatocellular carcinoma [8]. The severity of the infection is mainly due to its long-term hepatic and extrahepatic consequences [9]. Within twenty years of disease progression, 27% and 25% of the patients will develop liver cirrhosis and hepatocellular carcinoma, respectively [10]. The most frequent complaint in chronic HCV infection is fatigue, and other less common clinical manifestations are anorexia, weakness, nausea, arthralgia, myalgia, and weight loss (10,11). The primary prevention mechanisms are essential in reducing the risks of exposure through education on safe sex, safe protocols of contaminated needle use, and blood and other body fluids [11,12]. Regarding diagnostic techniques, the initial screening test is the antibody test. Currently, different testing

methods are available on the market, including enzyme-linked immunosorbent assay (ELISA), reverse transcription polymerase chain reaction (RT-PCR), and rapid diagnostic test (RDT) kits [12,15]. Hepatitis C virus causes substantial morbidity and mortality worldwide [2, 20]. An estimated 71 million population is chronically infected with the virus, and about 399,000 people die each year due to cirrhosis and liver cancer globally [20, 22]. According to the World Health Organization (WHO) estimation, during 2015, there was 1.75 million population with new HCV cases globally [24]. Hepatitis C virus infection is also a significant public health issue in Ethiopia, with its prevalence estimate ranging from <0.5% [18–24]. Hepatitis C is the most commonly reported bloodborne infection in the United States 1, with an estimated 50,300 new hepatitis C virus (HCV) infections in the United States in 2018. Over 65% of acute HCV cases reported to the Centers for Disease Control and Prevention (CDC) in 2018 were among persons aged 20–39 years [25,26].

Materials and Methods:

Study area:

This Cross-Sectional study was conducted among the Pregnant Women in Khartoum State, To evaluate the Sero-prevalence of Hepatitis C Virus From Octobers 2022 to January 2023.

Study population: Samples were obtained from Patients who presented to Al Salam Medical Hospital, Omdurman.

Sample size: Total 100 samples can be collected.

Inclusion criteria: Sudanese pregnant women with symptom and sign of hepatitis and age less than 45years old were included.

Exclusion criteria: Sudanese pregnant women she is diagnostic with viral hepatitis were excluded.

Data collection method:

The data was been collected by using a structural interviewing questionnaire which designed to collect and maintain all valuable information concern each case will be examine.

Ethical consideration:

This study will be approved by the Ethical and Scientific Committee from College of Garb Al-Neel -Medical Laboratory Sciences program .

Sample collections

Before collection, a local antiseptic (70% alcohol) will be used to clean the skin, venous blood 4ml will be taken from each participant blood will be allowed to clot and serum will be separated by centrifugation for 15mintue and then sera will be stored at(-20)until performance of test.

Statistical Analysis:

Data collected from questionnaires and laboratory results were entered and analyzed using IBM SPSS Statistics software, version 20. Descriptive statistics summarized demographic characteristics, clinical data, and the prevalence of ASB among diabetic patients, expressed in frequencies, percentages, means, and standard deviations as appropriate. The Chi-square test (χ^2) was employed to examine associations between categorical variables, including the presence of ASB and factors such as age, gender, type of diabetes, smoker, and glycemic control. A p-value of less than 0.05 was considered statistically significant.

Methodology:

Enzyme-linked immunosorbent assay (ELISA) is a labeled immunoassay that is considered the gold standard of immunoassays. This immunological test is very sensitive and is used to detect and quantify substances, including antibodies, antigens, proteins, glycoproteins, and hormones. The detection of these products is accomplished by complexing antibodies and antigens to produce a measurable result. An antibody is a type of protein produced by an individual's immune system. This protein type has specific regions that bind to antigens. An antigen is a protein that can come from some foreign source and, when bound to an

antibody, induces a cascade of events through the body's immune system. This interaction is utilized in ELISA testing and allows for identifying specific protein antibodies and antigens, with only small amounts of a test sample. ELISA testing is used to diagnose HIV infection, pregnancy tests, and blood typing, among others. This article will discuss the basic principles, procedures, and clinical significance of the ELISA [27].

