Prevalence of Hepatitis B virus and its predictors among volunteer blood donors in Jimma, Ethiopia, 2018

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Abstract

Background: Transfusion of contaminated blood causes a significant burden of Hepatitis B virus (HBV) infection globally and more than 45,000 infections in Sub-Saharan Africa annually. However, very few studies were conducted in Ethiopia to assess the status of HBV.

Objective: To determine the prevalence of HBV and its predictors among volunteer blood donors in Jimma Zone, Southwest Ethiopia.

Material and Methods: A cross-sectional study was conducted among volunteer blood donors who consecutively included from March 10 - April 20, 2018. The detection of the virus was made through the investigation of the Hepatitis B surface antigen in the serum. Data collected through a structured questionnaire were entered into Epi-data 3.1 and analyzed by SPSS 20. Adjusted Odds Ratio with 95% Confidence Interval computed using multivariable logistic regression and statistical significance established at $P < 0.05$.

Results: A total of 548 (98.7%) volunteer blood donors participated. The overall prevalence of HBV infection was 16 (2.92%) with 12 (4.5%) and 4 (1.4%) prevalence among males and females respectively. Male sex [AOR=3.28, 95%CI: 1.01-10.68], age 18-24 years [AOR=0.17, 95%CI: 0.36-0.78], frequency of donation [AOR= 0.25, 95%CI: 0.08-0.76] and exposure to unsafe therapeutic drug injection [AOR= 6.98, 95%CI: 1.66-29.29] were significant factors for HBV infection.

Conclusions: The prevalence of HBV in the study area was intermediate. Age, sex, frequency of donation, and exposure to unsafe therapeutic drug injection were independent predictors of HBV. Therefore, the blood bank should focus on blood donation among identified low-risk groups and should strengthen counseling for repeated volunteer blood donors.

Background

Hepatitis B infection which is caused by a DNA virus of the family *Hepadnaviridae*, Hepatitis B virus (HBV), is one of the most common infectious diseases in the world and a major health problem (1). It is about 50 to 100 times more infectious than the Human Immunodeficiency Virus (HIV) and 10 times more infectious than hepatitis C virus (HCV). Chronic infection with HBV is a common cause of death associated with liver failure, cirrhosis and liver cancer (2-4). Hepatitis B is a silent killer disease of the liver with many carriers not aware of their clinical status, therefore, they act as a potential source of infection to other seronegative people (5).

The presence of Hepatitis B surface antigen (HBsAg) in the blood indicates that an individual is currently infected with the virus. Individuals who recover from acute hepatitis B infections clear the blood off HBsAg within approximately four months after the onset of symptoms. These individuals develop antibodies to HBsAg (anti-HBs) that provides complete immunity to subsequent hepatitis B viral infection.

Similarly, individuals who are successfully vaccinated against hepatitis produce anti-HBsAg in the blood (6).

The risk of developing Chronic Hepatitis B (CHB) virus infection commonly defined as being positive for hepatitis B surface antigen (presence of HBsAg in the blood) for greater than 6 months is inversely related to the age of acquisition of the infection. Generally, the risk of chronic HBV infection is 90% following infants infected at birth while the risk is put at 30% for children infected between 1 and 5 years of age, and only about 1–5% for those infected as older children and adults (7).

The main routes of HBV transmission are by percutaneous or mucosal exposure to infected blood and various body fluids, as well as through saliva, tears, menstrual, vaginal, and seminal fluids. Transmission of the virus may also occur through the reuse of needles and syringes either in health-care settings or among persons who inject drugs. Also, the infection can occur during medical, surgical and dental procedures, through tattooing, or through the use of razors and similar objects that are contaminated with infected blood (8).

Worldwide, it is estimated that 240 million people are chronically infected with HBV (9). Recent reports demonstrated that 68,600 people die of HBV infection and more than 300,000 deaths due to liver cancer secondary to hepatitis B every year globally (10). The prevalence of chronic HBV infection worldwide could be categorized as high if it is higher than 8%, intermediate if it is between 2% and 7%, and low endemicity if it is below 2% (11). Overall, approximately 45% of the global populations live in areas of high chronic HBV prevalence (12). The prevalence of HBV is estimated at 8% in West Africa and 5-7% in Central, Eastern and Southern Africa (12). Ethiopia, being part of this region, is ranked within an area with medium to high endemicity for HBV (13, 14).

