Prevalence of Hepatitis B Virus and Hepatitis C Virus Among Blood Donors in Nekemte Blood Bank, Western Oromia, Ethiopia: Retrospective 5 Years Study

Mikias Abebe 1
Birhan Alemnew 2
Sirak Bisnew 3

1Department of Medical Laboratory Sciences, Institute of Health Sciences, Wollega University, Nekemte, Ethiopia
2Department of Medical Laboratory Sciences, College of Medical Health Sciences, Woldia University, Woldia, Ethiopia
3Department of Medical Microbiology, School of Biomedical and Laboratory Sciences, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

Background: Hepatitis B virus and hepatitis C virus are the greatest threats to blood safety for the recipient. This study aimed to determine the seroprevalence and trends of HBV and HCV infections among blood donors over a period of 5 years at Nekemte blood bank, Ethiopia.

Methods: A retrospective study was conducted from January 2015 to December 2019 at Nekemte blood bank. The recorded blood donors’ history and laboratory tests were reviewed by data collectors analyzed with Statistical Package for the Social Sciences version 20 software. A p-value of less than 0.005 was considered statistically significant.

Results: A total of 17,810 consecutive blood donors were screened between January 2015 and December 2019. The seroprevalence of HBV and HCV was 3.06% and 0.64%, respectively. The prevalence of HBV was significantly associated with male (AOR: 2.51; 95% CI: 1.17, 2.91), unmarried (AOR: 2.81; 95% CI: 1.79, 2.51) and rural (AOR: 2.11; 95% CI: 1.17, 3.05) blood donors. The prevalence of HCV was significantly associated with blood donor those were male (AOR: 3.01; 95% CI: 1.17, 3.91), within 45–65 years of age (AOR: 3.56: 95% CI: 1.14, 3.99) and unmarried (AOR: 3.14; 95% CI: 1.65, 3.96).

Conclusion: The current study shows the prevalence of hepatitis B virus was higher among study participants. However, the prevalence of HCV was low compared to the study conducted in other countries in Africa, a substantial percentage of the blood donors harbor HCV infections. Therefore, it is recommended to increase awareness of people (particularly unmarried, male and rural resident) on the transmission and prevention of infection could help in reducing the burden of both HBV and HCV.

Keywords: blood donor, prevalence, transmission, hepatitcs infection

Introduction
Blood transfusion service is mandatory and a therapeutic procedure, as there is no genuine substitution to save the life of many patients who suffer from the loss of blood. Globally, more than eighty-one million units of blood are donated by blood donors each year. However, the presence of blood-borne infections in blood cells of asymptomatic donors is the major cause of transmitting infectious agents through blood transfusion. These transfusions transmissible infectious diseases have long-term consequences on the recipients, families, and general communities since the infected person represents a pool for the infection and can transmit the disease during its asymptomatic period which can contribute to an ever-widening pool of
infection in the population. The most commonly encountered transfusion infections from the viral origin are Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV). Therefore, the World Health Organization (WHO) recommends that all blood collected should be tested for major transfusion transmissible infections (TTIs) caused by these pathogens prior to donation.

African countries require the greatest amount of blood transfusions worldwide while simultaneously facing great suffering and pain from serious TTIs. Proper donor selection and checkup of the donated blood for TTIs are essential to reduce the transmission of these infections. Conversely, the safety of blood for transfusion in a low-income country is still uncertain because of the increasing prevalence of viral infections (HBV and HCV) in the communities, inability of the laboratory test to detect persons infection in the window period, shortage of expert professionals, poverty, population growth, urbanization and insecure environments.

