

The Prevalence of Hepatitis B And C Viruses Among Blood Donors Attending Blood Bank in Jiblah University Hospital, Ibb, Yemen

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Abstract

Background: Transfusion-transmissible hepatitis B virus and hepatitis C virus infections are the most significant concern associated with blood donation in Yemen. Screening blood donors is needed to prevent further spread of such infections.

Objectives: The current study aimed to determine the prevalence of hepatitis B and hepatitis C viruses among blood donors at Jiblah University Hospital, Ibb, Yemen.

Methods: A cross-sectional study was conducted on blood donors attending Jiblah University Hospital. A total of 122 subjects were included in the survey from October to December 2023. Subjects were tested for evidence of anti-HBc and HCV antibodies. A questionnaire was used to collect demographic and personal data of each subject. SPSS software and the Chi-square test were used for data analysis. A p-value <0.005 was considered statistically significant.

Results: The prevalence of HBV and HCV infections, based on confirmation tests, were 6.56% and 0.82%, respectively. There was no significant difference between HBV infection and the residence of participants. A strong association between HCV infection and the residence of participants was discovered ($p < 0.001$). The prevalence of HBV was significantly higher among people who had not previously donated ($p < 0.007$).

Conclusion: This study demonstrates the need to develop an accurate framework for the screening process of blood donors. Young people should be encouraged to donate blood to help ensure a long-term increase in the blood supply without jeopardizing safety.

Keywords: Blood donors, hepatitis B virus, hepatitis C virus, IBB, Yemen

1. Introduction

Blood transfusion and its components [1] are essential for therapeutic process and life-saving humans [2]. Blood transfusion secures millions of people globally each year [1] and is rising worldwide [2]. World Health Organization (WHO) global database on blood safety showed that worldwide, more than 92 million blood samples are donated annually [3]. Despite the benefits of blood transfusion, it is essential to note that it is not without risks. Transfusion-transmitted infections, including viral infections such as hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and other related diseases [4].

Blood transfusion-related viral hepatitis, especially HBV and HCV, remains a significant concern in transfusion practice [5,6] and big

problem in developing countries where safe blood transfusion has not been established until recently [7]. At a global level, about 2 billion are infected with HBV, and 170 million are infected with HCV [1,8]. Additionally, recent data have indicated that HBV and HCV kill about 1.1 million people and infect another 3.0 million annually [9]. WHO reported in different reports that the prevalence of HBV and HCV infections among blood donors in other regions of the world varies from 0.03% - 8.47% and 0.02% - 1.80%, respectively. Meanwhile, such prevalence rates in low-income countries increase to 3.34% - 8.47%, 0.67% - 1.80% [10]. Therefore, the WHO recommends that all blood collected be tested for significant transfusion transmissible infections (TTIs) caused by these pathogens before donation [11].

HBV screening programs for blood donors have been implemented worldwide since the early 1970s [6].

Yemen is one of the least developed countries and has been the site of political conflict since 2014 [12]. In Yemen, viral hepatitis is one of the significant health problems. It represents 12 out of 22 infectious diseases [13]. The prevalence of HBV infection among blood donors ranges from 2% to 18% (14). However, the prevalence of HCV infection among blood donors has been 1.0% to 1.6% [9]. Blood transfusion infections, especially HBV and HCV infections, are one of the significant public health problems in Yemen. Studies conducted in Sana'a City, Aden, and Hodeidah revealed that HBV and HCV are significant issues among blood donors [15]. Data on the prevalence of HBV and HCV infections in the Ibb governorate are rare and inadequate; hence, the purpose of this study is to find out the frequency and trends of HBV and HCV infections among healthy blood donors at the blood bank unit of Jiblah University Hospital, Ibb -Yemen.

2. Materials and Methods

2.1 Study Population

A cross-sectional study was conducted among volunteer blood donors who attended the blood bank at Jiblah University Hospital in Ibb, Yemen, from October to December 2023. 122 blood donors who agreed to participate in the study were recruited through convenience sampling.