According to the World Health Organization (WHO) reports, the prevalence of HBV infections among blood donors in different parts of the world varies from 0.008% to 6.08% (9). Among voluntary, non-remunerated blood donors recruited with effective education and selection programs, the prevalence and incidence of HBV infection should be lower than in the general population. Despite a lower prevalence and incidence, screening of blood donors may lead to tests that are positive for HBV infection (15, 16).

Globally, transfusion of contaminated blood causes up to 16 million new infections with HBV. With each blood unit transfused, there is always a 1% likelihood of transfusion-linked risks including transfusion-transmitted infections (17, 18). Globally, an estimated 1.6 million blood units are discarded annually due to the presence of markers for transfusion-transmitted infections, including HIV, HBV, HCV, and syphilis (16).

In Sub-Saharan Africa, 12.5% of patients who received blood transfusion are at risk of post-transfusion hepatitis (19). It is estimated that more than 45,000 HBV infections are transmitted through contaminated transfusions annually (20). From 2000 to 2011, the number of countries in sub-Saharan Africa screening at least 95% of donated blood units for HBV increased from 76% to 94%. During the same period, the median percentage of HBV marker-reactive units decreased from 7.1% to 4.4% (21).

In Ethiopia, it was estimated that over 5 million people are living with chronic HBV infection among the general population (6). Several programs have been implanted in Ethiopia to reduce the burden of HBV in the community. These programs includes: the Expanded Program on Immunization policy including childhood immunization against HBV using a pentavalent form at ages 6, 10 and 14 weeks after birth; implementing antenatal screening for HBsAg of all pregnant women and the vaccination of their babies at birth; and recommending the vaccination of high risk groups such as health professionals against HBV. However, these programs have not been routinely enforced in most healthcare settings across the country (22).

Quality-guaranteed screening of all donated blood for transfusion-transmitted infections (TTIs) including HIV, HBV, and HCV, is recommended by the WHO and adopted by the Ethiopian government for the provision of safe and efficacious blood and blood components (8). In response to this strategy, Ethiopia takes responsibilities for blood transfusion from the Ethiopian Red Cross Society and granted it to the national blood transfusion service Agency, a government agency managed under the Federal Ministry of Health and Regional Health bureau created in 2010 to ensure blood safety and accessibility (23). A cross-sectional retrospective record review conducted in Jimma Blood Bank Center from 2010 to 2015 shows the prevalence of HBV 3.05% (24).

Previous studies conducted on the prevalence of HBV infection and its predictors among blood donors in Ethiopia were focused on all types of donors including family replacement blood donors and commercial blood donors in which the prevalence of HBV is high due to absence of exposure screening before blood donation.

Therefore, this study was aimed to determine the prevalence of HBV and associated factors among volunteer blood donors in Jimma zone, which will contribute as an input for prevention and control of the hepatitis B virus infection, assuring blood safety in achieving the national blood transfusion services strategies and improving blood donor selection protocol according to the geographic area and population subgroup.

Methods

Study setting

The study was conducted in the Jimma zone, Oromia Regional State which is located at a distance of 354 km away from Addis Ababa to the Southwest part of Ethiopia. According to the data from the Jimma Zone Statistical Department in 2017, the zone has an estimated 3,174,484 total population. It has 21 districts with a total of 555 villages. In the zone, there is a branch of national blood transfusion service agency providing blood donation services to the hospitals.

Study design and period

A cross-sectional study was conducted in Jimma Zone among volunteer blood donors who visited the blood bank and blood collection sites for donating blood during study period, have lived in the zone for the last six months and were qualified for blood donation according WHO blood bank guidelines for blood donation eligibility criteria's (8). Blood donors who refused to give informed consent were excluded. Data were collected from March 10 to April 20, 2018.

