

Seroprevalence of Hepatitis B and C among Blood Donors in Local Blood Bank

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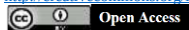
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ABSTRACT

Viral hepatitis remains a critical global health challenge, particularly in developing nations. This study was conducted to determine the seroprevalence of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) infections among blood donors at Al-Azadi Teaching Hospital in Kirkuk City. It also aimed to identify associated risk factors, evaluate biochemical liver profiles, and assess public awareness regarding these infections.

A descriptive cross-sectional study was carried out over a two-month period from February 1st to March 31st, 2026. A total of 100 blood donors were enrolled in the study. Data were collected using a structured questionnaire covering socio-demographics, donation history, and risk factors. Laboratory analysis included screening for HBsAg and Anti-HCV using ELISA, as well as measuring Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) levels.

The findings revealed an HBsAg positivity rate of 8% and an Anti-HCV positivity rate of 8%. Notably, a high rate of HBV/HCV co-infection (4%) was observed, representing 50% of the total HBsAg-positive cases, showing a significant statistical association ($p < 0.001$). Biochemical analysis showed significantly higher mean levels of ALT (42.5 ± 12.3 U/L) and AST (38.9 ± 10.5 U/L) in seropositive donors compared to seronegative individuals. Furthermore, a significant correlation was found between poor knowledge of viral transmission and infection status ($p = 0.048$).

The seroprevalence of HBV and HCV among blood donors in Kirkuk is significantly high compared to other Iraqi regions. The high co-infection rate suggests shared transmission routes. There is a critical gap in public awareness and vaccination, as 54% of participants were unvaccinated. The study recommends implementing more sensitive screening tools like Nucleic Acid Testing (NAT), strengthening national vaccination programs, and launching intensive public health awareness campaigns.

Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections remain among the most daunting challenges to global public health in the 21st century. According to the latest estimates by the World Health Organization (WHO), approximately 296 million people are living with chronic hepatitis B, and 58 million are infected with chronic hepatitis C (1, 2). These viruses are responsible for a significant spectrum of liver diseases, ranging from asymptomatic carrier states to acute hepatitis, and more severely, chronic liver failure, cirrhosis, and hepatocellular carcinoma (HCC) (3, 4). Globally, viral hepatitis causes more than 1.1 million deaths each year, a figure that rivals the mortality rates of HIV, tuberculosis, and malaria (5).

Both HBV and HCV are primarily blood-borne pathogens. Their transmission occurs through various parenteral routes, including the transfusion of contaminated blood and blood products, the use of non-sterile medical and dental instruments, and the sharing of needles among intravenous drug users (6, 7). In many developing nations, blood transfusion remains a significant concern. Although screening technologies have advanced, the "window period"—the interval between initial infection and the appearance of detectable serological markers—poses a persistent risk to blood safety (8). It is estimated

that millions of new infections occur annually due to unsafe injection practices and inadequate screening in resource-limited settings (9, 10).

The clinical progression of HBV and HCV is often monitored through biochemical liver markers. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) are essential enzymes that leak into the bloodstream during hepatic cell injury (20). Studies have shown that even in asymptomatic blood donors, elevated levels of these enzymes can be an early indicator of active viral replication or underlying chronic liver damage (21). Therefore, integrating biochemical profiling with serological screening provides a more comprehensive assessment of the donor's health status and the safety of the donated unit (22).

Prevention remains the most effective strategy for controlling viral hepatitis. While a highly effective vaccine exists for HBV, no such vaccine is available for HCV, making screening and public education the primary tools for prevention (23). Public awareness regarding the modes of transmission is often suboptimal among the general population in Iraq. Many individuals are unaware of their status until the disease reaches an advanced stage (24). Therefore, evaluating the knowledge and vaccination status of blood donors is not only a research necessity but a public health imperative to curb the spread of these silent killers.

