ISSN: 2457-0400

Impact Factor: 7.675

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

www.wjahr.com

Volume: 10, Issue: 11

Page N. 139-144

Year: 2026

Original Article

Coden USA: WJAMA3

ASSESSMENT OF HEPATITIS B AND HEPATITIS C INFECTIONS AMONG PREMARITAL SCREENING APPLICANTS IN MOSUL CITY

Dr. Nada Nazar Qasim Al Safar*, Dr. Ruba Mohammed Ibrahim, Dr. Anfal Mumtaz Ahmed Al Mukhtar

[1]M.B.Ch.B/ C.A.B.H.S (Internal Medicine).
[2,3]M.B.Ch.B/ C.I.B.M.S (Adult Hematology).

Article Received: 30 Sept. 2026 **Article Revised:** 21 Oct. 2026 **Article Published:** 01 Nov. 2026

***Corresponding Author: Dr. Nada Nazar Qasim Al Safar**

M.B.Ch.B/ C.A.B.H.S (Internal Medicine).

DOI: https://doi.org/10.5281/zenodo.23803601

How to cite this Article: Dr. Nada Nazar Qasim Al Safar*, Dr. Ruba Mohammed Ibrahim, Dr. Anfal Mumtaz Ahmed Al Mukhtar. (2026). Assessment of Hepatitis B And Hepatitis C Infections Among Premarital Screening Applicants In Mosul City. World Journal of Advance Healthcare Research, 10(11), 139–144.

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ABSTRACT

Background: Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections represent important public health concerns because of their potential to cause chronic liver disease and long-term complications. Premarital screening provides an opportunity to identify individuals with positive screening results and facilitate appropriate counselling and clinical assessment. **Objectives:** To assess HBV and HCV screening positivity among premarital screening applicants in Mosul City, Iraq, and describe its distribution according to year and sex. **Methods:** A retrospective cross-sectional study was planned at Ibn Sina Teaching Hospital, Ibn Al-Atheer Teaching Hospital, and Mosul General Hospital for the period from January 2, 2021, to December 31, 2024. The available aggregate screening records included 56180 applicants from 2021–2024. HBV screening was based on hepatitis B surface antigen (HBsAg), while HCV screening was based on anti-HCV antibodies. **Results:** Among 56180 applicants, 146 were HBsAg-positive, yielding an HBV screening positivity rate of 0.26%, while 26 were anti-HCV-positive, corresponding to 0.046%. HBV positivity was 0.471% in 2021, 0.240% in 2022, 0.305% in 2023, and 0.164% in 2024. HCV positivity was 0.114%, 0.060%, 0.052%, and 0.017%, respectively. Males accounted for 94 (64.38%) of HBV-positive cases and 17 (65.38%) of anti-HCV-positive cases. **Conclusions:** The available records demonstrated low screening positivity for HBV and HCV among premarital screening applicants in Mosul, with a higher proportion of male cases. Continued premarital screening, appropriate counselling, clinical referral, and HBV vaccination for susceptible individuals are recommended. HCV RNA testing is required to confirm active HCV infection.

KEYWORDS: Hepatitis B virus; hepatitis C virus; premarital screening; HBsAg; anti-HCV; Mosul; Iraq.

1- INTRODUCTION

Viral hepatitis is a major global public health concern because of its potential to cause chronic liver disease, liver cirrhosis, hepatocellular carcinoma, and premature mortality. Among the viruses responsible for hepatitis, HBV and HCV are particularly important because they may cause persistent infections that remain clinically silent for many years. The absence of obvious symptoms during the early stages of infection contributes to delayed diagnosis and increases the possibility of continued transmission within communities. Consequently, early detection, appropriate laboratory investigation, and timely linkage to medical care are essential components of strategies aimed at reducing the burden of viral hepatitis.[1-2]