Study variables

Dependent variable: HBV infection status

The independent variables were;

Socio-demographic factors: Age, sex, marital status, educational status, residency, occupation

Behavior related factors: Razor and sharp material sharing, unprotected multiple sexual activities, tattooing, ear/nose piercing, using unsafe therapeutic drug injection, number of blood donation

Knowledge related factors: Knowledge about the causative agent, means of transmission, sign and symptoms and treatment of HBV

Treatment-related/clinical factors: Blood transfusion, surgical procedure, dental procedure, HB vaccination status, previous history of hospitalization

Sample size determination

The sample size was calculated manually using a single population proportion formula by taking the prevalence of HBV among blood donors in the Southwest Ethiopia 3.05% (24), 1.5% margin of error and 95% confidence interval (CI). Assuming a 10% non-response rate, the final sample was 555. The prevalence of HBV among blood donors gives the largest sample size than factors associated with it and so used to determine the final sample size.

Sampling techniques

All volunteer blood donors were selected consecutively from the collection sites in Jimma zone and blood bank center during the study period until the required sample obtained. Sampling procedure follows the movement plans of blood bank service due to the data collectors assigned with each team of blood bank staff. Three functional teams established to collect blood from volunteer blood donors. Each team planned to collect 250 blood units within ten days at blood bank center and fifteen days outreach since the number of volunteers in each planned collection site usually unknown. So, the sample size was equally distributed for case teams. After community mobilization, the data collectors moved for blood collection to the planned collection sites with blood bank staffs.

Data collection tool and techniques

Data were collected by a structured questionnaire adapted from previous different literature (8, 24) and it was numbered to identify those who had to respond and/or not. The questionnaire was originally prepared in English and translated into the local language, Afan Oromo and Amharic, for fieldwork purposes and back to English for checking language consistency.

After donors agreed to take part in the study, he or she signed a consent form and data collectors collect baseline information of each participant. Then, the blood sample was taken from blood bags of donated blood to sterile test tubes which further used for the screening with a closed system. Then the collected blood was centrifuged, plasma separated and stored at 2 to 8°C until it was tested. Samples were brought to room temperature before testing. The plasma sample was performed and analyzed for HBsAg using the 4th generation Enzyme-Linked Immune Sorbent Assay (ELISA) test kit by a senior laboratory professional in the blood bank.

Data quality assurance

Data collectors were selected based on the ability to speak the local language and two days orientation was given by the investigators on the objective, process of data collection and field ethics. The whole data collections were supervised by the investigators.

Each questionnaire was cross-checked daily by the investigators for completeness and consistency. ELISA kits were checked for appropriate storage conditions and its expiry date. Internal positive and negative controls were included in each assay run and standard operation procedures and manufacturer instructions were strictly followed.

A pretest was conducted in a nearby zone taking 5% of the total sample to test the data collection tool. Consequently, clarifications and corrections were made on problems encountered about the questionnaire.

Data analysis

Each questionnaire was coded and checked manually for completeness, consistency, and clarity. Then, the coded and cleaned data were entered into Epidata 3.1 and exported to SPSS version 20.0 where statistical analyses were done. Descriptive analyses were done to determine the prevalence of HBV. Bivariate analysis was done to select candidate variables with $P < 0.25$. Then entered into multivariable analysis to identify independent predictor variables and control for confounders. Finally independent variables at $P < 0.05$ level of significance with Adjusted Odds Ratio (AOR) and its 95% Confidence Interval (CI) in multivariable logistic regression were used to identify statistical significance.

Operational definition

Knowledge about HBV prevention and control was measured using 18 questions that include general awareness about HBV, mode of transmission, sign and symptoms, complications and treatment based on the current literature. Each correct answer scored 1 and wrong answer or “I don’t know” scored 0. Thus the knowledge score was scaled from 0 to 18. A person scoring a total of 9 or less was taken as having poor knowledge and those scoring 10 and above had good knowledge.

Results

Socio-demographic characteristics

A total of 548 (98.7%) volunteer blood donors were participated in the study. The age of respondents ranges from 18 to 51 years with the mean age of 24.84 years and Standard Deviation (SD) of ± 5.85 years. The majority of the 334(60.9%) were found in the age group of 18-24 years and 330(60.2%) were students in occupation (**Table 1**).

Knowledge of the respondents

Among 548 participants, 443 (80.84%) respondents had good knowledge about HBV and the majority, 248 (45.3%) get the information from health professionals.