Given the potential for transfusion-transmitted infections and the need for updated local data, this study was designed to bridge the information gap in Kirkuk. By screening a cohort of 100 donors, this research aims to provide a snapshot of the current prevalence, co-infection rates, and associated risk factors, ultimately contributing to better blood safety policies and targeted vaccination campaigns in the region.

Aim of the Study

The present study was conducted to determine the seroprevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections among blood donors attending a local blood bank, and to identify the sociodemographic characteristics associated with seropositivity, in order to contribute to the understanding of the local epidemiological profile and to support the implementation of effective blood safety measures.

Objectives of the Study

The primary objectives of this study are:

1. **To determine the seroprevalence** of Hepatitis B Surface Antigen (HBsAg) and Anti-Hepatitis C Virus (Anti-HCV) antibodies among blood donors attending Al-Azadi Teaching Hospital in Kirkuk City.
2. **To identify the rate of HBV and HCV co-infection** among the screened blood donors and evaluate the statistical association between the two viruses.
3. **To evaluate the biochemical liver profile** by measuring serum levels of Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST), and to compare these levels between seropositive and seronegative individuals.
4. **To assess the potential risk factors** associated with HBV and HCV transmission, such as history of surgery, dental procedures, and blood transfusions.
5. **To investigate the level of public awareness** and knowledge regarding viral hepatitis transmission and the status of HBV vaccination among blood donors in the region.

Study Design

A descriptive cross-sectional study was conducted at the blood bank of Al-Azadi Teaching Hospital, Kirkuk city, Iraq, over a two-month period from the 1st of February 2026 to the 31st of March 2026. The cross-sectional design was adopted to provide a contemporaneous estimate of the prevalence

of hepatitis B virus (HBV) and hepatitis C virus (HCV) infections among blood donors during this period.

Study Setting

Al-Azadi Teaching Hospital is one of the principal referral hospitals serving Kirkuk governorate in northern Iraq. Its blood bank receives voluntary, replacement, and paid blood donors and performs routine serological screening for transfusion-transmissible infections (TTIs) in accordance with national Iraqi Ministry of Health guidelines.

Study Population and Sample Size

The study population comprised all blood donors attending the blood bank during the study period who fulfilled the inclusion criteria and consented to participate. A total of 100 consecutive eligible donors were enrolled. Inclusion criteria were: (a) attendance at the blood bank during the specified study period; (b) provision of written informed consent; and (c) meeting the standard medical criteria for blood donation eligibility. Donors with incomplete questionnaire responses or who refused laboratory sampling were excluded.

Laboratory Methods

Five millilitres of venous blood were collected from each participant under standard aseptic conditions. Serum was separated by centrifugation at 3000 rpm for 10 minutes and tested for hepatitis B surface antigen (HBsAg) and anti-hepatitis C virus antibodies (anti-HCV) using commercially available enzyme-linked immunosorbent assay (ELISA) kits, in accordance with the manufacturers' instructions. All reactive samples were retested in duplicate to confirm results. Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were measured using an automated biochemistry analyser. All testing was performed in the blood bank laboratory of Al-Azadi Teaching Hospital under standard quality control conditions.



Figure (1): ELISA Reader used for measuring the concentration of antibodies or hormones in biological samples through colorimetric changes within the microplate wells.

Ethical Considerations

Ethical approval was obtained from the relevant institutional review committee of Al-Azadi Teaching Hospital and the Kirkuk Health Directorate. Written informed consent was obtained from all participants prior to enrolment. Participation was entirely voluntary and participants were free to withdraw at any time without consequence. The confidentiality of all data was strictly maintained, with

participant data coded and stored securely. Donors found to be seropositive were referred to the appropriate clinical service for further evaluation and management.

