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Seroprevalence of hepatitis c virus in Blood Donors in Kabul in 2023

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ABSTRACT

Introduction: Understanding the prevalence and distribution of the hepatitis C virus (HCV) is crucial for the development of effective prevention and control strategies, given its significant impact on global public health. The objective of this study was to examine the seroprevalence of HCV among blood donors in Kabul and assess the possible gender-based variations in infection rates.

Materials and Methods: This study analyzed blood donor records from the central blood bank in Kabul, including both male and female donors, from January to December 2023. HCV screening was performed using ELISA testing, and the data were analyzed using SPSS to determine HCV prevalence and investigate gender-based differences in infection rates.

Results: In this study, 59 out of 15,080 individuals (0.39%) tested positive for HCV infection. Among the HCV-positive cases, 81.5% were male and 18.6% were female. The majority of infected males (64.4%) were in the 30-39 age range. A significant proportion of HCV-positive patients had no formal education (69.5%) and were unemployed (61.0%). Additionally, the majority of HCV-positive patients reported a low monthly income (66.1%).

Discussion: The study found a low prevalence of HCV infection (0.39%) among the participants, with the highest rates observed in the 30-39 age group. Socioeconomic factors, such as lack of education, unemployment, and low income, were associated with HCV infection. Targeted interventions are needed to address gender disparities, age-specific risks, and socioeconomic determinants to improve prevention and control strategies for HCV in Kabul's blood donor population and enhance overall population health.

Keywords: Hepatitis C virus, Blood Transfusion, Blood Donors, Kabul

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1. Introduction

Blood transfusion and blood conservation, which encompass methods or approaches aimed at reducing the need for blood transfusion, are interrelated practices that form an integral part of the field of transfusion medicine in clinical settings (1). Blood transfusions and the utilization of blood components have demonstrated their effectiveness in saving numerous lives worldwide. However, the unsafe administration of blood and its components plays a significant role in the transmission of blood-borne infections. These infectious agents primarily include, but are not limited to, hepatitis C virus (HCV), hepatitis B virus (HBV), human immunodeficiency virus (HIV), *Treponema pallidum* (causing syphilis), and various species of *Plasmodium* (causing malaria). According to the World Health Organization (WHO), in low- and middle-income countries, the prevalence of blood-borne infections remains high and far from achieving a risk-free environment (2).

Hepatitis C is a blood-borne disease caused by HCV, leading to either acute or chronic infection. Individuals who are newly infected are usually asymptomatic. Approximately 30% (with a range of 15% to 45%) of people with acute HCV infection are able to clear the virus on their own within 6 months. However, the remaining 70% (with a range of 55% to 85%) of those infected will go on to develop chronic hepatitis C (3). HCV is an RNA virus that belongs to the Flaviviridae family. It replicates in hepatocytes' cytoplasm without causing direct cell damage. Persistent infection occurs due to rapid virus production and continuous cell-to-cell transmission, along with a weak immune response from T cells against HCV antigens. HCV replication is highly active, generating 1010 to 1012 virions per day with an estimated viral half-life of 2 to 3 hours. The high replication rate and absence of error-proofing in the viral RNA polymerase lead to frequent mutations in the HCV RNA genome. HCV is categorized into six genotypes (1 to 6) and more than 50 subtypes (such as 1a, 1b, and 2a). The presence of numerous subtypes and frequent mutations presents challenges in developing an effective HCV vaccine (4). HCV infection poses a significant public health concern, with an approximate annual global incidence of 3–4 million new infections and a staggering 170-200 million individuals serving as carriers. These carriers face the risk of developing liver cirrhosis and/or liver cancer. Furthermore, HCV-related liver diseases result in over 350,000 deaths annually. It is important to note that these estimates primarily focus on the hepatic consequences of HCV infection and do not encompass the additional extrahepatic manifestations associated with the disease (5).