Hepatitis B Virus is highly contagious because it can be able to transmit easily from one person to another by blood transfusion. Globally, estimated 257 and 71 million peoples were living with chronic HBV and HCV infections, respectively. Moreover, it was estimated that about 1.34 million deaths were attributed to hepatitis. Furthermore, transfusion of contaminated blood causes up to 16 million new infections with Hepatitis B and 5 million new infections with Hepatitis C every year in the world. Findings from a study conducted in India also indicated that the magnitude of HBV and HCV among blood donors was 1.76% and 0.19%, respectively, whereas 0.51% and 0.25% of blood donors in China were positive for HBC and HCV infection, respectively. Besides, 12.5% of patients who receive blood transfusion are at risk of post-transfusion Hepatitis in sub-Saharan Africa. Another study conducted in Ethiopia revealed that HBV is highly prevalent among blood donors (8.4%) next to immigrants (11.0%). It is also documented that viral hepatitis is the most predominant viral TTI than HIV and HCV among blood donors in Ethiopia.

The high demand for blood transfusion as a result of frequent road traffic accidents, children suffering from malaria and anemia, surgical, and obstetric blood loss heightened the problems of blood safety in Ethiopia. Thus, continuous monitoring of the magnitude of transfusion transmissible infections in blood donors is important for optimizing donor recruitment strategies to minimize infectious disease transmission. Therefore, this study was conducted to determine the seroprevalence and associated risk factors of HBV and HCV from 2015 to 2019 among blood donors at Nekemte blood bank.

Materials and Methods
Study Area
The data were collected from the Nekemte blood bank. The blood bank is situated in the Nekemte town, East Wollega Zone, which is located 326 km from the capital city of Ethiopia, Addis Ababa. The blood bank mainly provides services to 16 hospitals that are found in the Wollega zone.

Study Design
A retrospective study of blood donor data recorded on Nekemte Blood Bank from January 2015 to December 2019 was undertaken.

Study Population
Voluntary non-remunerated blood donors who were attended at Nekemte blood bank during 5 years period and those were screened for hepatitis B and hepatitis C infection. Blood donors who were physically fit, aged between 18 and 65 years, and had a body weight greater than 50 Kg were included in the study. However, blood donors who were anemic (hemoglobin level: ≤12.5g/dl for females and ≤13.5g/dl for males) and apparently unhealthy or malnourished individuals were excluded.

Laboratory Examination
All blood donors’ samples were tested for HBsAg and anti-HCV using Wantai AiD™ HBsAg Enzyme Linked Immuno-Sorbent Assay (ELISA) and Wantai AiD™ anti-HCV ELISA test kit, respectively, developed by Beijing Wantai Biological Pharmacy Enterprise Co., Ltd. China laboratory diagnosis.

Data Collection and Statistical Analysis
All complete data on socio-demographic variables (age, sex, residence, marital status, occupation, educational status and blood group) and laboratory test results during the study period were retrieved from the blood donors register at Nekemte Blood Bank using the data extraction format by laboratory technicians. Donors who visited the blood bank twice or more were identified, and their first visit was considered with the aim to control bias by indication. Data were entered into Epi Info software (version 7), and then
transferred to SPSS version 20 software for analysis. Logistic regression was applied to identify the potential risk factors. Candidate variables at p-value <0.25, in bivariate analysis, were entered into multivariable logistic regression. Backward model selection method was used. The degree of association between dependent and independent variables was assessed using an adjusted OR with 95% CI at p-value <0.05. The Hosmer and Lemeshow test were used to check model fitness at a p-value of 0.05.

Results
Demographic Characteristics of Blood Donors
A total of 17,810 blood samples donated to the Nekemte Blood Blank Center from January 2015 to December 2019 were retrieved. Of the total, the majority (70.1%) of the donors were males, 64.3% were within 18–30 years of age, 74.4% were unmarried, 59.4% were students, and 70% were urban blood donors (Table 1).

Seroprevalence of HBV and HCV
The seroprevalence of HBV and HCV was 3.06% (546/17,810) and 0.64% (114/17,810) respectively. Both HBV and HCV infection was highest among male blood donor, college students, donor within the age group 46–65 years. Furthermore, the highest prevalence of HBV was among married blood donors, whereas for HCV, it was highest among unmarried donors (Table 1).