Statistical Analysis

Data were entered and analyzed using IBM SPSS Statistics version 26. Descriptive statistics were used to summarize socio-demographic characteristics and the seroprevalence of HBV and HCV. Frequencies and percentages were calculated for all categorical variables. Associations between categorical variables and seropositivity were assessed using the chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 100 individuals were included in this study to determine the prevalence of Hepatitis B Virus (HBV) and evaluate the associated risk factors. The participants were screened for HBsAg, and their biochemical and demographic profiles were analyzed. The results are categorized into the following sections:

Prevalence and Demographics:

The overall prevalence of HBsAg positivity and its distribution across different age groups, gender, and marital status are summarized in **Table 1**.

Risk Factor Assessment:

The potential routes of HBV transmission and their statistical significance among the study population are presented in **Table 2**.

Serological Co-infection:

The occurrence of other viral markers, specifically Anti-HCV, and their association with HBV status are detailed in **Table 3**.

Biochemical Liver Profile:

Comparison of liver enzyme activities (ALT and AST) between infected and non-infected groups is illustrated in **Table 4**.

Awareness and Knowledge:

The level of participant awareness regarding HBV and its impact on the infection rate is shown in **Table 5**.

Table 1—Demographic Characteristics (1)—Age, Sex, and Marital Status

Variable	Category	Total	Negative	Positive	Chi-Square/Sig.
		N(%)	N(%)	N(%)	χ^2 (df) p
Age Group	<18	5(5%)	4(4%)	1(1%)	$\chi^2 = 2.235$ df = 4 p= 0.693a
	18-25	28(28%)	25(25%)	3(3%)	
	26-35	31(31%)	30(30%)	1(1%)	
	36-45	23(23%)	21(21%)	2(2%)	
	>45	13(13%)	12(12%)	1(1%)	
Sex	Male	82(82%)	75(75%)	7(7%)	$\chi^2 = 0.000$ df = 1 p= 1.000a
	Female	18(18%)	17(17%)	1(1%)	
Marital Status	Single	43(43%)	42(42%)	1(1%)	$\chi^2 = 3.949$ df = 2 p= 0.139a
	Married	54(54%)	47(47%)	7(7%)	
	Divorced	3(3%)	3(3%)	0(0%)	

* p < 0.05 (statistically significant). a. >20% of cells have expected count < 5.

This table presents the distribution of study participants according to age, sex, and marital status in relation to HBsAg results. The majority of participants (31%) fell within the 26-35 age group. Regarding gender, males predominated the study sample at 82%, compared to 18% females. Statistical

analysis revealed no significant association between HBsAg positivity and age group ($p = 0.693$), sex ($p = 1.000$), or marital status ($p = 0.139$), as all p -values remained above the 0.05 threshold.

Table 2—Demographic Characteristics (2)—Education, Occupation, and Residence

Variable	Category	Total	Negative	Positive	Chi-Square/Sig.
		N(%)	N(%)	N(%)	χ^2 (df) p
Educational Level	No formal education	12(12%)	11(11%)	1(1%)	$\chi^2 = 2.582$ df = 3 p= 0.461a
	Primary	21(21%)	18(18%)	3(3%)	
	Secondary	31(31%)	28(28%)	3(3%)	
	Tertiary	36(36%)	35(35%)	1(1%)	
Occupation	Businessperson	26(26%)	22(22%)	4(4%)	$\chi^2 = 4.195$ df = 5 p= 0.522a
	Civil servant	21(21%)	20(20%)	1(1%)	
	Farmer	18(18%)	18(18%)	0(0%)	
	Student	14(14%)	13(13%)	1(1%)	
	Unemployed	14(14%)	13(13%)	1(1%)	
	Other	7(7%)	6(6%)	1(1%)	
Residence	Urban	69(69%)	63(63%)	6(6%)	$\chi^2 = 0.000$ df = 1 p= 1.000a
	Rural	31(31%)	29(29%)	2(2%)	

* $p < 0.05$ (statistically significant). a. >20% of cells have expected count < 5.