According to the World Health Organization (WHO), approximately 240 million people were living with chronic HBV infection worldwide in 2024, while HCV remained a major cause of chronic liver disease and hepatitis-related mortality. Both infections may progress to serious complications, particularly when diagnosis and treatment are delayed. Although HBV infection can be prevented through effective vaccination and chronic infection can be controlled with antiviral treatment, HCV infection can be cured in most patients using direct-

acting antiviral medications. Nevertheless, substantial gaps remain in screening, confirmation of infection, and access to treatment. These challenges emphasize the importance of accessible screening programs that identify infected individuals before the development of advanced liver disease.[1-2]

Hepatitis B virus is an enveloped, partially double-stranded DNA virus belonging to the Hepadnaviridae family, whereas HCV is an enveloped, positive-sense, single-stranded RNA virus belonging to the Flaviviridae family. Both viruses primarily affect hepatocytes, but their biological characteristics, natural histories, and laboratory diagnostic approaches differ. Hepatitis B virus can be transmitted through exposure to infected blood and body fluids, sexual contact, and perinatal transmission. Hepatitis C virus is predominantly transmitted through blood-to-blood exposure, including unsafe medical procedures, inadequately screened blood products, and the sharing of contaminated injection equipment. Sexual transmission of HCV is also possible, although its efficiency varies according to the circumstances of exposure. Understanding these routes of transmission is important for identifying opportunities for prevention and reducing the risk of infection among couples preparing for marriage.[1-3]

Serological tests are commonly used for initial screening, including hepatitis B surface antigen (HBsAg) for HBV and anti-HCV antibodies for HCV. However, these tests have limitations. Moreover, HBsAg positivity generally indicates current HBV infection but does not quantify viral replication, while anti-HCV positivity indicates previous exposure and does not necessarily establish active infection. Consequently, molecular testing using polymerase chain reaction (PCR) is important for detecting viral genetic material, including HBV DNA and HCV RNA, and confirming active HCV infection following a reactive antibody result.[3-5]

Viral load measurement by quantitative real-time PCR provides information about the concentration of viral genetic material in the blood, usually expressed as international units per millilitre (IU/mL). In HBV infection, quantitative HBV DNA helps assess viral replication, determine treatment eligibility, and monitor the response to antiviral therapy. In HCV infection, quantitative HCV RNA confirms viraemia and supports the assessment of treatment response. Nevertheless, viral load should be interpreted alongside clinical findings and other laboratory parameters because it does not independently determine the severity of liver damage.[3-5]

In Iraq, regional studies have demonstrated the presence of HBV and HCV among individuals attending premarital screening services, emphasizing the importance of local epidemiological investigations.[6] However, prevalence may vary between geographical areas according to population characteristics, vaccination coverage, and exposure patterns. Therefore, the present study aims to assess HBV and HCV infections among premarital screening applicants in Mosul City. Where molecular testing is available, the assessment of viral load may provide additional information regarding active infection and help guide appropriate referral, counseling, and preventive measures.

2-PATIENTS AND METHODS

This is a retrospective cross-sectional study, conducted to assess HBV and HCV infections among individuals undergoing premarital screening in Mosul City, Iraq, during the period from 2 January 2021 to 31 December 2024. The study was conducted at Ibn Sina Teaching Hospital, Ibn Al-Atheer Teaching Hospital, and Mosul General Hospital. The study population included individuals who attended premarital screening services at these institutions during the specified period.

Consecutive sampling was employed, including all eligible premarital screening records available during the study period. Records with incomplete information, duplicate entries, or missing laboratory results required for the assessment of HBV and HCV infections were excluded. Data were retrospectively collected from premarital screening registers, laboratory reports, and relevant hospital databases.

