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Hepatitis B and C virus infection among couples undergoing premarital screening in Iraqi Kurdistan



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ABSTRACT

Background and Objectives: Hepatitis B virus (HBV) and hepatitis C virus (HCV) are significant global health challenges, leading to severe complications such as liver cirrhosis and hepatocellular carcinoma. Despite available vaccines and treatments, these infections persist, particularly, in regions such as Iraq. This study aimed to assess the prevalence of HBV and HCV among couples attending premarital screening programs in Zakho, Kurdistan Region of Iraq and explore the associated demographic risk factors.

Methods: A retrospective cross-sectional study was conducted from October 1, 2019 to December 31, 2023, including 15,091 couples. Laboratory screening for HBV and HCV was performed using enzyme-linked immunosorbent assay, followed by RNA quantification for HCV-positive cases.

Results: Of the total of 15,091 couples, the overall prevalence of HBV was 0.92% and HCV was 0.07%. Males, individuals aged 23-31 years, and urban residents had higher infection rates. Significant risk factors included age 23-31 years, male gender, and urban residency (P < 0.05).

Conclusions: The prevalence of HBV and HCV among couples in Zakho is consistent with regional data. Higher infection rates in males and urban areas suggest the need for targeted interventions, including public education and screening for high-risk populations.

Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are significant global health concerns. Due to the chronic nature of these infections, they may result in the development of serious life-threatening conditions such as liver cirrhosis and hepatocellular carcinoma, which lead to considerable morbidity and mortality [1,2]. World Health Organization estimated that 254 million people were living with chronic HBV infection and 50 million with the HCV infection worldwide; HBV and HCV cause about 3500 deaths per day [3].

Hepatitis B and hepatitis C are still circulating among populations worldwide, despite the availability of safe and effective vaccines for hepatitis B and antiviral treatments for HBV and HCV. In 2001, the HBV vaccine was formally incorporated into the expanded national vaccination program in the Kurdistan Region of Iraq. Since then, all newborns have been routinely vaccinated against HBV. In addition, the vaccine is freely available at primary health centers, where it can be administered to individuals at increased risk, those with a doctor recommendation, or traveling to endemic areas [4,5] In Iraq, there are no nationwide studies to report the prevalence of HBV and HCV. However, studies' reported prevalence of HBV ranged from approximately 1% in the north to 3.5% in the south [6–8].

Transmission of HBV and HCV occurs through several ways: direct contact with contaminated blood, blood transfusion, intravenous injections, unprotected sex, and perinatally from the mother to the fetus [9]. To decrease the risk of disease transmission, many countries, including those in the Middle East, have established a premarital screening program to screen couples for several genetic and infectious diseases [10]. This program helps to identify asymptomatic carriers of these genetic and communicable diseases to provide them with the needed counseling and prevent the spread of infection to their partners and children, which may become sources of infection in the future [11].

Several studies have been conducted in the Kurdistan Region of Iraq to assess the prevalence of HBV and HCV among different groups of people, which included those undergoing blood transfusion, dialysis, and kidney transplant; pregnant women; couples; and health care workers

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[6,7,12–14]. However, to the best of our knowledge, this is the most updated and the first report to include a vast number of couples, with the aim of determining the prevalence of HBV and HCV among couples attending premarital screening programs in Zakho. Analyzing these data will help us better understand the epidemiology of these infectious diseases, which will guide targeted intervention to decrease the burden of these infectious diseases within the community.

Materials and methodology

Study design and participants

This retrospective cross-sectional study was conducted in premarital screening center at Zakho Emergency Hospital. Data of couples who underwent screening for HBV and HCV in this center over a period of 5 years from October 1, 2019 to December 31, 2023 were collected. The study gathered fundamental demographic information, including age, gender, and residential area, along with HBV and HCV screening results.

Study settings

The premarital screening center is the sole authorized center to perform screening in couples undergoing marriage process in the Zakho Independent Administration, Kurdistan Region of Iraq. This program offers complimentary screening, mandated by the Kurdistan Regional Government, for all couples before marriage. Couples are screened for infectious diseases, including HBV, HCV, HIV, and syphilis, as well as for genetic conditions such as thalassemia. Those who test positive for any condition are referred for specialized consultation to ensure appropriate counseling and treatment. In cases of HBV infection, in addition to treatment for the affected couples, the uninfected partner is provided with the HBV vaccination.