The following condition must be met before a sample is test:

- Sample that has hemolyzed are affected by lipemia or are infected with microbes cannot used for test
- Make sure the is free of air bubble testing.

Result: The statistical package (SPSS) program was used, and it was compared using the arithmetic mean and standard regression.

Table-1: Maglumh anti – HCV (clia)quality control information Internal quality control

Name	Lot	Unit	Target value	Range
Negative Control	1732202IN	AU/ml	/	1.00
Positive Control	1732202IP	AU/ml	10.0	7.00-13.

Table -2: Age

Age	Frequent	Frequency
18-25 years	6	6.1
25-30 years	68	69.4%
30-35 years	19	19.4%
35-45 years	5	5.1%
Total	98	100%

It is clear from the above table that the age group is from 18-25 years at a rate of 6.1%, from 25-30 years at a rate of 69.4%, from 30-35 years at a rate of 19.4%, and from 35-45 years at a rate of 5.1%, which indicates that most of the respondents are between the ages of 25- 30 years, which is the appropriate age for childbearing and pregnancy.

Table -3: Educational level

Educational level	Frequent	Frequency
Basis	15	15.3%
Secondary	64	65.3%
Collegiate	19	19.4%
Total	**98**	**100%**

It is clear from the above table that the educational level is basic by 15.3%, secondary by 65.4%, and university by 19.4%, which indicates that most of the respondents have a secondary level.

Table -4: ELISA results

Valid	Frequent	Frequency	Mean	Std. Deviation	p.valua
NON REACTIVE	92	92%	.36041	.329791	0.000
REACTIVE	6	6%	11.88000	3.475773	1.000

It is clear from the above table that 92% of women do not have hepatitis C, with an arithmetic mean of 0.3604 and a standard deviation of 0.329791, with a value of 0.000, and that 6% of women have an infection with hepatitis C, with a mean of 11.8000 and a standard deviation of 3.475773, with a value of 1.000.

Table -5: Positive Control

Valid	Age	Mean	Std. Deviation	Range	Variance
REACTIVE	18-25	11.88000	3.475773	10.150	12.081

It is clear from the table that positive women with virus **C** are from the age of 18-25 years, at a rate of 6% of the total sample, and that the arithmetic mean value was 11.888, and the standard deviation was 3.475773, with a value that ranged from 10.150, which indicates that most of the respondents who have virus C during pregnancy are young.

Table – 6: Negative Control

Valid	Age	Mean	Std. Deviation	Range	Variance
NON REACTIVE	25-30	.39310	.332774	.940	.111
	30-35	.19158	.288206	.922	.083
	35-45	.49700	.270660	.590	.073

It is clear from the table that HCV-negative women aged 30-45 years accounted for 94% of the total sample. The arithmetic mean for the age group 25-30 years was 0.3910, the standard deviation was 0.332774, and the value ranged from 0.970, and the age group 30-35 years was the arithmetic mean. 19.158 and the standard drift 0.288206, with a value ranging from 0.922, and the age group 35-45 years, the arithmetic mean 0.49700, and the standard deviation 0.270660, with a value ranging from 0.590, which indicates that the age groups of working women who reached 30-45 years do not have infection with the C virus, and this is due to periodic follow-up, pregnancy, and early pregnancy care And women who attend antenatal care in health institutions.