In Afghanistan, a country grappling with an ongoing humanitarian crisis, the delivery of blood transfusion services consistently falls short of meeting international benchmarks. The Afghan National Blood Safety and Transfusion Service (ANBSTS) encounters substantial obstacles in ensuring blood safety due to multiple factors, including the lack of legislation addressing blood safety, inadequate infrastructure, financial limitations, insufficiently trained staff, inadequate data management systems, and the absence of a national campaign focused on donor selection and retention (6). Limited data exists regarding the prevalence of blood-borne infections among blood donors in Afghanistan. Previous studies and reports have attempted to estimate the prevalence of these infectious agents among the general population and high-risk groups; however, they have been constrained by small sample sizes. It is crucial to evaluate blood donors for blood-borne infections, particularly HCV, as this assessment plays a

vital role in determining the prevalence and associated risks of such infections in the overall population (7-9). Furthermore, this evaluation provides valuable scientific evidence that informs blood safety policies, strategies, and standards (6). To the best of our knowledge, no prior study has been conducted to assess the epidemiology of HCV and determine its prevalence specifically among blood donors in Kabul in the year 2022. Therefore, this study aims to examine the seroprevalence of HCV among blood donors at the Kabul Blood Bank center, with a specific focus on analyzing potential gender disparities in infection rates. The findings of this study will contribute insights into the gender-specific burden of HCV infection among blood donors in Kabul.

2. Materials and Methods

2-1. Study Design

This research employed a cross-sectional study design and utilized retrospectively collected data from the central blood bank of the ANBSTS. Established in 2009 under the Ministry of Public Health, the ANBSTS oversees blood banking services across Afghanistan (10, 11). The study population consisted of individuals who visited the blood banks between January and December 2023 to become prospective blood donors. The inclusion criteria for donors did not consider factors such as occupation, religion, education level, or ethnic background. Instead, eligibility for blood donation was determined according to national criteria, which included a minimum weight of 50 kg, age between 18 and 60 years, hemoglobin levels between 12.5 and 16.5 g/dl, blood pressure within the range of 120/80 mmHg, and not being pregnant, lactating, or menstruating. Eligible blood donors underwent a behavioral screening interview, provided written consent, and donated blood. The behavioral screening interview involved the completion of a donor history questionnaire designed based on principles of cognitive psychology. The questionnaire was structured with specific timeframes to aid donor comprehension and accurate recall of relevant risk activities. Additional inquiries were made regarding medications and travel history to assess donor suitability for blood donation (6).

Ethical considerations were strictly followed by guidelines and regulations concerning studies involving human subjects. These guidelines aim to safeguard the rights, well-being, and privacy of participants. Before their inclusion in the study, participants received comprehensive information regarding the study's objectives, procedures, and potential risks or benefits (12). Stringent measures were implemented throughout the study to ensure the confidentiality and anonymity of participant data. This involved utilizing secure data storage systems, employing unique identifiers instead of personal identifying information, and limiting access to authorized personnel only.

2-2. Sample Collection

Blood sample collection was conducted as part of routine blood donation procedures for eligible blood donors, following established protocols to ensure proper handling and minimize the risk of contamination (6). Each blood sample was carefully labeled with unique identifiers and then transported to the laboratory for further analysis.

2-3. Laboratory Evaluation

All blood samples obtained from the donors were subjected to thorough testing to identify the presence of an anti-HCV antibody. The testing procedure involved several steps: first, the blood samples were centrifuged to separate the plasma from other blood components; then, the isolated plasma samples were screened

using a Thermo Scientific Multiskan EX enzyme-linked immunosorbent assay (ELISA) absorbance reader. ELISA is a widely used diagnostic technique that is specifically designed to detect the presence of specific antibodies or antigens in a sample. In this case, the ELISA test was employed to detect the presence of anti-HCV antibodies in the plasma samples, which would provide information about the potential HCV infection status of the donors.

2-4. Statistical Analysis

Data analysis was performed using the statistical package for the social sciences (SPSS). Descriptive statistics were employed to concisely summarize the demographic characteristics of the blood donor population and calculate the seroprevalence rates of HCV infection. A stratified analysis was conducted to compare the infection rates between male and female donors.