Prevalence of HBV

The detection of HBV was made through the investigation of HBsAg in the serum. The overall prevalence of HBsAg among volunteer blood donors who participated in this study was 16(2.92%) and the seropositivity was higher in male participants 12(4.5%).

The prevalence of HBsAg was higher among volunteer blood donors aged ≥ 35 years. The highest occupation-specific prevalence of HBsAg was observed among the daily laborer (4.8%) and lowest prevalence was seen among students (2.1%) (**Table 2**).

Prevalence of HBV by clinical exposures

Concerning the distribution of HBsAg positivity by clinically related exposures, 36(6.6%) of the respondents had a history of hospitalization and 12(2.2%) of them had an exposure history of blood transfusion. The seropositivity among those hospitalized and exposed was 2(5.6%) and 1(8.3%) respectively. The majority of respondents 502(91.6%) were not vaccinated for the Hepatitis B virus and they took a higher prevalence of HBsAg 15(3.0%) as compared to those vaccinated.

Prevalence of HBV by behavioral and knowledge factors

Forty-four (8.0%) of study participants were using a razor and other sharp materials together and 19(3.5%) had multiple sexual partners. Among those participants, the prevalence of HBsAg was 2(4.5%) and 1(5.3%) respectively. While 23(4.2%) of study participants were exposed to unsafe therapeutic drug injection and their seropositivity for HBsAg was 3(13.0%) which was higher than those who were not exposed, however, it was not statistically significant.

Of 548 study participants, 313(57.1%) donated blood twice and more times. The prevalence of HBV infection was higher 11(4.7%) among first-time volunteer blood donors and blood donors with poor knowledge 4(3.8%).

Predictors of Hepatitis B Viral Infection

Those candidate variables with P-value <0.25 in bivariate logistic regression were entered in multivariable logistic regression models to control for confounders and to evaluate the net effects of risk variables on hepatitis B viral infections among the studied group and considered as significant in the model if the P-value less than 0.05.

Being male was found to be an independent predictor of Hepatitis B Viral Infection. Male volunteer blood donors were about three times more seropositive for HBV infection than female donors [AOR=3.28, 95%CI: 1.01-10.68].

Age group is also found to be a risk factor for Hepatitis B viral infection. Blood donors within the age group 18-24 were 83% less likely seropositive for HBV infection than those age group ≥ 35 years old [AOR=0.17, 95%CI: 0.36-0.78].

The number of blood donation was identified as a predictor variable for HBV infection. Volunteer blood donors who were donated blood more than once were about 75% less likely seropositive for HBV infection than first-time donors [AOR= 0.25, 95%CI: 0.08-0.76].

History of exposure to unsafe therapeutic drug injection was an independent predictor of HBV infection. Volunteer blood donors who exposed to unsafe therapeutic drug injection were about seven times more likely to seropositive for HBV infection than those who were not exposed [AOR= 6.98, 95%CI: 1.66-29.29] (**Table 3**).

Discussion

In this study the proportion of male and female volunteer blood donors were approximately equal 268(48.9%) and 280(51.1%) in contrast to the previous studies from some parts of Ethiopia that showed majority of blood donors were male donors; 87.9% in Gondar (25), 74.6% in Wolaita (26) and 98.7% in

Jigjiga (27). This may show that the awareness of males and females became comparable concerning blood donation due to the majority of current study participants were students.

The majority of the participants 334(60.9%) were aged between 18-24 years. The findings of this study partly agreed with a study conducted in Hawasa 86.2% (28), in Arba Minch 80.2% (29) and with that of WHO report that 45.0% of blood donors aged 25 or less (16). This indicated that routine blood bank activities were targeted on donors of a younger age, mostly high school and college students, as this group is perceived to be more willing to donate blood and also a low-risk group.

The prevalence of HBsAg among volunteer blood donors in the study area was 16(2.92%). Based on the WHO classification of HBV endemicity which based on the seropositivity rate of HBsAg, this result indicates the study area is categorized in an intermediate endemicity to HBV infection (5, 8). This finding also in line with a retrospective study conducted in Jimma Blood Bank from 2010 to 2015 that revealed HBsAg prevalence among blood donors was 3.05%(30).