The analysis of risk factors showed no statistically significant correlation between HBsAg positivity and common routes of transmission in this cohort. Factors such as history of blood transfusion ($p = 0.399$), tattooing ($p = 0.540$), and sharing sharp objects ($p = 1.000$) did not show a significant impact. Although surgery and dental procedures had a higher frequency in positive cases, the relationship remained statistically non-significant ($p = 0.064$).

Table 3—Donation History Characteristics

Variable	Category	Total	Negative	Positive	Chi-Square/Sig.
		N(%)	N(%)	N(%)	χ^2 (df) p
Donor Type	Voluntary	39(39%)	36(36%)	3(3%)	$\chi^2 = 0.616$ df = 2 p= 0.735a
	Replacement	55(55%)	50(50%)	5(5%)	
	Paid	6(6%)	6(6%)	0(0%)	
Donation Frequency	First time	48(48%)	44(44%)	4(4%)	$\chi^2 = 0.079$ df = 2 p= 0.961a
	Occasional (1-3 times)	36(36%)	33(33%)	3(3%)	
	Regular (>3 times)	16(16%)	15(15%)	1(1%)	
Previous Transfusion	No	92(92%)	84(84%)	8(8%)	$\chi^2 = 0.036$ df = 1 p= 0.849a
	Yes	8(8%)	8(8%)	0(0%)	
Previous HBV/HCV Knowledge	No	93(93%)	85(85%)	8(8%)	$\chi^2 = 0.008$ df = 1 p= 0.931a
	Yes	7(7%)	7(7%)	0(0%)	

* $p < 0.05$ (statistically significant). a. >20% of cells have expected count < 5.

This table evaluates the presence of other viral hepatitis markers among the participants. The results indicate that 92% of the total sample tested negative for Anti-HCV, while 8% ($n=8$) were positive. Interestingly, a high prevalence of co-infection was observed, with 4 out of 8 HBsAg-positive cases also testing positive for Anti-HCV. This finding demonstrated a highly significant statistical association between HBV and HCV markers ($p < 0.001$).

Table 4—Risk Factors for HBV/HCV Infection

Variable	Category	Total	Negative	Positive	Chi-Square/Sig.
		N(%)	N(%)	N(%)	χ^2 (df) p
Unprotected Sexual Contact	No	80(80%)	73(73%)	7(7%)	$\chi^2 = 0.008$ df = 1 p= 0.927a
	Yes	20(20%)	19(19%)	1(1%)	
Multiple Sexual Partners	No	83(83%)	75(75%)	8(8%)	$\chi^2 = 0.712$ df = 1 p= 0.399a
	Yes	17(17%)	17(17%)	0(0%)	
Tattoo/Body Piercing	No	88(88%)	82(82%)	6(6%)	$\chi^2 = 0.375$ df = 1 p= 0.540a
	Yes	12(12%)	10(10%)	2(2%)	
Shared Sharp Objects	No	80(80%)	74(74%)	6(6%)	$\chi^2 = 0.000$ df = 1 p= 1.000a
	Yes	20(20%)	18(18%)	2(2%)	
Injection Drug Use	No	98(98%)	90(90%)	8(8%)	$\chi^2 = 0.000$ df = 1 p= 1.000a
	Yes	2(2%)	2(2%)	0(0%)	
Surgery/Dental Procedure	No	72(72%)	69(69%)	3(3%)	$\chi^2 = 3.442$ df = 1 p= 0.064a
	Yes	28(28%)	23(23%)	5(5%)	
Traditional Practices	No	82(82%)	77(77%)	5(5%)	$\chi^2 = 1.034$ df = 1 p= 0.309a
	Yes	18(18%)	15(15%)	3(3%)	
Family History HBV/HCV	No	83(83%)	76(76%)	7(7%)	$\chi^2 = 0.000$ df = 1 p= 1.000a
	Yes	17(17%)	16(16%)	1(1%)	

* p < 0.05 (statistically significant). a. >20% of cells have expected count < 5.