Trends of HBV and HCV Seroprevalence
The seroprevalence of HBV was increased from 2.98% in 2015 to 3.46% in 2019 but decreased to 2.05% in 2017. Regarding HCV the prevalence was increased further from 0.37% in 2015 to 3.64% in 2017 then decreased further back to 0.34% in 2018 and 0.46% in 2019 (Table 2).

Seroprevalence and Associated Factors of HBV and HCV
A multivariate logistic regression analysis was undertaken to determine associated risk factors with HBV and HCV infection. Blood donors who were male were two times more likely (AOR: 2.51; 95% CI: 1.17, 2.91) to be infected with HBV than female blood donors. In this analysis, study participants who were in the age group of 46–65 years were two times more likely (AOR: 2.18; 95% CI: 1.16, 2.01) to be infected with HBV than those who were in the age group of 18–30 years. Blood donors who were unmarried were three times more likely (AOR: 2.81; 95% CI: 1.79, 2.51) to be infected with HBV than females. Regarding residence blood donors, rural donors were two times more likely (AOR: 2.11; 95% CI: 1.17, 2.05) to be infected with HBV than urban blood donors (Table 3). Furthermore, the overall prevalence of HCV significantly higher among males (AOR: 3.01; 95% CI: 1.17, 3.51) and unmarried (AOR: 3.14; 95% CI: 1.65, 3.96) compared to their counterparts. It was also significantly higher among the age groups of 46–65 years who were three times more likely (AOR: 3.56; 95% CI: 1.14, 3.99) to be infected with HCV than those who were in the age group of 18–30 years (Table 4).

Discussion
Blood transfusion is an important component of health care in which millions of lives are being saved each year through this procedure. In the present study majority of the donors (70.1%) were males and were aged between 18 and 30 years. Similar findings were reported from Gondar. This is due to Ethiopia women are usually housewives and this may lead them to avoid outdoor activities. Moreover, women have lower hemoglobin levels and a higher number of vasovagal reactions. This may cause a high rate of refusal for women donors. In the current study, the total seroprevalence of HBV and HCV showed an increment with respect to year even though it does not show a trend. Consistently an increment in the seroprevalence had been reported previously from Gondar and Bahir Dar study, which was conducted from 2014 to 2018. This might be as a result of the overall increment in the seroprevalence of this infection in the community since it is assumed that blood donors are representative of the community. Besides, the sensitivity of the test methods used to screen donated blood is improved as a result of changes in policies and strategies that governments have enforced to control TTIs.

The seroprevalence of HBV in the current study was 3.06% which was comparable with a study done by Kebede et al 3.05% and Biado et al 3.6% in Ethiopia. However, the present study was lower than previously conducted studies in a different region of Ethiopia which were 9.5% Wolaita Sodo, 4.67% in Dire Dawa, 4.4% in Harar, 4.1% in Gondar and 10.9% in Jigjiga. Besides, the current study was also lower than studies from another African country which were 4.1% in Nigeria, 9.7% in Sierra Leone, 14.75% in Mali, and 14.3% in Ghana. This is probably because of the differences in the geographical distribution of the infection in the society, population differences regarding social
behavior, lifestyle, socioeconomic status, and level of awareness in different regions of the country. Moreover, differences in specificity and sensitivity of screening tests used at different sites during the time of screening might be the cause of variations. On another hand, the current study was higher than a report from Eritrea which was 2.58%, 25 0.6% in Namibia, 26 0.46% in Nepal, 27 1.93% in India, 14 0.13% in Iran 28 and 0.87% in China. 29 The difference might be due to different risky behaviors at different geographical locations, the capacity of the primary screening test, and the method of laboratory diagnostic test.