2.1.1 Inclusion Criteria of blood donors

The standard criteria for the selection of blood donors were used based on WHO guidelines [15]. These criteria include the age of the donor arranged between 18 to 55 years, body weight greater than 50 kg, hemoglobin level between 14–18 g/dl for males and 12.5–16 g/dl for females with an average pulse rate of 60–100 per minute and blood pressure (systolic of 100–140 mmHg and diastolic of 60–90 mmHg). The exclusion criteria were age less than 18 or more than 55 years and weight less than 50 kg. Hemoglobin values less than 12.5 g/dl, history of blood donation < 3 months, and history of jaundice, cupping, recent surgical operation, hypertension or current fever, recent illness, and not giving consent.

2.2 Ethical Approval

The Faculty of Medical Laboratories, the University of Jiblah, and the hospital's director gave ethical approval.

2.3 Data Collection

Data was collected using a structured questionnaire. Blood donors who could not read or write were interviewed face-to-face by a trained

public health specialist to complete the questionnaire, which included sociodemographic characteristics, clinical factors, and behavioral characteristics.

2.4 Blood tests

Five ml of venous blood was drawn under aseptic conditions; then sera were screened by Cobase technique for anti-HBc with commercial kits (Roche Diagnostics GmbH, UK) and screened for anti-HCV using commercial kits (One step anti-HCV Test, Intec, China). HCV-positive samples were confirmed by enzyme immunoassay (EIA) for Hepatitis C antibodies with commercial kits (Fortress Diagnostic Ltd. UK).

2.5 Statistical Analysis

Statistical analyses were performed using SPSS version 26 software. The Chi-squared test was employed to determine the statistical difference. The significance level was set at p -value <0.05.

3. Results

In the current study, the data of 122 blood donors who donated blood at Jiblah University Hospital during the period from October to December 2023 were reviewed and analyzed. All participants in this study were males 100%, showing that 6.56% and 0.82% of the donors were positive for anti-HBc and anti-HCV, respectively, as shown in **Figure 1**. The mean age was 34.3 years, 83.61% were married, 91% lived in rural areas, 35.2% had a university degree, and 41% had a monthly income of 100 USD or less. HBV infection is more prevalent in the 19–24 years younger age group, 13.64%, whereas HCV infection is prevalent in the 44–49 years older age group, 0.1%. No relationship between HBV infection and the residence of participants was statistically significant ($p < 0.102$). However, a statistically solid association between HCV infection and the residence of participants was discovered ($p < 0.001$).

The rate of HBV infection was greater among donors who had not previously donated 15.79% compared to those who had previously donated blood 2.38%, and there was statistical significance ($p < 0.007$). In the case of HCV infection, the rate of infection was also greater among donors who had not previously donated 2.6% compared to those who had previously donated blood 0.0%, but there was no statistical significance ($P < 0.143$). The current study showed that there is no statistical association between HBV and HCV infections and age, educational status, and marital status, as well as there was no relationship between monthly income and some habits, such as smoking and chewing khat.