3. Results

The study aimed to analyze a significant number of blood donor samples, specifically 15,080 individuals, to gain insights into the sociodemographic characteristics of the participants. Among these individuals, 14,769 were males, while 311 were females, indicating a higher representation of males in the sample. The study's findings are summarized in Table 1, which provides a comprehensive overview of the sociodemographic factors explored. One key aspect examined in the study was the age distribution of the participants. The age range of the donors spanned from 20 to 57 years, encompassing a wide spectrum of adulthood. Notably, the most prevalent age group among the participants was individuals aged 30-39 years, constituting 40.0% of the total participants. This finding suggests that individuals in their thirties were more likely to be blood donors compared to other age groups within the sample. In addition to age, the study also investigated the educational attainment of the blood donors. The results indicated that a significant majority of the donors, approximately 45.4%, had achieved at least a primary level of education. This suggests that a considerable proportion of the participants had acquired a foundational level of formal education, which may have influenced their decision to become blood donors. Furthermore, the study examined the employment status of the blood donors. It was found that approximately 33.8% of the participants were unemployed at the time of the study.

This finding highlights the potential impact of employment status on blood donation, as unemployed individuals may have more flexibility and availability to engage in altruistic activities such as donating blood. Another noteworthy finding pertains to the participants' monthly income. A substantial proportion, around 66.1%, reported having a low monthly income. This indicates that a significant number of the blood donors in the study faced financial challenges, which might have influenced their motivation or ability to donate blood. Understanding the economic background of the participants is crucial to comprehending the sociodemographic factors associated with blood donation. Overall, the findings of this study provide valuable insights into the sociodemographic profile of the blood donors involved. By examining characteristics such as age, education, employment status, and income, researchers and healthcare professionals can develop a deeper understanding of the population under investigation. This knowledge can inform targeted strategies and interventions to promote blood donation among specific demographic groups or address barriers that may hinder participation.

Table 1. The sociodemographic attributes of the study participants

Description	Frequency (n = 12445)	Percentage %
Gender		
Male	14769	97.9
Female	311	2.1
Age		
20-29	2106	14.0
30-39	6031	40.0
40-49	4987	33.0
50-59	1956	13.0
Education level		
Illiterate	4418	29.2
Primary	6841	45.4
Secondary	2201	14.6
High school	1620	10.8
Job status		
Unemployed	5092	33.8
Employed	9988	66.2
Monthly income		
Low	8251	54.8
Intermediate	4073	27.0
High	2756	18.2

Table 2. The prevalence of HCV among blood

Description	**Frequency (n = 15080)**	**Percentage %**
Positive	59	0.39
Negative	15021	99.6

To determine the presence of antibodies to HCV infection among the participants, all individuals in the study underwent testing using the ELISA method, which is a commonly used diagnostic tool for detecting antibodies in blood samples. The results of the ELISA testing were compiled and presented in Table 2. According to the findings, a total of 59 individuals tested positive for HCV infection, which accounts for approximately 0.39% of the total participants in the study. Among these HCV-positive cases, 48 (81.5%) were males, while 11 (18.6%) were females. Further analysis of the HCV-positive cases focused on the sociodemographic characteristics of the affected individuals. Among the male HCV patients included in the study, the majority (64.4%) fell within the 30-39 age range. Within the subgroup of HCV-positive patients, it was observed that a

significant proportion (69.5%) of individuals were identified as illiterate. Additionally, a considerable number of HCV-positive patients (61.0%) reported being unemployed, implying that they were not currently engaged in paid work. Moreover, a significant majority (66.1%) of the HCV-positive patients reported having a low monthly income.

3. Discussion

Globally, more than 2 billion people have been infected with hepatitis. HCV infection affects a substantial portion of the global population (13), with an estimated prevalence of around 1.4 million from hepatitis-related complications (14). The estimated number of individuals who are chronically infected with HCV in the United States is approximately 4 million, while in Western Europe, it is estimated to be around 5 million. Moreover, the prevalence of HCV infection appears to be higher in Eastern Europe compared to Western Europe (13). Within developed nations, HCV infection contributes to 20% of instances of acute hepatitis, 70% of cases of chronic hepatitis, 40% of occurrences of end-stage cirrhosis, 60% of incidents of hepatocellular carcinoma (HCC), and 30% of liver transplantations (15). Globally, the number of new HCV infections in 2019 was similar between men and women, but HCV-related deaths and disability-adjusted life years (DALYs) were disproportionately higher in men, with a greater increase over time. India accounted for nearly one-sixth of the new HCV infections worldwide, followed by China, and had the highest HCV-related DALYs, while China experienced the greatest number of HCV-related deaths. In all three countries (India, China, and the United States), men had higher incidence, deaths, and DALYs associated with HCV infection compared to women. The United States saw the highest percentage increase in HCV-related disease burden from 1990 to 2019, with US women experiencing the largest increase, while the number of new HCV infections, related deaths, and DALYs in Chinese women decreased significantly, with a less pronounced decline in Chinese men (16).