The present study revealed that male blood donors were two times more likely to be infected with HBV than females. A consistent result has been reported from a number of studies from different regions of Ethiopia in Harar, 19 Dire Dawa, 30 North Shewa, 31 Bahir Dar, 32 Gondar, 12 Jigjiga, 1 and studies from other countries such as Ghana 30 and Egypt. 16 This might be due to the fact males are approximately 1.5 times more likely to develop chronic HBV infection than females as a result of the slower plasma disappearance rate for HBsAg in males compared to females. 33 Moreover, the gender differences in behavioral risk factors such as having multiple sex partners could attribute to an increase in the prevalence of HBV among male donors. Besides, a plausible explanation of this disproportionate male to female seropositivity ratio may be related to the fact that females are better diagnosed in Ethiopia due to prenatal care. Therefore, a higher proportion of female blood donors may be aware of their seronegative status of HBV. 34 The current study also showed that unmarried donors were more likely to be infected with HBV. Similar findings have been reported from a study conducted in the different study areas. 4,35-37 The relatively lower HBV seropositivity among donor those were married might be attributed to marriage stable the sexual network (a group of individuals connected through sexual contact). Moreover, unmarried people have a probability of a wider sexual network, leading to more sexual partners, which in turn elevate their risk of acquiring HBV. Additionally, the prevalence of HBV was significantly higher among rural populations. This outcome agrees with a similar study conducted in other countries. 16,22 Rural donors can be the attributing factor for the high prevalence of HBV due to their poor awareness regarding the mode of transmission and prevention, low educational status, and access to medical care is more limited in rural communities compared to urban. Furthermore, in this study, higher prevalence of HBV was detected in study participants within the age group 31–35 years and 45–65 years compared to age group 18–30 years. Similar studies in other countries have shown that age to be one of the independent predictors of acquiring

| Variables | HBV Positive N (%) | HCV Positive N (%) | Total N (%) |
|-----------|--------------------|--------------------|-------------|
| Sex       |                    |                    |             |
| Male      | 383(3.06)          | 328(2.63)          | 12,480(70.1) |
| Female    | 163(3.06)          | 218(4.09)          | 5330(29.9)  |
| Age       |                    |                    |             |
| 18–30     | 250(2.18)          | 20(0.17)           | 11,460(64.3) |
| 31–45     | 210(3.56)          | 42(0.71)           | 5892(33)    |
| 46–65     | 86(18.77)          | 52(11.35)          | 458(2.7)    |
| Marital status |          |                    |             |
| Unmarried | 350(2.64)          | 82(0.65)           | 13,245(74.4) |
| Married   | 83(1.82)           | 14(0.36)           | 4565(25.6)  |
| Occupation |                    |                    |             |
| Student   | 373(3.53)          | 75(0.71)           | 10,572(59.4) |
| Private worker | 34(2.76) | 14(1.14)           | 1230(6.9)   |
| Government Employ | 127(2.32) | 25(0.46)          | 5476(30.75) |
| Farmer    | 12(2.26)           | 0(0)               | 532(3)      |
| Educational status |          |                    |             |
| No formal education | 136(3.53) | 25(0.65)         | 3849(21.6)  |
| Primary and Secondary school | 206(3.78) | 55(1.01)         | 5443(30.6)  |
| College   | 205(2.41)          | 34(0.40)           | 8518(47.8)  |
| Residence |                    |                    |             |
| Urban     | 439 (3.52)         | 69(0.55)           | 12,456(70.0) |
| Rural     | 107(2.00)          | 45(0.84)           | 5354(30.0)  |

## Table 2 Seroprevalence of HBV and HCV Infection with Respect to Donation Year Among Blood Donors at Nekemte Blood Bank from January 2015 to December 2019

| Year of Donation | No. of Donor N (%) | HBV Positive N (%) | HCV Positive N (%) |
|------------------|--------------------|--------------------|--------------------|
| 2015             | 2693               | 80 (2.98%)         | 10 (0.37%)         |
| 2016             | 2197               | 64 (2.9%)          | 17 (0.78%)         |
| 2017             | 4178               | 86 (2.05%)         | 52 (1.24%)         |
| 2018             | 4406               | 166 (3.77%)        | 15 (0.34%)         |
| 2019             | 4336               | 150 (3.46%)        | 20 (0.46%)         |
| Total            | 17,810             | 546 (3.06%)        | 114 (0.64%)        |
Table 3 Logistic Regression of HBV with Socio-Demographic Characteristics of Blood Donor at Nekemte Blood Bank from January 2015–2019