Laboratory procedure for HBV and HCV screening

Hepatitis B surface antigen (HBsAg) was detected using the LIAI-SON XL MUREX enzyme-linked immunosorbent assay kit according to the manufacturer's guidelines. Serum samples were added to wells precoated with specific antibodies, followed by incubation and washing steps to remove unbound substances. A secondary enzyme-linked antibody was then introduced, and a substrate was added, resulting in a detectable color change. The optical density was measured at 450 nm, with a cut-off index value of 1.00 used to determine a positive result. Similarly, anti-HCV antibodies were detected using the LIAISON XL MUREX enzyme-linked immunosorbent assay kit. Serum samples were placed in wells coated with HCV antigens, and a similar detection process was followed. Samples with an signal-to-cutoff ratio value of 1.00 or higher were considered reactive for HCV antibodies. Reactive or equivocal samples were retested in duplicate to confirm the results and lower the probability of false-positive outcomes. In case of doubts, a referral to specialist was done.

HCV-RNA quantification

To verify HCV positivity, all samples that tested positive for HCV antibodies were subjected to further analysis using the Xpert HCV quantification assay (Cepheid, Sunnyvale, California, USA). This assay quantifies HCV RNA, with a detection range between 10 IU/ml and 10^8 IU/ml, offering an accurate assessment of the viral load. Patients with confirmed HCV antibody positivity underwent this molecular analysis to verify the presence of active infection.

Ethical approval

The final study protocol received approval from the Scientific and Ethics Committee of the College of Medicine, University of Zakho on

Table 1

Basic demographic characteristics (n = 15091).

Variables	Frequency	Percentage	
Age			
14-22	3642	24.13%	
23-31	8839	58.57%	
32-40	2098	13.9%	
≥41	512	3.39%	
Mean \pm SD	26.87±6.57		
Gender			
Male	7116	47.15%	
Female	7975	52.84%	
Living environment			
Urban	14087	94.35%	
Rural	1004	6.65%	

Table 2

Prevalence of hepatitis B virus and hepatitis C virus (n = 15,091).

Variables	Frequency	Percentage
Hepatitis B surface antigen	139	0.92%
Hepatitis C antibody	10	0.07%

June 10, 2023, with a reference number (JUN2023/E03), and consent for data access was granted by the Zakho Emergency Hospital Manager. Given the retrospective nature of the study, the ethics committee waived the requirement for informed consent.

Statistical analysis

All calculations and analyses were performed using GraphPad Prism version 8. Categorical data were expressed as numbers and percentages, whereas continuous variables were summarized using the mean and SD. The association between demographic variables and HBV infection was assessed using the chi-square test (or Fisher's exact test, where appropriate). A *P*-value of 0.05 or less was considered indicative of a statistically significant association.

Results

Demographic characteristics

Table 1 summarizes the basic demographic characteristics of the enrolled couples. This study recruited 15,091 couples who attended the Premarital Screening Department in Zakho Emergency Hospital. The mean age of the study sample was 26.87 ± 6.57 years, and about three-fifths of participants fall in the 23-31 years age group. Of the total, 7975 (52.84%) were females and 7116 (47.15%) were males. The vast majority of participants were living in urban areas.

Prevalence of HBV and HCV

In the sample, only 139 (0.92%) of the participants tested positive for HBV, whereas only 10 (0.07%) had a hepatitis C infection. Table 2 shows the prevalence of infection among the screened couples.

Correlation between demographic characteristics and hepatitis *B* virus and hepatitis *C* virus infection

The highest prevalence of HBV infection was found in the 23-31 years age group, where (73.38%) of infected individuals fell, compared with other age groups, with a statistically significant *P*-value (P = 0.001). Similarly, for HCV, half (50%) of the infections were also observed in this age group, but this was not statistically significant (P = 0.6288). Gender differences were also notable, with males accounting for 65.47% of HBV infections, significantly more than females

Table 3	
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Risk factors for HBV and HCV infection (n = 15,091).