The collected data included age, sex, hospital of attendance, month and year of screening, and the total number of individuals screened. Laboratory information included HBsAg results for HBV and anti-HCV antibody results for HCV. Additional laboratory investigations, including HBV DNA and HCV RNA detected by polymerase chain reaction (PCR), were recorded. Qualitative PCR results were used to identify detectable viral genetic material, whereas quantitative PCR results were recorded as viral load in international units per millilitre (IU/mL). HBV DNA testing was considered useful for assessing viral replication, while HCV RNA testing was used to confirm active HCV infection among individuals with reactive anti-HCV antibody results. Liver biochemical parameters, where available in the medical records, included alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin, and direct bilirubin. These parameters were reviewed to assess biochemical evidence of liver injury and abnormalities in liver function. Serum albumin and prothrombin time or international normalized ratio (INR), when available, were also recorded to provide additional information regarding hepatic synthetic function. Laboratory results were interpreted according to the reference ranges of the laboratories performing the tests. Liver enzyme abnormalities were assessed alongside the available serological and molecular findings because normal enzyme levels do not exclude chronic viral hepatitis, and elevated levels are not specific to HBV or HCV infection.

A positive HBV screening case was defined as an individual with a documented positive HBsAg result, while a positive HCV screening case was defined as an individual with a documented positive anti-HCV antibody result. Active HCV infection was identified by detectable HCV RNA when PCR results were available. HBV DNA detection and viral load measurements were used to characterize viral replication among individuals who underwent molecular testing. The primary outcomes were the prevalence of positive HBV and HCV screening results among premarital screening applicants. Secondary outcomes included the distribution of infections according to age, sex, hospital, month, and year, as well as the available relationships between viral load and liver biochemical parameters.

The prevalence of each infection was calculated by dividing the number of individuals with a positive screening result by the total number of individuals screened and multiplying the result by 100. Quantitative viral load results and liver biochemical parameters were summarized using appropriate descriptive statistics. Associations between categorical variables were assessed using the chi-square test or Fisher's exact test, as appropriate. Comparisons of continuous variables between groups were performed using the independent-samples t-test for normally distributed data or the Mann–Whitney U test for non-normally distributed data. Correlations between viral load and liver biochemical parameters were assessed using Pearson's or Spearman's correlation coefficient, as appropriate. The Statistical Package for the Social Sciences (SPSS), version 31, was used for statistical analysis, and a P value of less than 0.05 was considered statistically significant.

Ethical and administrative approvals were obtained from the Ninevh Direcorate of Health authorities and participating hospitals before data collection. Confidentiality was maintained by excluding personal identifiers from the analytical dataset and restricting access to the collected information. Data were used exclusively for research purposes in accordance with institutional requirements and applicable research ethics guidelines.

3-RESULTS

Among the 56,180 individuals screened, 146 tested positive for hepatitis B surface antigen (HBsAg), representing a prevalence of 0.260%. In comparison, 26 individuals tested positive for hepatitis C virus antibodies (anti-HCV), corresponding to a prevalence of 0.046%. As shown in table 3.1.

Table 3.1: Overall hepatitis B and hepatitis C screening positivity.

Screening outcome	Number	Prevalence (%)
Total screened	56,180	—
HBsAg-positive	146	0.260
Anti-HCV-positive	26	0.046

The annual screening results showed considerable variation in screening volume and HBV and HCV positivity between 2021 and 2024. Hepatitis B virus prevalence was highest in 2021 (0.471%), decreased to 0.240% in 2022, increased to 0.305% in 2023, and subsequently declined to 0.164% in 2024. In contrast, HCV prevalence decreased progressively from 0.114% in 2021 to 0.017% in 2024, despite a temporary increase in the number of individuals screened in 2023 and 2024. The highest numbers of HBV-positive (59) and HCV-positive (10) results were recorded in 2023, when 19342 individuals were screened. As shown in table 3.2.

Table 3.2: Annual screening volume and prevalence of HBV and HCV, 2021–2024.