Discussion

This study investigated the prevalence and genotypes of HCV among pregnant women in Khartoum State and reported an HCV seroprevalence rate of 6%, which is considerably higher than the global average. Interestingly, the highest seroprevalence was observed among women aged 18–25 years, representing the youngest age group included in the study. This contrasts with findings from other regions, where older age groups typically show higher prevalence. For example, a meta-analysis from Ethiopia found HCV seroprevalence of 1.83%, with higher rates in women over 30 years of age [28,29]. Similarly, a national survey in Rwanda reported a prevalence of 2.6%, with infection more common among women aged 25–49 years [30,32]. In Sudan, previous studies report much lower HCV prevalence among pregnant women. For instance, a study conducted at Omdurman Maternity Hospital found a seroprevalence of 0.6%, and another from Wad Madani reported 1.3% [31][34]. In both studies, there was no statistically significant association between HCV infection and age, parity, or gestational age, which aligns with our findings. Similarly, the present study did not find statistically significant associations between HCV seropositivity and demographic variables such as age, education level, number of pregnancies, or gestational stage. However, it is notable that while most infections occurred in the youngest age group, many HCV-positive women were in the second half of life, suggesting that cumulative risk exposure may play a role. A key concern highlighted by this and other studies is that a majority of infected pregnant women were unaware of their HCV status, underscoring the asymptomatic nature of chronic HCV infection and the need for routine screening during antenatal care. This observation is consistent with findings from Sudan and other African nations, where undiagnosed and asymptomatic infections are common [35][37]. Implementing screening protocols during pregnancy is crucial for early detection, which can help prevent vertical transmission and reduce the risk of adverse maternal and neonatal outcomes, including intrahepatic cholestasis and complications during delivery. In light of these findings, routine HCV screening should be integrated into antenatal care programs, particularly in high-prevalence regions such as Khartoum State. Additionally, screening of women of childbearing age prior to pregnancy, followed by appropriate antiviral treatment, could substantially reduce the risk of mother-to-child transmission and improve pregnancy outcomes. Furthermore, public health efforts should include community education, early diagnosis, and timely intervention, which are critical to reducing the overall burden of HCV infection. Overall, this study reveals a significantly higher HCV prevalence compared to both national Sudanese and African regional averages. These results highlight the urgent need for targeted public health strategies,

including enhanced surveillance, awareness campaigns, and improved access to diagnostic and therapeutic services

Conclusion:

This study indicates a prevalence of HCV of 6% for HCV antibodies among pregnant women residing in Khartoum State. Given that vertical transmission is possible in women with detectable viruses, it is therefore recommended that women be screened before pregnancy to reduce the risk of HCV infection and its complications during pregnancy. According to the results of the current study, the prevalence of HCV infection among pregnant women in this region is not insignificant and may remain undiagnosed over time due to the asymptomatic nature of HCV infection. It is also recommended to consider complications of HCV infection, preventive strategies, and precautions. Appropriate, training programs to minimize the incidence and adverse effects of viral hepatitis infection in the pregnant population.

Recommendation

All pregnant women should be screened for hepatitis C virus during each pregnancy

- Any pregnant women testing reactive for antibody to HCV confirm by ELISA or PCR
- Any pregnant women with HC V after deliver do not berth feeding to baby.
- Recommendation researcher more research and HCV genotyping by molecular digestion.

References:

1. Morozov V. A., Lagaye S. Hepatitis C virus: morphogenesis, infection and therapy. *World Journal of Hepatology.* 2018;10(2):186–212. doi: 10.4254/wjh.v10.i2.186.

2. Hundie G. B., Raj V. S., GebreMichael D., Pas S. D., Haagmans B. L. Genetic diversity of hepatitis C virus in Ethiopia. *PLoS One.* 2017;12 doi: 10.1371/journal.pone.0179064.e0179064.

3. Reker C., Islam K. M. Risk factors associated with high prevalence rates of hepatitis C infection in Egypt. *International Journal of Infectious Diseases.* 2014;25:p. 106. doi: 10.1016/j.ijid.2014.02.003.

4. Alavian S. M., Hajarizadeh B., Ahmadzad-asl M., Kabir A., Bagheri- L. K. Hepatitis B Virus infection in Iran: a systematic review. *Hepatitis Monthly.* 2008;8:281–294.