Variables	Risk factors for HBV infection ($n = 139$)		Risk factors for HCV infection $(n = 10)$			
	Infected n (%)	Non-infected <i>n</i> (%)	^a P-value	Infected n (%)	Non-infected <i>n</i> (%)	^a P-value
Age						
14-22	8 (5.76)	3634 (24.3)	0.001	2 (20)	3639 (24.13)	0.6288
23-31	102 (73.38)	8737 (58.43)		5 (50)	8833 (58.57)	
32-40	21 (15.1)	2077 (13.89)		2 (20)	2095 (13.89)	
≥41	8 (5.76)	504 (3.38)		1 (10)	514 (3.4)	
Mean ± SD	29.77 ±6.18	26.84 ± 6.57	0.0001	27.91 ± 8.3	26.92 ± 7.375	0.6565
Gender						
Male	91 (65.47)	7025 (46.98)	0.001	6 (60)	7110 (47.15)	0.4156
Female	48 (34.53)	7927 (53.02)		4 (40)	7971 (52.85)	
Living environment						
Urban	136 (97.84)	13951 (93.4)	0.026	10 (100%)	14079 (93.36%)	0.3989
Rural	3 (2.16)	1001 (6.69)		0 (0.00%)	1002 (6.64%)	

HBV, hepatitis B virus; HCV, hepatitis C virus, SD: Standard deviation.

Percentages are calculated vertically.

^a*P*-value is determined using chi-square and unpaired Student's *t*-test.

(P = 0.001), whereas 60% of HCV infections were in males, although this difference was not statistically significant (P = 0.4156). In terms of living environment, the vast majority (97.84%) of individuals infected with HBV resided in urban areas, with a statistically significant difference (P = 0.026) compared with those in rural areas. For HCV, all infections occurred in urban areas, but this association was not statistically significant (P = 0.3989). Table 3 provides a detailed summary of the correlation between demographic variables and HBV and HCV infection.

Discussion

This study illustrates the latest data on HBV and HCV infections among couples attending premarital screening programs, offering a valuable comparison with previous studies conducted in Iraq and the surrounding regions. These findings are crucial in identifying high-risk populations and associated risk factors, thereby guiding future research and public health interventions aimed at reducing infection rates. The overarching goal of premarital screening programs is to lower infection rates, ensuring that couples can enter marriage safely and, if necessary, receive timely treatment from health care providers. By addressing these risk factors and focusing on high-risk groups, the screening program aims to contribute to the overall health and well-being of the population.

This study included 15,091 couples who underwent premarital screening for HBV and HCV. The prevalence of HBsAg positivity was found to be 0.92%, which aligns with findings from a previous study conducted in the Kurdistan Region of Iraq, where 0.89% of participants tested positive for HBsAg [13]. In contrast, HCV was detected in only 0.07% of the couples, which is lower than the 0.2% prevalence reported among blood donors attending Duhok blood bank, Iraqi Kurdistan [12]. Comparatively, in Saudi Arabia, the prevalence of HBV and HCV among couples undergoing premarital screening were 0.52% and 0.05%, respectively, indicating a lower prevalence in that country [15]. However, a study conducted in Syria, which randomly screened 3168 individuals, reported seroprevalence of 5.6% for HBV and 2.8% for HCV [16]. In Turkey, the prevalence of HBV was reported to be 4%, which could be attributed to the country's status as a popular tourist destination, contributing to the higher rates observed [17].

In the current study, age 23-31 years, male gender, and residing in urban areas were identified as significant risk factors for contracting HBV and HCV infections. Notably, the male gender emerged as a prominent factor, with a male-to-female infection ratio of approximately 2:1. This finding aligns with previous studies conducted at the same center, which similarly identified male gender as a risk factor for infection [13]. Comparable results have also been reported in various regions of Iraq, including studies from Basra and Samarra, further confirming the association between male gender and higher infection rates [18,19].

In addition, studies from the Jazan Region in Saudi Arabia and Pakistan have consistently demonstrated a higher prevalence of infectious diseases among males [20,21]. The increased vulnerability of males to infection may be attributed to several cultural and behavioral factors. Locally, common practices, such as the use of unsterilized needles and razors in barbershops, which often lack proper hygiene standards, contribute to higher transmission rates among males. Moreover, the rise in intravenous drug use, which is more prevalent among males, further exacerbates the risk of infection [22].