Year	Screened	HBV-positive	HBV prevalence (%)	HCV-positive	HCV prevalence (%)
2021	7,000	33	0.471	8	0.114
2022	6,658	16	0.240	4	0.060
2023	19342	59	0.305	10	0.052
2024	23180	38	0.164	4	0.017

The sex distribution of positive screening results showed a higher proportion of males than females for both infections. Among the 146 HBsAg-positive individuals, 94 (64.38%) were males and 52 (35.62%) were females. Similarly, among the 26 anti-HCV-positive individuals, 17 (65.38%) were males and 9 (34.62%) were females. As shown in table 3.3.

Table 3.3: Sex distribution among positive screening results.

Infection	Male, n (%)	Female, n (%)	Total
HBV (HBsAg-positive)	94 (64.38)	52 (35.62)	146
HCV (anti-HCV-positive)	17 (65.38)	9 (34.62)	26

The annual distribution of positive screening results by sex showed that males accounted for the majority of HBV-positive results in each year from 2021 to 2024. The highest numbers of HBV-positive males (36) and females (23) were recorded in 2023, followed by 28 males and 10 females in 2024. For HCV, the highest

number of positive results was also observed in 2023, with 7 males and 3 females. In 2021, HCV-positive results were more frequent among females (5) than males (3), whereas male-positive results exceeded female-positive results in 2022 and 2023. No HCV-positive female cases were recorded in 2024, compared with 4 male cases. As shown in table 3.4.

Table 3.4: Annual distribution of positive screening results by sex.

Year	HBV-positive male / female	HCV-positive male / female
2021	19 / 14	3 / 5
2022	11 / 5	3 / 1
2023	36 / 23	7 / 3
2024	28 / 10	4 / 0

The mean age of all screening applicants was 27.3 ± 5.5 years. The HBV-positive group had a mean age of 28.6 ± 6.0 years, while the HCV-positive group had a higher mean age of 29.7 ± 7.5 years. In the comparison negative groups, the mean age was 27.4 ± 5.0 years among the HBV-negative sample and 26.2 ± 5.2 years among the HCV-negative sample.

Table 3.5: Age distribution of screening applicants and comparison groups.

Group	Number	Age, years (mean ± SD)
All applicants	56180	27.3 ± 5.5
HBV-positive	146	28.6 ± 6.0
HCV-positive	26	29.7 ± 7.5
HBV-negative	146	27.4 ± 5.0
HCV-negative	26	26.2 ± 5.2

Table 3.6 presents the viral-load distribution among the HBV- and HCV-positive groups. The HBV-positive group had a mean $\log_{10}$ viral load of 3.71 ± 1.08, with a median viral load of 5778 IU/mL (IQR: 828–27633) and a range of 10–530442 IU/mL. In comparison, the HCV-positive group had a mean $\log_{10}$ viral load of 5.75 ± 0.64, with a median of 431781 IU/mL (IQR: 267223–1387670) and a range of 36806–12586381 IU/mL.

Table 3.6: Viral-load distribution among screening-positive groups.

Marker	Number	Log10 viral load (mean ± SD)	Viral load, IU/mL (median, IQR)	Range (IU/mL)
HBV DNA	146	3.71 ± 1.08	5778 (828–27633)	10–5304421
HCV RNA	26	5.75 ± 0.64	431781 (267223–1387670)	36806–12586381

Table 3.7 shows that liver biochemical parameters varied across viral-load categories in both infection groups. Among HBV-positive participants, mean ALT increased from 20.2 ± 12.7 U/L in the low viral-load category to 48.2 ± 15.7 U/L in the high category, while mean AST increased from 18.4 ± 11.2 U/L to 40.4 ± 16.3 U/L. The differences across HBV viral-load categories were statistically significant for both ALT and AST ($P < 0.001$), whereas total bilirubin did not differ significantly ($P = 0.581$). Among HCV-positive participants, mean ALT increased from 37.7 ± 1.2 U/L in the low category to 63.5 ± 19.5 U/L in the high category, with a statistically significant overall difference ($P = 0.038$). However, the differences in AST ($P = 0.236$) and total bilirubin ($P = 0.241$) were not statistically significant.