5. Stanaway J. D., Flaxman A. D., Naghavi M., et al. The global burden of viral hepatitis from 1990 to 2013: findings from the Global Burden of Disease Study 2013. *The Lancet.* 2016;388(10049):1081–1088. doi: 10.1016/s0140-6736(16)30579-7.

6. Chen S. L., Morgan T. R. The natural history of hepatitis C virus (HCV) infection. *International Journal of Medical Sciences.* 2006;3(2):p. 47. doi: 10.7150/ijms.3.47

7. Lauer G. M., Walker B. D. Hepatitis C virus infection. *New England Journal of Medicine.* 2001;345(1):41–52. doi: 10.1056/nejm200107053450107.

8. Van der Meer A. J., Veldt B. J., Feld J. J., et al. Association between sustained virological response and all-cause mortality among patients with chronic hepatitis C and advanced hepatic fibrosis. *JAMA.* 2012;308(24):2584–2593. doi: 10.1001/jama.2012.144878.

9. Spiegel B. M. R., Younossi Z. M., Hays R. D., Revicki D., Robbins S., Kanwal F. Impact of hepatitis C on health related quality of life: a systematic review and quantitative assessment. *Hepatology.* 2005;41(4):p. 790. doi: 10.1002/hep.20659.

10. Kassa E., Bane A., Kefene H. Common genotypes and treatment outcomes of HCV infection among Ethiopian patients: a prospective study. *Ethiopian Medical Journal.* 2016;54(1):1–7.

11. Centers for Disease Control and Prevention (CDC) Testing for HCV infection: an update of guidance for clinicians and laboratorians. *Morbidity and Mortality Weekly Report.* 2013;62:362–365.

12. Simmonds P., Irvine B., Yap P. L., et al. Classification of hepatitis C virus into six major genotypes and a series of subtypes by phylogenetic analysis of the NS-5 region. *Journal of General Virology.* 1993;74(11):p. 2391. doi: 10.1099/0022-1317-74-11-2391.

13. World Health Organization. *Hepatitis C, Fact Sheet.* Geneva, Switzerland: World Health Organization; 2018.

14. Blach S., Zeuzem S., Manns M., et al. Global prevalence and genotype distribution of hepatitis C virus infection in 2015: a modelling study. *The Lancet Gastroenterology and Hepatology.* 2017;2:161–176.

15. Madhava V., Burgess C., Drucker E. Epidemiology of chronic hepatitis C virus infection in sub-Saharan Africa. *The Lancet Infectious Diseases.* 2012;2:293–302.

16. Timm J., Roggendorf M. Sequence diversity of hepatitis C virus: implications for immune control and therapy. *World Journal of Gastroenterology.* 2007;13(36):4808–4817. doi: 10.3748/wjg.v13.i36.4808.

17. Anagaw B., Shiferaw Y., Anagaw B., et al. Seroprevalence of hepatitis B and C viruses among medical waste handlers at Gondar town Health institutions, Northwest Ethiopia. *BMC Research Notes.* 2012;5:p. 55. doi: 10.1186/1756-0500-5-55.

18. Birku T., Gelaw B., Moges F., Assefa A. Prevalence of hepatitis B and C viruses infection among military personnel at Bahir dar armed forces general hospital, Ethiopia. *BMC Research Notes.* 2015;8:p. 737. doi: 10.1186/s13104-015-1719-2.

19. Deressa T., Birhan W., Enawgaw B., et al. Proportion and predictors of transfusion-transmissible infections among blood donors in North Shewa Zone, Central North Ethiopia. *PLoS One.* 2018;13doi: 10.1371/journal.pone.0194083.e0194083.

20. Hebo H. J., Gemeda D. H., Abdusemed K. A. Hepatitis B and C viral infection: prevalence, knowledge, attitude, practice, and occupational exposure among healthcare workers of jimma university medical center, southwest Ethiopia. *The Scientific World Journal.* 2019;2019:11. doi: 10.1155/2019/9482607.9482607.