The prevalence of HBsAg in this study was higher than researches conducted in Eritrea 2.58%, Egypt 2.3% and India 1.94% (31-33). This is probably because of the differences in social, behavior, lifestyle, socioeconomic status and level of awareness in different countries. In contrast, it is lower than the study conducted in Yemen 5.1%, Cameroon 11.2%, and Nigeria 9.3% (34-36). This might be because most of the study participants in the previous study were family replacement and commercial blood donors whereas only volunteer blood donors were included in this study.

Similarly, the prevalence of HBV infection in this study was lower when compared with similar studies conducted in Ethiopia, national wide 3.9% (37); Bahir Dar 4.1% (38), Wolaita Sodo 9.6% (26), and Arba Minch 4.7% (29). This might be due to the previous studies that include replacement type of blood donation and a higher number of first-time blood donors. Although, some possible differences in specificity and sensitivity of screening tests used at different sites during the time of screening might also explain in-part for the observed variations.

Being a male donor was about three times more likely to have HBV infection than a female donor. This finding was consistent with other studies previously conducted in Gondar, Dire Dawa and Jimma (25, 39, 40). This association might be attributed to cultural practices that could expose to HBV infection like circumcision using non-sterile equipment and while in male beauty salons which may use unsterilized barbing utilities.

Participants in the age group 18-24 years were about 83% less likely to have HBV infection than those who were in the age group ≥ 35 years. This result in line with studies conducted in Jimma Blood Bank from 2010 to 2015 and in Gonder in 2010 (25, 29). Similarly, studies conducted in India and Nigeria shows the prevalence of hepatitis B higher among ≥ 35 years and has a significant statistical association with Hepatitis B infection (33, 36). This might be due to youths between 18 and 24 years of age group is less exposed to risk factors like occupational risk and unsafe sex.

Participants who had a previous history of blood donation were about 72% times less likely to seropositive for HBV infection than those first-time donors. This finding also in line with other studies conducted in Gonder where the prevalence of HBV among the first-time donor is about two times more likely to have HBsAg infection than repeated donor and Yemen where first time donor had 22 times more likely to have HBsAg infection than the repeated donor (25, 34). This might be due to most new donors have not been previously tested for markers of infections that used to exclude individuals from the donor population and repeated donors get awareness about the disease transmission.

Donors who exposed to unsafe therapeutic drug injection were about seven times more likely to have HBV infection than those who were not exposed. This study finding was in line with the studies conducted in Arba Minch (29) and Jimma University Specialized Hospital (40), and also in agreement with that of WHO reports in developing countries, contaminated injections caused an estimated 21 million HBV infections worldwide in 2000, accounting for 32% of all new infections (5). This might be due to the therapeutic injection giver using contaminated syringes or other materials and unsafe procedures.

The majority of potential risk factors included in this study were not significantly associated with HBV infection. This might be due to the homogeneity of the study population as the majority of participants were young students.

Limitation Of The Study

The sero-markers used for assessment of HBV infection were not complete; HBV DNA was not detected by polymerase chain reaction due to the unavailability of resources, which might increase the detection rate of HBV and hence increase prevalence. Recall bias might be introduced due to previous exposure history solicited.

Conclusions

The prevalence of HBV infection with positive tests for HBsAg among volunteer blood donors in Jimma was 2.92%. The prevalence of HBsAg is found to be intermediate prevalence according to the WHO hepatitis B endemicity category. The finding of this study indicated that low-risk volunteer blood donors were female, repeated donors and age group below 25 years. Thus, the blood bank should focus on blood donation among identified low-risk groups and should strengthen repeated volunteer blood donors to ensure the safety of blood for the recipient and to prevent HBV infection.

Declarations

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Authors' Contributions

DM developed the proposal, carried out data collection, conducted the analysis, involved in reviewing the manuscript and had full access to all the data in the study. TS provided general guidance on overall study progress, participated in reviewing the proposal, reviewing the analysis, developing the final manuscript document, and had final responsibility for the decision to submit for publication. MN involved in interpretation of data, drafting and reviewing the manuscript. All the authors read and approved the final manuscript.