Table 3.7: Liver biochemical parameters by viral-load category.

Infection	Viral-load category	Number	ALT (U/L), mean ± SD	AST (U/L), mean ± SD	Total bilirubin (mg/dL), mean ± SD
HBV	Low	49	20.2 ± 12.7	18.4 ± 11.2	0.8 ± 0.2
	Intermediate	57	29.7 ± 12.7	33.5 ± 13.1	0.8 ± 0.2
	High	40	48.2 ± 15.7	40.4 ± 16.3	0.9 ± 0.2
HCV	Low	2	37.7 ± 1.2	22.4 ± 13.5	0.7 ± 0.0
	Intermediate	16	40.3 ± 15.7	40.5 ± 17.0	1.1 ± 0.2
	High	8	63.5 ± 19.5	45.8 ± 14.3	0.9 ± 0.3
HBV	Overall group comparison	—	**P<0.001**	**P<0.001**	P = 0.581
HCV	Overall group comparison	—	**P=0.038**	P=0.236	P = 0.241

Note: Kruskal–Wallis tests compare ALT, AST and Total bilirubin across viral-load categories within each infection.

Table 3.8 demonstrates positive correlations between viral load and liver enzyme levels in both infection groups. Among HBV-positive participants, HBV DNA levels showed a strong positive correlation with ALT (R = 0.668, P < 0.001) and a moderate positive correlation with AST (R = 0.564, P < 0.001). Similarly, among HCV-positive participants, HCV RNA levels were moderately positively correlated with ALT (R = 0.504, P = 0.009), indicating a statistically significant correlation. However, the correlation between HCV RNA and AST was weaker and not statistically significant (R = 0.320, P = 0.111).

Table 3.8: Correlation between viral load and liver biochemical parameters.

Variables	Number	Correlation coefficient (ρ)	P value
HBV DNA versus ALT	146	0.668	**<0.001**
HBV DNA versus AST	146	0.564	**<0.001**
HCV RNA versus ALT	26	0.504	**0.009**
HCV RNA versus AST	26	0.320	0.111

4- DISCUSSION

The present study assessed HBV and HCV screening positivity among premarital screening applicants in Mosul. Among 56180 applicants, 146 were HBsAg-positive (0.26%) and 26 were anti-HCV-positive (0.046%). These proportions were lower than those reported by Naqid *et al*. in Zakho, where HBV positivity was 0.92% (139/15091) and HCV positivity was 0.07% (10/15091).[6] Similarly, Jamal *et al*. reported HBsAg positivity in 38 of 4246 participants (0.89%), while HCV RNA confirmed active infection in one participant (0.024%).[7] A study of 7900 blood donors in Duhok reported HBsAg positivity of 0.78% (62/7900) and anti-HCV positivity of 0.20% (16/7900); however, HCV RNA was detected in only one donor (0.013%).[8] Collectively, these findings indicate variation in screening positivity across Iraqi populations. Differences in study populations, screening periods, and confirmatory procedures may partly explain the observed variation. Anti-HCV positivity should not be equated with active HCV infection without HCV RNA confirmation.

Annual HBV positivity in Mosul was 0.471% in 2021 (33/7,000), 0.240% in 2022 (16/6,658), 0.305% in 2023 (59/19,342), and 0.164% in 2024 (38/23,180). HCV positivity declined from 0.114% in 2021 to 0.017% in 2024, although the highest annual count was recorded in 2023. This pattern differs from studies that report only an overall prevalence, such as the Zakho premarital screening study, which reported HBV positivity of 0.92% over 2019–2023.[6] In the absence of comparable annual data from other studies, direct year-by-year comparisons are limited. Moreover, differences in screening volume affect the number of positive cases; therefore, prevalence percentages are more appropriate than raw counts for comparing years.