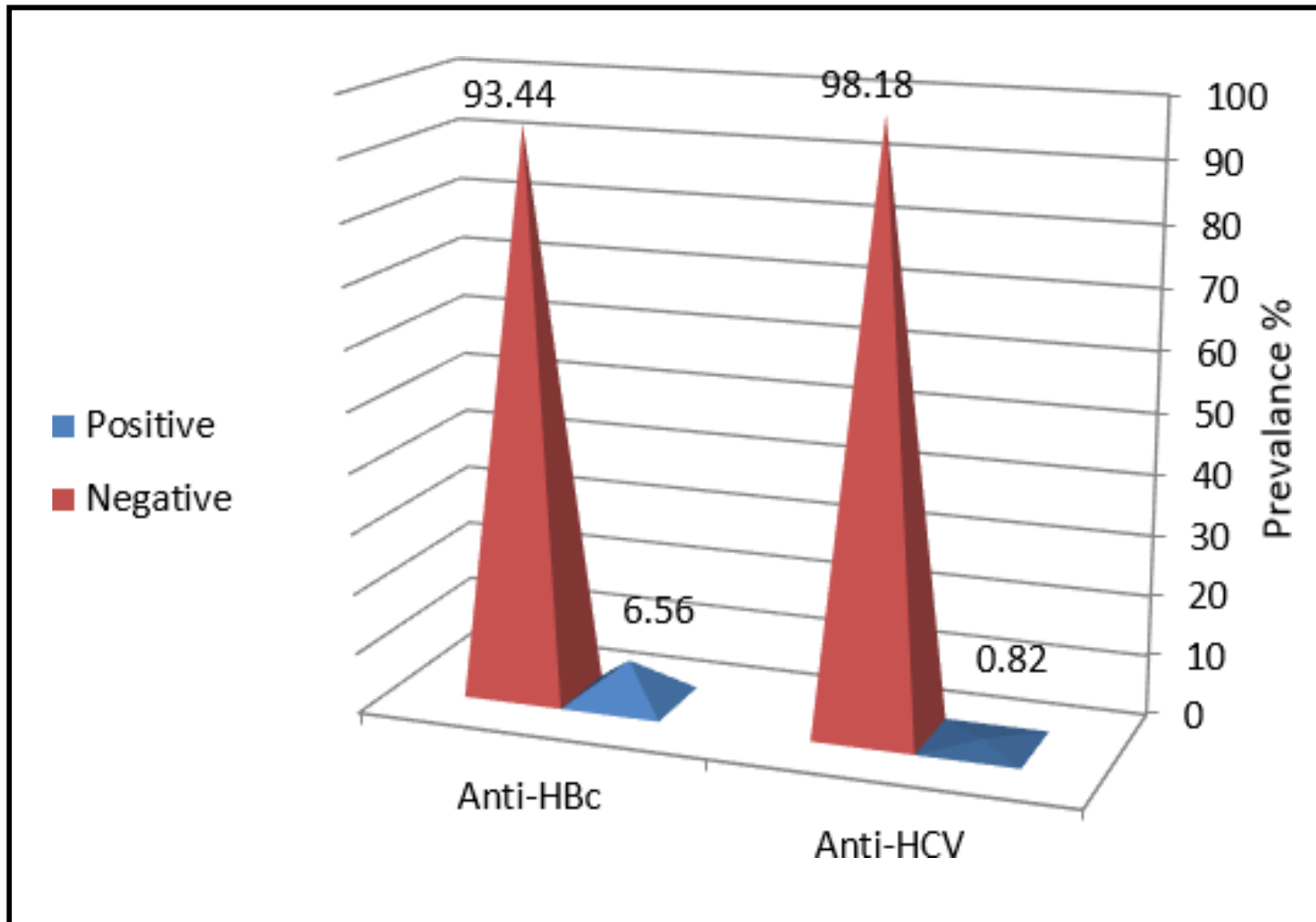


Figure: Seroprevalence of anti-HBc and anti-HCV among study population

Table 1: Sociodemographic characteristics of participants in association with the HBV and HCV infections (n=122).

Variable	NO. (%)	Anti-HBc		P*value	Anti-HCV		P* value
		Positive NO. (%)	Negative NO. (%)		Positive NO. (%)	Negative NO. (%)	
Age (years)				0.666			0.046
19-14	22 (18)	3 (13.64)	19 (86.36)		0 (0.00)	22 (100)	
25-30	29 (23.8)	1 (3.5)	28 (96.5)		0 (0.00)	29 (100)	
31-36	26 (21.3)	1 (3.85)	25 (96.15)		0 (0.00)	26 (100)	
37-43	25 (20.5)	1 (4)	24 (96)		0 (0.00)	25 (100)	
44-49	10 (8.2)	1 (10)	9 (90)		1 (10)	9 (90)	
≥50	10 (8.2)	1 (10)	9 (90)		0 (0.00)	10 (100)	
Marital status				0.095			0.657
Married	102 (83.61)	5 (4.9)	97 (95.1)		1 (0.98)	101 (99.02)	
Unmarried	20 (16.39)	3 (15)	17 (85)		0 (0.00)	20 (100)	
Residence				0.102			0.001
Urban	11 (9)	2 (18.2)	9 (81.8)		1 (9.09)	10 (90.91)	
Rural	111 (91)	6 (5.41)	105 (94.59)		0 (0.00)	111 (100)	
Educational status				0.637			0.604
Illiterate	9 (7.38)	1 (11.11)	8 (88.89)		0 (0.00)	9 (100)	
Primary education	29 (23.77)	1 (3.45)	28 (96.55)		0 (0.00)	29 (100)	
Secondary education	41 (33.61)	4 (9.76)	37 (90.24)		0 (0.00)	41 (100)	
University education	43 (35.25)	2 (4.65)	41 (95.35)		1 (2.33)	42 (97.67)	
Monthly income				0.415			0.496
≤ 50 USD	36 (29.5)	2 (5.6)	34 (94.4)		0 (0.00)	36 (100)	
> 50 – 100 USD	50 (41)	5 (10)	45 (90)		1 (2)	49 (98)	
> 100 USD	36 (29.5)	1 (2.78)	35 (97.22)		0 (0.00)	36 (100)	
Number of donations				0.007			0.143