| Variables          | HBV Status | COR (95% CI) | AOR (95% CI) | P-value |
|--------------------|------------|--------------|--------------|---------|
|                    | Negative   | Positive     |              |         |
| Sex                |            |              |              |         |
| Female             | 5247       | 83           | 1.00         |         |
| Male               | 12,017     | 463          | 2.43 (1.18, 2.81) | 2.51 (1.17–2.91) |
|                    |            |              |              | 0.02    |
| Age                |            |              |              |         |
| 18–30              | 11,150     | 310          | 1.00         |         |
| 31–45              | 5682       | 210          | 1.33 (1.11, 1.63) | 1.33 (1.21, 1.52) |
| 46–65              | 432        | 26           | 2.16 (1.11, 2.31) | 2.18 (1.16, 2.01) |
|                    |            |              |              | <0.01   |
| Marital status     |            |              |              |         |
| Married            | 4426       | 139          | 1.00         |         |
| Single             | 12,838     | 407          | 3.29 (1.89–2.56) | 2.81 (1.79–2.51) |
|                    |            |              |              | <0.01   |
| Occupation         |            |              |              |         |
| Farmer             | 520        | 12           | 1.00         |         |
| Student            | 10,199     | 373          | 1.58 (0.91–3.01) |         |
| Private worker     | 1196       | 34           | 1.23 (0.77–1.31) |         |
| Government Employ  | 5349       | 127          | 1.02 (0.45–2.53) |         |
| Educational status |            |              |              |         |
| No formal education| 3713       | 136          | 1.00         |         |
| 1° and 2° schools  | 5237       | 206          | 1.07 (0.80–3.40) |         |
| College            | 8313       | 205          | 1.05 (0.53–2.03) |         |
| Residence          |            |              |              |         |
| Urban              | 12,177     | 279          | 1.00         |         |
| Rural              | 5087       | 267          | 2.29 (1.08–3.05) | 2.11 (1.17–2.50) |
|                    |            |              |              | 0.04    |

Notes: *Statistically significant (P<0.05); I, reference value; COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval; 1°, primary; 2°, secondary.

HBV infection. This would probably be the birth cohort effect and presumptively due to a lack of immunization against HBV in their times. The overall prevalence of HCV in the current study was 0.64% which was comparable with the study done in Ethiopia by Yohannes et al which was 0.6% and 0.6% by Birhanesellassie. The present study was slightly higher than studies conducted in South Ethiopia which was 0.2%, 0.32% in Central North Ethiopia, 0.4% in Jijiga, Ethiopia, and 0.3% in Eritrea. However, the prevalence was lower when compared to previously conducted studies in a different region of Ethiopia 0.8%, 1.6%, 13.3% and in another country 3.4% Sudan, 1.5% Tanzania, 4% in Ghana and 4.3% in Egypt. These variations in the prevalence of HCV infection in different parts of the world could be a result of a combination of several factors including, different risky behaviors at different geographical locations, the quality of the primary screening test, and the effectiveness of their program to select blood donors.

In the current study, higher prevalence of HCV was associated with study participants in the age group of 31–35 years and 45–65 years compared to study participants in 18–30 years. This outcome might be due to patients of older age at the time of infection and impaired immune system are at increased risk of developing chronic HCV infection. Additionally, male blood donors were three times more likely to be infected with HCV infection than female donors. This result was agreed with studies done in another study area. The findings could be due to some risk behaviors of males such as outside socialization, multiple sex relationships and habit of drinking alcohol than females. Furthermore, it may also be due to fewer females donating blood; hence, fewer females are screened compared to males. Besides, unmarried blood donors were more likely to have HCV infection than married study participants in the current study. The result was an agreement with studies conducted in another study area. This might be due to unmarried blood donors might have a wider group of individuals connected through sexual contact, leading
Table 4 Logistic Regression of HCV with Socio-Demographic Characteristics of Blood Donor at Nekemte Blood Bank from Jan 2015 to Dec 2019