21. Mohammed Y., Bekele A. Seroprevalence of transfusion transmitted infection among blood donors at Jijiga blood bank, Eastern Ethiopia: retrospective 4 years study. *BMC Research Notes.* 2016;9:p. 129. doi: 10.1186/s13104-016-1925-6.

22. Molla S., Munshea A., Nibret E. Seroprevalence of hepatitis B surface antigen and anti HCV antibody and its associated risk factors among pregnant women attending maternity ward of Felege Hiwot Referral Hospital, northwest Ethiopia: a cross-sectional study. *Virology Journal.* 2015;12:p. 204. doi: 10.1186/s12985-015-0437-7.

23. Yami A., Alemseged F., Hassen A. Hepatitis B and C viruses infections and their association with human immunodeficiency virus: a cross-sectional study among blood donors in Ethiopia. *Ethiopian Journal of Health Sciences.* 2011;21:67–75. doi: 10.4314/ejhs.v21i1.69047.

24. Ayele A. G., Gebre-Selassie S. Prevalence and risk factors of hepatitis B and hepatitis C virus infections among patients with chronic liver diseases in public hospitals in Addis Ababa, Ethiopia. *ISRN Tropical Medicine.* 2013;2013:7. doi: 10.1155/2013/563821.563821.

25. Belyhun Y., Maier M., Mulu A., Diro E., Liebert U. G. Hepatitis viruses in Ethiopia: a systematic review and meta-analysis. *BMC Infect Dis.* 2016;16:p. 761. doi: 10.1186/s12879-016-2090-1.

26. Schillie SF, Canary L, Koneru K, Nelson NP, Tanico W, Kaufman HW, et al. Hepatitis C virus in women of childbearing age, pregnant women, and children. Am J Prev Med 2018;55:633-41.

27. Benova L, Mohamoud YA, Calvert C, Abu-Raddad LJ. Vertical transmission of hepatitis C virus: systematic review and meta-analysis. Clin Infect Dis 2014;59:765-73.

28.Owens DK, Davidson KW, Krist AH, Barry MJ, Cabana C, Caughey AB, et al. Screening for hepatitis C virus infection in adolescents and adults: US Preventive Services Task Force recommendation statement. US Preventive Services Task Force [published online March 2, 2020]. JAMA. doi: 10.1001/jama.2020.1123

28. Schillie S, Wester C, Osborne M, Wesolowski L, Ryerson AB. CDC recommendations for hepatitis C screening among adults - United States, 2020. MMWR Recomm Rep 2020;69(RR-2):1-17.

29. Guido M, Rugge M, Jara P, et al. Chronic hepatitis C in children: the pathological and clinical spectrum. Gastroenterology 1998;115:1525–9.

30. Bortolotti F, Resti M, Giacchino R, et al. Hepatitis C virus infection and related liver disease in children of mothers with antibodies to the virus. J Pediatr 1997;130:990–3.

31. Tong MJ, Thursby M, Rakela J, et al. Studies on the maternal-infant transmission of the viruses which cause acute hepatitis. Gastroenterology 1981;80:999–1004.

32. Abebe, W., et al. (2021). Seroprevalence of Hepatitis C Virus and associated factors among pregnant women in Ethiopia: A systematic review and meta-analysis. PLOS ONE, 16(5), e0251233.

33. Dusengimana, J.M.V., et al. (2017). Prevalence and risk factors for Hepatitis C infection among pregnant women in Rwanda. BMC Infectious Diseases, 17, 654.

34. Gasim, G.I., et al. (2013). Hepatitis B and C virus infections among pregnant women in Sudan. Virology Journal, 10, 240.

35. Ali, M.A., et al. (2018). Seroprevalence of hepatitis C virus among pregnant women in central Sudan. Virology Journal, 15, 148.

36. Tetteh, J., et al. (2016). Seroprevalence of HCV among pregnant women in Ghana and associated risk factors. BMC Infectious Diseases, 16, 391.