First time	38 (31.15)	6 (15.79)	32 (84.21)		1 (2.63)	37 (97.37)	
>1 (repeat)	84 (68.85)	2 (2.38)	82 (97.62)		0 (0.00)	84 (100)	
Chewing khat				0.545			0.836
Yes	117 (95.91)	8 (6.84)	109 (93.16)		1 (0.85)	116 (99.15)	
No	5 (4.09)	0 (0.00)	0 (0.00)		0 (0.00)	5 (100)	
Smoking				0.589			0.347
Yes	83 (68)	3 (3.6)	80 (96.39)		0 (0.00)	83 (100)	
No	39 (32)	5 (12.82)	34 (87.18)		1 (2.56)	38 (97.44)	

* $p < 0.05$ is considered as significant.

4. Discussion

The spread of blood-borne viruses, especially HBV and HCV, increases at an alarming rate worldwide, and this has created a dramatic impact on some countries such as Yemen. Testing for hepatitis B surface antigen (HBsAg) is commonly used as a screening test for the detection of HBV infection. HBsAg test does not rule out the risk of transmission of hepatitis B [16] because, during the core window period, the HBsAg cannot be detected in the blood. During this phase, the antibody to the anti-HBc can be used as a useful serological marker for HBV infection [7]. In the USA, Japan, and several European countries, 70% of anti-HBc positive individuals have an anti-HBs titer of $>100\text{IU/ml}$. Whereas in developing countries with a high prevalence of HBV infection, the level of anti-HB titer is much lower than in developed countries [17]. The current study used the anti-HBc test as a serological marker for HBV infection among target donors.

The present study revealed that the positivity rate of anti-HBc among respective blood donors is found to be 6.56%, which was higher compared to that reported in Egypt at 3.8% [6] Saudi Arabia at 5.7% [9] Germany at 0.2%, Switzerland at 1.4% [18]. On the other hand, the result of the current study was lower than that of studies carried out in Al Majmaah city, northern Riyadh province, Saudi Arabia at 6.96% [8], Syria at 10.3%, and India at 10.9% [9]. A study conducted in Iran demonstrated that 6.56% of healthy donors were anti-HBc positive [6]. This result was consistent with the current research.

In this study, blood donors' seroprevalence of HCV was 0.82%, which resembles that of studies carried out in Jordan at 0.9%, Iran at 0.5% [7], Saudi Arabia at 0.32% [8], and Iraq at 0.12% [7]. However, the result of the current study was far lower than that of studies done elsewhere in different countries. For instance, in Egypt, Peshawar in Pakistan, Kenya, and Nigeria, the prevalence of HCV among donors was 24%, 4%, 3.2%, and 2.8%, respectively [19,20,21].