The current study observed a higher prevalence of HBV and HCV infections among couples aged 23-31 years. This result is consistent with a previous study from Diyala, Iraq, which reported that the highest infection rates for HBV and HCV were found in individuals aged 20-30 years, particularly, among those attending a premarital screening program [23]. In contrast, a study conducted in Basra, Iraq, which included 69,915 blood donors, found that the majority of infections occurred in the 30-40 years age group [18]. The discrepancy between these findings may be attributable to differences in the mean age of the participants, which was 26.87 \pm 6.57 years in the present study, compared with 39 \pm 15 years in the Basra study. Notably, in the current study, 8839 (58%) participants were aged between 21 and 31 years. The higher infection rate in this age group could be explained by an increased likelihood of drug abuse among younger individuals. This behavioral factor likely contributes to the elevated infection rates observed in younger populations [22].

Another notable finding from this study was the significantly higher HBV infection rates among urban residents than those in rural areas. Only three infected individuals were identified from rural areas, in stark contrast to the 136 infected individuals from urban settings. These results differ from a study conducted in southern Turkey, which reported a higher prevalence of HBV in rural areas than urban regions [24]. The discrepancy in findings may be attributed to differences in sampling methods. In our study, data were derived from government records at premarital screening centers, whereas the study from southern Turkey collected samples through home visits. The elevated prevalence of infectious diseases in urban areas could potentially be explained by a higher concentration of illegal drug distribution and abuse, which is more prevalent in urban environments than rural areas [22].

Limitations and recommendations

The present study has several limitations. First, the data collection was limited to a single city in the Kurdistan Region of Iraq, focusing solely on couples undergoing premarital screening, which restricts the generalizability of the results to other cities and the wider population. This scope may have excluded a substantial portion of the population. Second, neutralization of HBsAg as a confirmatory test was not performed in this center when the positivity signal was low. Furthermore, the lack of a comprehensive medical database hindered the ability to assess complete medical histories, couples' vaccination status, their awareness of their infection status before screening, and other covariates, making it challenging to accurately determine specific risk factors associated with the higher infection rates observed in certain groups.

We recommend the implementation of a comprehensive medical database that records thorough health information of couples, including all previously mentioned information. Such a database will facilitate a better targeted public health intervention, recognize change in infection trends, and allow a more precise evaluation of the effectiveness of screening programs and health campaigns in the region.

Conclusion

The overall prevalence of HBV was 0.92%, whereas HCV was 0.07%, with higher infection rates observed among males, individuals aged 23-31 years, and urban residents. These findings align with regional data; however, the study's limited geographic scope and absence of comprehensive medical histories highlight the need for broader research to explore population-wide trends and risk factors in affected couples. We recommend increasing public education on HBV transmission routes and offering targeted screening for high-risk groups.

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Ethical approval

The final study protocol received approval from the Scientific and Ethics Committee of the College of Medicine, University of Zakho on June 10, 2023, with a reference number (JUN2023/E03), and consent for data access was granted by the Zakho Emergency Hospital Manager.

Author contributions

Conception and design of the study: Ibrahim A. Naqid, Ali Jotiar Mahmood, Ahmed A. Mosa; acquisition of data: Ali Jotiar Mahmood, Zana Sherwan Ahmed, Abdulrrahman Saad Abdullah, Dana Sherzad Abdulkareem, Rojeen Chalabi Khalid, Iman Ramadhan Yousif, Hajar Hassan Abdulqadir; analysis and interpretation of data: Ibrahim A. Naqid, Ali Jotiar Mahmood, Ahmed A. Mosa; drafting the article: Ali Jotiar Mahmood, Zana Sherwan Ahmed, Abdulrrahman Saad Abdullah, Dana Sherzad Abdulkareem, Rojeen Chalabi Khalid, Iman Ramadhan Yousif, Hajar Hassan Abdulqadir; revising the draft critically for important intellectual content: Ibrahim A. Naqid, Ahmed A. Mosa. All the authors approve the final version of manuscript to be submitted.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT 40 to improve the linguistic format of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Data availability statement

All data supporting the findings of this manuscript are available without restriction.

Declaration of competing interest

The authors have no competing interests to declare.

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