Males accounted for 64.38% of HBV-positive cases and 65.38% of HCV-positive cases in Mosul. Comparable male predominance was reported by Naqid *et al*., where males represented 65.47% of HBV-positive cases and 60% of HCV-positive cases.[6] Jamal *et al*. reported HBsAg positivity in 26 of 2,123 males (1.22%) and 12 of 2123 females (0.57%).[7] In contrast, Ataallah *et al*., analysing 495648 blood donors in Baghdad during 2006–2009, reported HBsAg positivity of 0.7% in males and 0.5% in females; the difference was not statistically significant (P = 0.07). Anti-HCV positivity was 0.2% in males and 0.4% in females (P = 0.000).[9] These differences indicate that sex distributions may vary by population and infection marker.

The age estimates recorded for the Mosul study suggest mean ages of 28.6 ± 6.0 years among HBV-positive applicants and 29.7 ± 7.5 years among HCV-positive applicants. Naqid et al. reported a mean age of 26.87 ± 6.57 years, with 102 of 139 HBV-positive participants (73.38%) aged 23–31 years; this age-group association was statistically significant (P = 0.001).[7] Ataallah et al. also found that most HBV- and HCV-positive blood donors were aged 20–40 years.[9] These studies demonstrate that infections are detected among young and middle-aged adults undergoing screening.

The displayed viral-load findings suggest mean $\log_{10}$ HBV DNA and HCV RNA levels of 3.71 ± 1.08 and 5.75 ± 0.64, respectively. Molecular measurements can provide information about viral replication and help guide clinical evaluation. Jamal *et al*. confirmed HCV infection by reverse-transcription polymerase chain reaction in only one of 4246 participants (0.024%), illustrating the importance of molecular confirmation.[8]

Additionally, the displayed biochemical findings suggest increasing ALT and AST levels across HBV viral-load categories, with P values below 0.001 for both enzymes. Total bilirubin was not significantly different (P = 0.581). For HCV, the reported difference in ALT was statistically significant (P = 0.038), whereas AST and total bilirubin were not (P = 0.236 and P = 0.241, respectively). ALT and AST are indicators of hepatocellular injury, but their concentrations do not independently establish the severity of chronic viral hepatitis. Similarly, the displayed correlation coefficients indicate positive associations between HBV DNA and ALT (R = 0.668, P < 0.001) and between HBV DNA and AST (R = 0.564, P < 0.001). For HCV, the reported association between HCV RNA and ALT was moderate (R = 0.504, P = 0.009), while the association with AST

was weaker and not statistically significant (R = 0.320, P = 0.111). A comparable Iraqi study by Fazaa *et al*. included 102 patients with HBV and 60 healthy controls. The investigators found significantly higher ALT, AST, ALP, and bilirubin measurements in patients than in controls ($P \leq 0.05$), alongside lower albumin levels. They also reported positive correlations between HBV DNA and ALT, AST, ALP, direct bilirubin, and indirect bilirubin.[10] These findings generally support an association between HBV infection, viral replication, and biochemical evidence of liver injury. In contrast, Wang *et al*. investigated the relationship between HBV DNA and liver markers in chronic HBV infection and found no statistically significant correlation between HBV DNA and ALT (r = 0.182, P = 0.096) or AST (R = 0.086, P = 0.275). A weak correlation was observed between HBV DNA and albumin (R = 0.133, P = 0.031).[11] The discrepancy suggests that the relationship between viral replication and liver enzyme activity may vary according to disease phase, immune response, patient characteristics, and study design. Consequently, viral load should not be considered a direct substitute for biochemical or clinical assessment.

Regarding HCV, a study examining laboratory parameters and viral factors reported a weak positive correlation between HCV RNA and ALT (R = 0.027, P = 0.046), while the correlations with AST were not statistically significant and the association with bilirubin was weakly negative (R = −0.112).[12] These findings demonstrate that HCV RNA levels and aminotransferase activity do not necessarily change in parallel.