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Ethical approval and consent to participate

Ethical approval for this study was obtained from the Institutional Review Board of Jimma University, Institute of Health Sciences. A permission letter was obtained from Jimma Blood Bank service center. Written informed consent was obtained from each participant. All blood donors who were positive for HBsAg during the study period were counseled by nurses assigned for counseling in the Blood Bank and linked to Jimma University Medical Center.

Consent for publication

The study participants were informed that finding of the study would published. Identifying images or clinical details of participants that compromise anonymity were not applicable in this manuscript.

Competing interests

We declare that the study has no competing interests.

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Tables

Table 1: Socio-demographic characteristics of volunteer blood donors in Jimma Zone, South West Ethiopia, April 2018

Characteristic	Categories	Frequency	Percent (%)
Age in years	18- 24	334	60.9
	25- 34	174	31.8
	≥35	40	7.3
Sex	Male	268	48.9
	Female	280	51.1
Marital status	Single	319	58.2
	Married	211	38.5
	Separated	18	3.3
Residence	Urban	444	81.0
	Rural	104	19.0
Educational level	Elementary	16	2.9
	Secondary	162	29.6
	College diploma	159	29.0
	Degree and above	211	38.5
Occupation	Government employed	130	23.7
	Self-employed	67	12.2
	Daily laborer/ jobless	21	3.8
	Student	330	60.2

Table 2: Prevalence of HBsAg by socio-demographic characteristics of volunteer blood donors in Jimma Zone, South West Ethiopia, April 2018

Variable	Category	HBsAg Infection Status		COR(95%CI)	P-value
		Positive (%)	Negative (%)		
Age group (in years)	18- 24	5(1.5)	329(98.5)	0.19(0.04-0.82)	0.026*
	25- 34	8(4.6)	166(95.4)	0.59(0.15-2.35)	0.458
	≥ 35	3(7.5)	37(92.5)	1	
Sex	Male	12(4.5)	256(95.5)	3.23(1.03-10.16))	0.044*
	Female	4(1.4)	276(98.6)	1	
Marital status	Single	8(2.5)	311(97.5)	0.44(0.53-3.70)	0.448
	Married	7(3.3)	204(96.7)	0.58(0.068-5.02)	0.624
	Separated	1(5.6)	17(94.4)	1	
Residence	Urban	14(3.2)	430(96.8)	1.66(0.32-7.42)	0.507
	Rural	2(1.9)	102(98.1)	1	
Educational level	Elementary	0(0)	16(100)	0.000	0.999
	Secondary	5(3.1)	157(96.9)	0.93 (0.289-2.99)	0.640
	Diploma	4(2.5)	155(97.5)	0.75 (0.216-2.62)	0.654
	Degree and above	7(3.3)	204(96.7)	1	
Occupation	Employed	6(4.6)	124(95.4)	2.23 (0.74-6.77)	0.256
	Self employed	2(3.0)	65(97.0)	1.42(0.29-6.99)	0.666
	Daily laborer	1(4.8)	20(95.2)	2.31(0.271-19.68)	0.445
	Student	7(2.1)	323(97.9)	1	

Note: *= P-value < 0.25, COR= Crude Odds Ratio

Table 3: Multivariable logistic regression analyses of the factors associated with HBsAg among volunteer blood donors in Jimma Zone, South West Ethiopia, April 2018

Variable	Category	HBsAg Status		COR(95%CI)	AOR(95%CI)	P-value
		Positive	Negative			
Age group (years)	18-24	5	329	0.19(0.04-0.82)	0.17(0.36-0.78)	0.022*
	25-34	8	166	0.59(0.15-2.35)	0.53(0.13-2.24)	0.391
	≥ 35	3	37	1	1	
Sex	Male	12	256	3.19(1.02-10.68)	3.28(1.01-10.68)	0.049*
	Female	4	276	1	1	
Number of blood donation	Repeated	5	308	0.33(0.11-0.97)	0.25(0.08-0.76)	0.015*
	First time	11	224	1	1	
Unsafe therapeutic drug injection	Yes	3	20	5.91(1.56-22.39)	6.98 (1.67-29.30)	0.08*
	No	13	512	1	1	

Note: *=Statistically significant (P-value < 0.005)