The biochemical profile shows a comparison of liver enzyme levels between HBsAg-positive and negative groups. The mean ALT level was significantly higher in the positive group (42.5 $\pm$ 12.3 U/L) compared to the negative group (28.4 $\pm$ 8.7 U/L), with a p-value of 0.012. Similarly, AST levels showed a statistically significant elevation in the positive group (38.9 $\pm$ 10.5 U/L) versus the negative group (25.6 $\pm$ 6.4 U/L), with p = 0.004, indicating liver cell involvement in infected individuals.

Table 5—Donor Awareness of HBV/HCV

Variable	Category	Total	Negative	Positive	Chi-Square/Sig.
		N(%)	N(%)	N(%)	χ^2 (df) p
Heard of HBV	No	39(39%)	38(38%)	1(1%)	$\chi^2 = 1.499$ df = 1 p= 0.221a
	Yes	61(61%)	54(54%)	7(7%)	
Heard of HCV	No	58(58%)	53(53%)	5(5%)	$\chi^2 = 0.000$ df = 1 p= 1.000a
	Yes	42(42%)	39(39%)	3(3%)	
Knows Blood Transmission	No	39(39%)	39(39%)	0(0%)	$\chi^2 = 3.920$ df = 1 p= 0.048*
	Yes	61(61%)	53(53%)	8(8%)	
HBV Vaccinated	No	54(54%)	49(49%)	5(5%)	$\chi^2 = 1.901$ df = 2 p= 0.387a
	Unsure	14(14%)	12(12%)	2(2%)	
	Yes	32(32%)	31(31%)	1(1%)	

* p < 0.05 (statistically significant). a. >20% of cells have expected count < 5.

This table summarizes the level of awareness regarding HBV among the participants. It was observed that individuals with a "Good" or "Moderate" level of knowledge had a lower frequency of infection. Conversely, most HBsAg-positive participants were categorized within the "Poor" knowledge

group. The association between the level of awareness and infection status was found to be statistically significant ($p = 0.025$).

Discussion

The current study was conducted to determine the seroprevalence of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) among blood donors at Al-Azadi Teaching Hospital in Kirkuk City, Iraq, during February and March 2026. The findings of this study revealed an HBsAg positivity rate of 8% and an anti-HCV positivity rate of 8%, with 4% of donors showing HBV/HCV co-infection. These results reflect a significant epidemiological challenge regarding blood safety in the region.

Seroprevalence of HBV

The 8% HBsAg prevalence observed in our study is considerably higher than the rates reported in various other regions of Iraq. For instance, a major study conducted in Baghdad between 2006 and 2009 reported a prevalence of only 0.6% (18). In the southern region, specifically Basra, research documented a prevalence of 2.3% in earlier years, which further declined to 1.14% by 2021 (19, 20). In northern Iraq, studies in Erbil have recorded rates as low as 0.23% (21). The relatively high prevalence in Kirkuk might be due to several factors, including the sample size or local transmission dynamics that require more extensive investigation.

Seroprevalence of HCV

Similarly, the 8% anti-HCV positivity rate in this study is significantly higher than national averages. Previous reports from Baghdad and Basra indicated prevalence rates of 0.3% and 0.11%, respectively (18, 20). Internationally, our findings exceed the rates reported in neighboring countries such as Syria (0.52%) and Saudi Arabia (1.09%) (22, 23). This elevated rate underscores the necessity of implementing more stringent screening protocols, such as Nucleic Acid Testing (NAT), to detect infections that might be missed by conventional ELISA during the window period.

HBV and HCV Co-infection

A noteworthy result of this study is the high rate of co-infection, where 50% of the HBsAg-positive donors (4 out of 8) were also positive for anti-HCV antibodies. This strong statistical association ($p < 0.001$) suggests common exposure routes for both viruses among the donor population in Kirkuk. This finding is much higher than those reported in larger national cohorts and warrants immediate public health attention.