In Yemen, this study's finding of a hepatitis B virus prevalence rate of 6.56% is consistent with that reported in Amran Governorate, Yemen, which is 6.4% [13]. This is higher than the number of studies conducted in different regions in Yemen, 5.3% in Mukalla [22] and 0.74% in Hodeidah [23]. 5.1% in Aden (24), and 2.5% in Sanaa, [15]. However, the lower rate, in 2022, Al-Zubayri et al. revealed in their study conducted in the city of Sana'a that the positivity rate for anti-

HBc was 10.9% [14]. Comparing the result of the current research with the previous study conducted in 2023 among the general population in the town of Jiblah, which was 3.33% [25]. A higher prevalence of hepatitis B virus infection has been observed among blood donors compared to the general population. Differences in prevalence between the current study and previous studies in Yemen may be due to differences in the sensitivity of the assays used. In the HBsAg assay, the absence of antigen does not entirely rule out the presence of the virus [2]. At the same time, anti-HBc seroreactivity can indicate active exposure to HBV, chronic infection, or resolution of infection [2]. Geographical, social, and economic differences and differences in the selection of subjects can also be considered among the reasons behind the differences in the prevalence rate between this study and previous studies.

In addition, the present study found that 0.82% of the blood donors were positive for anti-HCV. Slightly lower prevalence rates of HCV were reported, 0.19% in Hodeidah [26], 0.6% in Hadramout [22], and 0.62% in Amran [13]. However, the results of studies conducted in Sana'a were 1.2% [15] and in Aden 1.3% [24], which were higher than the results of this study. The differences in the prevalence between our study and previous studies in Yemen may be attributed to geographical and socio-economic differences and differences in the selection of participants.

The present study showed that 100% of donors were males. The gender imbalance may be caused by the fact that men in Yemeni society are more proactive and make decisions independently. In addition, males are encouraged to take on responsibilities and are more culturally prominent in the environment.

In this study, the age of subjects is an insignificant predictor of HBV and HCV infections. Although the national vaccination program was implemented in 2000, which ensured that free HBV vaccination was provided for all neonates born in Yemen, this study showed that the highest prevalence of HBV infection was found in the youngest age group, 19-24 years [25]. This indicates low awareness of the seriousness of hepatitis B and the inability to obtain free vaccination against the virus among the Yemeni population due to inadequate vaccine coverage. The result of the current study is dissimilar to the survey conducted in Sana'a, Yemen, and noted in various studies

conducted internationally [14]. At the same time, the incidence of hepatitis C virus was the highest among the participants in the study, who were between 44 and 49 years old. Similar results were demonstrated in participants in Egypt [19], Saudi Arabia [8], China [27], Pakistan [20], and Ethiopia [11]. Unlike this study, a lower prevalence of HCV was reported in people aged 16–25 years, as found in the study of Al-Harazi et al. [9].

In this study, there was no statistical relationship between hepatitis B and C infections and educational status, monthly income, marital status, smoking, and khat chewing. This finding was consistent with studies conducted in Amran governorate, Yemen [13], and Ethiopia [11].

The present study showed that no statistically significant relationship was observed between marital status, place of residence of volunteer donors, and educational status and HBV. This finding was consistent with studies conducted in Amran governorate, Yemen [13], and Ethiopia [11]. The current study reported that there was no association between the hepatitis B virus and participants' residence, which is similar to studies conducted in Yemen [13] and Ethiopia [28] and different from the survey conducted in Sana'a, Yemen, which reported that there was a statistical relationship. The residence of participants was discovered as a risk factor for HCV infection ($P < 0.001$), with respect to the present study seroprevalence of HBV and HCV in first-time donors 15.79% and 2.63%, respectively. Similar findings were reported in Senegal [29], Sierra Leone [30], Pakistan [20], and Yemen [14]. This is likely because donors are advised that they cannot donate again after a positive test result.

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5. Conclusion

Based on the findings of the current study and other studies conducted in Yemen, the results of these studies are different, which may be attributed to the use of hepatitis B surface antigen (HBsAg) to detect HBV infection in blood bank centers in Yemen. In screening for HBV infection, blood donors who are negative for HBsAg marker can be identified by testing for anti-HBc antibodies. The importance of anti-HBc antibody testing remains the primary strategy to identify donors with occult HBV infection.

Notably, the prevalence of hepatitis B and hepatitis C markers was lower among young donors than among older donors; hence, young people should be encouraged to donate blood to help ensure a long-term increase in the blood supply without jeopardizing safety.

Further studies over a more extended period and with a larger sample size should also be considered.

Author's contribution

The authors read and agreed to the final version for submission to this journal and agree to be accountable for all aspects of the work.

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Conflict of interest: No conflict of interest is associated with this work.

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