The study examined the sociodemographic characteristics and prevalence of HCV infection among a large sample of 15,080 blood donors in Iran. The study population was predominantly male (97.9%), and the most common age group was 30-39 years (40.0%). Most donors had at least a primary level of education (45.4%) and around one-third were unemployed (33.8%). Overall, 0.39% of the blood donors tested positive for HCV antibodies. Among the HCV-positive individuals, the majority were male (81.5%), belonged to the 30-39 age group (64.4%), were illiterate (69.5%), unemployed (61.0%), and had a low monthly income (66.1%). These findings suggest that certain sociodemographic factors, such as male gender, lower education, unemployment, and low income, may be associated with a higher risk of HCV infection among blood donors in Iran. The study provides valuable insights into the profiles of blood donors and the epidemiology of HCV in this population. In Iran, the general population has a low prevalence of HCV infection, estimated to be less than 0.5%. However, certain high-risk populations in Iran have shown significantly higher rates of HCV infection, such as people who use drugs (PWUD), particularly those with a history of drug injection, with prevalence as high as 41-47% among people who inject drugs (PWID) and 22-28% among prisoners. Other high-risk populations, including hemodialysis patients, female sex workers, and homeless children, have also exhibited elevated HCV infection rates (17).

According to another study conducted in Iran, a total of 306 cases of hepatitis B and 128 cases of hepatitis C were recorded. The average age

of individuals with hepatitis B was 40.15 ± 18.95 years, while the average age of those with hepatitis C was 45.12 ± 13.31 years. The overall incidence of hepatitis B was estimated to be 18.44 per 100,000 people, while the incidence of hepatitis C was 7.71 per 100,000. The study further revealed that the highest incidence rate of hepatitis B was observed in 2019 and 2018, with 50.91 and 26.01 cases per 100,000 people, respectively. In contrast, the lowest incidence rate of hepatitis B was reported in 2016, with 1.46 cases per 100,000 people. Similarly, the highest incidence of hepatitis C was reported in 2018 and 2019, with 17.94 and 15.01 cases per 100,000 people, respectively, while the lowest incidence of hepatitis C was 0.36 per 100,000 population, recorded in 2016 (18).

According to the information provided, Pakistan has a significant burden of HCV infections, ranking second globally in terms of HCV prevalence. The review of various studies conducted in Pakistan estimated the overall prevalence of HCV infection in the adult population to be around 11.55%. However, the prevalence of HCV infection varied considerably across different provinces within Pakistan. The lowest prevalence was reported in the province of Sindh, at 2.55%, while the highest prevalence was observed in the province of Baluchistan, reaching 25.77%. These findings suggest that the HCV epidemic in Pakistan is not homogeneous across the country, and there are significant regional variations in the burden of the disease. The relatively high overall prevalence of 11.55% indicates that approximately one in every 20 Pakistanis is already infected with HCV, representing a major public health challenge for the country (19).

The studies show that the registered incidence rate of hepatitis C virus (HCV) in Jiangsu Province, China, increased significantly, from 2.60 per 100,000 people in 2011 to 4.96 per 100,000 people in 2020, representing a 190.77% rise over the studied period. The World Health Organization's 2024 Global Hepatitis Report highlights that viral hepatitis, including hepatitis C, remains a major public health concern in China, where the estimated number of deaths from viral hepatitis increased from 1.1 million in 2019 to 1.3 million in 2022, with 83% of these deaths caused by hepatitis B and 17% by hepatitis C, underscoring the significant burden of hepatitis C in the country (20).

Conclusion

The findings of this study provide valuable insights into the sociodemographic characteristics of blood donors and the prevalence of HCV infection among them. The results highlight demographic factors such as age, education, employment status, and income that may be associated with blood donation and HCV infection. This knowledge can inform targeted strategies and interventions to promote blood donation among specific demographic groups and address barriers that may hinder participation. Additionally, it can guide efforts to prevent and manage HCV infection by identifying vulnerable populations and implementing appropriate measures.

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