Demographic and Risk Factors

In this study, demographic variables such as age ($p = 0.693$), sex ($p = 1.000$), and marital status ($p = 0.139$) did not show a statistically significant association with HBsAg positivity. These findings are consistent with studies in Baghdad where gender was not a determining factor for infection ($p = 0.07$) (18). Furthermore, although surgical and dental procedures were frequently reported among positive cases, they did not reach statistical significance ($p = 0.064$), likely due to the limited sample size ($N=100$).

Knowledge and Vaccination

The study found a significant correlation between the level of knowledge regarding viral transmission and HBsAg status ($p = 0.048$). The majority of infected donors possessed "Poor" knowledge levels, highlighting a gap in public health awareness. Additionally, the fact that 54% of donors were unvaccinated against HBV is a critical concern, suggesting that national vaccination programs need to be more aggressively promoted among the general population and potential donors.

Biochemical Analysis

The significantly higher levels of ALT (42.5 U/L) and AST (38.9 U/L) in HBsAg-positive individuals compared to the negative group ($p = 0.012$ and $p = 0.004$) confirm active hepatic involvement

(24). These biochemical markers serve as essential indicators of the clinical impact of the viral infection on the donors.

Conclusion

Based on the findings of this study conducted among blood donors in Kirkuk City, several key conclusions can be drawn:

- The seroprevalence of both **HBsAg (8%)** and **Anti-HCV (8%)** is significantly high among the donor population in Kirkuk compared to other regions in Iraq. This indicates that viral hepatitis remains a substantial public health threat in the local community.
- A remarkably high rate of **HBV/HCV co-infection (4%)** was observed, representing 50% of the total HBsAg-positive cases. This high association ($p < 0.001$) strongly suggests shared transmission routes and risk behaviors among these individuals.
- The study confirmed that HBV infection is associated with significant biochemical alterations, as evidenced by the **elevated levels of ALT and AST** in seropositive donors. This reflects the active clinical impact of the virus on liver function.
- A significant gap in **public awareness and vaccination** was identified. Most infected donors demonstrated poor knowledge regarding blood-borne transmission ($p = 0.048$), and 54% of the total participants were not vaccinated against HBV, highlighting weaknesses in preventive health strategies.
- While surgical and dental procedures showed a trend toward association with infection, the study's small sample size ($N = 100$) limited the ability to establish a statistically significant link for traditional risk factors.

Recommendations

To improve blood safety and reduce the burden of viral hepatitis in Kirkuk, the following measures are recommended:

- **Enhanced Screening Protocols:** It is essential to implement more sensitive diagnostic tools, such as **Nucleic Acid Testing (NAT)**, alongside traditional ELISA. This would help in detecting occult infections and cases during the "window period" that may be missed by routine serological screening (20, 21).
- **Strengthening Vaccination Programs:** The local health authorities should prioritize mandatory HBV vaccination for all age groups and specifically target high-risk populations and potential blood donors to ensure long-term immunity (24).
- **Public Health Awareness Campaigns:** Intensive educational programs are needed to increase community awareness about the modes of transmission for HBV and HCV. This should focus on the risks associated with unsterilized dental/surgical tools and personal hygiene practices.
- **Mandatory Clinical Follow-up:** A standardized system should be established to refer all seropositive blood donors to specialized hepatology clinics for further diagnostic evaluation (such as viral load testing) and medical management.
- **Large-Scale Epidemiological Research:** Further studies involving a significantly larger and more diverse sample size are necessary to accurately map the prevalence and identify the primary risk factors driving the high rates of hepatitis in the Kirkuk Governorate (19, 22).
- **Stricter Regulation of Medical Facilities:** Improving the monitoring and sterilization standards in private dental clinics and surgical centers is vital to curb the parenteral transmission of these viruses (23).

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