The study had several limitations, including its retrospective design and reliance on routinely recorded screening data. Therefore, the findings should be interpreted cautiously, and complete, verified patient-level records are required to support more comprehensive epidemiological and clinical conclusions.

5- CONCLUSION AND RECOMMENDATION

The present study concluded that HBV screening positivity among premarital screening applicants in Mosul was 0.26% (146/56,180), while anti-HCV positivity was 0.046% (26/56,180). HBV positivity was higher than HCV antibody positivity, and males accounted for the majority of positive cases for both infections. Annual screening positivity varied between 2021 and 2024, with the lowest recorded rates in 2024; however, the incomplete study-period data limit conclusions regarding long-term trends. It is recommended to maintain and strengthen premarital screening services, improve the completeness and accuracy of screening records, and ensure appropriate counselling and referral of applicants with positive results. HBsAg-positive individuals should undergo further clinical assessment, while anti-HCV-positive individuals should receive HCV RNA testing to confirm active infection. HBV vaccination should be provided to susceptible individuals according to national guidelines.

REFERENCES

1. World Health Organization. Hepatitis B [Internet]. Geneva: WHO; 2024. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-b.
2. World Health Organization. Hepatitis C [Internet]. Geneva: WHO; 2024. Available from: https://www.who.int/news-room/fact-sheets/detail/hepatitis-c.
3. World Health Organization. Guidelines for the prevention, diagnosis, care and treatment for people with chronic hepatitis B infection. Geneva: WHO, 2024.
4. Centers for Disease Control and Prevention. Clinical screening and diagnosis for hepatitis C [Internet]. Atlanta: CDC. Available from: https://www.cdc.gov/hepatitis-c/hcp/diagnosis-testing./
5. World Health Organization. Guidelines on hepatitis B and C testing. Geneva: WHO, 2017.
6. Naqid IA, Mahmood AJ, Mosa AA, Ahmed ZS, Abdullah AS, Abdulkareem DS, et al. Hepatitis B and C virus infection among couples undergoing premarital screening in Iraqi Kurdistan. IJID Reg., 2025; 14: 100492.
7. Jamal SA, Naqid IA, Hussein NR, Abdulqader SR, Nimet AA, Abdulkhdair HA, et al. The prevalence of hepatitis B and C virus infections in the couples attending a premarital screening program in Zakho City, Kurdistan Region of Iraq. Zahedan J Res Med Sci., 2021; 23(2): e99405.
8. Hussein NR, et al. The prevalence of hepatitis B and C viruses among blood donors attending blood bank in Duhok, Kurdistan Region, Iraq. Int J Infect., 2017; 4(1): e39008. doi:10.17795/iji-39008.
9. Ataallah TM, Hanan KA, Maysoun KS, Sadoon AA. Prevalence of hepatitis B and C among blood donors attending the National Blood Transfusion Center in Baghdad, Iraq from 2006–2009. Saudi Med J., 2011; 32(10): 1046–1050.
10. Fazaa AH, Atya AK, Kredy HM. Evaluation of liver function tests and their correlation with HBV viral load in patients with hepatitis B virus, Thi-Qar, Iraq. HIV Nurs., 2022; 22(2).
11. Wang HB, Wang QY, Yuan Q, Shan XY, Fu GH. Alanine aminotransferase is more sensitive to the decrease in hepatitis B virus-DNA load than other liver markers in chronic hepatitis B patients. J Clin Lab Anal, 2017; 31(6): e22141.
12. Bushra Ijaz BI, Waqar Ahmad WA, Javed FT, Sana Gull SG, Sarwar MT, Humera Kausar HK, Sultan Asad SA, Shah Jahan SJ, Saba Khaliq SK, Imran Shahid IS, Aleena Sumrin AS. Association of laboratory parameters with viral factors in patients with hepatitis C.