| Variable            | HCV Status  | COR (95% CI)         | AOR (95% CI)         | P-value |
|---------------------|-------------|----------------------|----------------------|---------|
|                     | Negative    | Positive             |                      |         |
| Sex                 |             |                      |                      |         |
| Female              | 5317        | 13                   | 1.00                 | 1.00    | 0.02 |
| Male                | 12,379      | 101                  | 3.29 (1.19–4.56)     | 3.01(1.17–3.51)* |
| Age                 |             |                      |                      |         |
| 18–30               | 11,400      | 60                   | 1.00                 | 1.35(1.43–2.03)* | 0.01 |
| 31–45               | 5850        | 42                   | 1.36(1.51–3.66)      | 3.56(1.14–3.99)* | 0.02 |
| 46–65               | 446         | 12                   | 5.11(1.13–5.02)      |         |     |
| Marital status      |             |                      |                      |         |
| Married             | 4557        | 8                    | 1.00                 | 3.14(1.65–3.96)* | <0.01 |
| Unmarried           | 13,139      | 106                  | 4.29(1.85–4.05)      |         |     |
| Occupation          |             |                      |                      |         |
| Student             | 10,497      | 75                   | 1.00                 | 3.14(1.65–3.96)* | <0.01 |
| Private worker      | 1216        | 14                   | 1.61(0.79–2.64)      | 0.06(0.34–1.95) |     |
| Government Employed | 5451        | 25                   | 0.06(0.34–1.95)      |         |     |
| Farmer              | 532         | 0                    |                      |         |     |
| Educational status  |             |                      |                      |         |
| No formal education | 3824        | 25                   | 1.00                 | 1.56(0.67–2.30) |     |
| 1° and 2° school    | 5388        | 55                   | 1.56(0.67–2.30)      | 0.6(0.36–1.82) |
| College             | 8484        | 34                   |                      |         |     |
| Residence           |             |                      |                      |         |
| Urban               | 12,387      | 69                   | 1                    | 1.52(0.89–4.79) |     |
| Rural               | 5309        | 45                   |                      |         |     |

Notes: *Statistically significant (P<0.05); 1, reference value; COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval; 1°, primary; 2°, secondary.

To more sexual partners, which in turn increase their risk of acquiring HCV compared with those married.

This study has some limitations; due to a retrospective blood donation card were review it might not include some variables. Additionally, all the test results did not give positive serological result during the window period. Besides, the method of laboratory analysis does not include molecular analysis, which is a more confirmatory test. However, this study tried to give better information on the magnitude, trends and some associated factors of HBV and HCV since it used a large sample size and a long year of blood donors’ data.

Conclusion

The current study shows the prevalence of hepatitis B virus was higher among study participants. However, the prevalence of HCV was low compared to the study conducted in other countries in Africa, a substantial percentage of the blood donors harbor HCV infections. Therefore, it is recommended to strictly the choice of blood donors and screening their blood sample using standard methods to ensure the safety of blood for the recipient. Besides, increasing awareness of people (particularly on unmarried, male and rural resident) on modes of transmission and prevention of infection could help in reducing the burden of both HBV and HCV.

Data Sharing Statement

All data generated or analyzed during this study were included in this article.

Ethics Approval and Consent to Participate

This research was conducted after obtaining ethical clearance from the Wollega University, Department of Medical Laboratory Sciences ethical review committee.
All data and samples obtained from them were kept confidential by using codes instead of any personal identifiers and were meant only for the purpose of the study. However, because of the nature of the study (retrospective review of blood donors’ records), informed consent was not applied from the study subjects. The study was conducted in accordance with the Declaration of Helsinki.

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Author Contributions
All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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