

Seroprevalence and transmission risk factors of Hepatitis B and C in Wolaita Zone, Southern Ethiopia: Community-Based Cross-Sectional Study

Atnafwork Haile Mesfin^{1*}, Desta Mota Kuma¹, Kelemu Desta Deyassa¹, Tibebe Solomon Dade¹ and Mengistu Meskele Koyra²

¹College of Health Sciences, Siloam Health Sciences College, Wolaita-Sodo, Ethiopia

²Department of Public Health, College of Medicine and Health Sciences, Wolaita-Sodo University, Ethiopia

*Corresponding author: atnafh0@gmail.com

Abstract

Background: The most significant causes of liver-related illness and mortality worldwide are hepatitis B and C viruses. At the community level, little research has been done on the seroprevalence of hepatitis B and C virus infections in Ethiopia.

Objectives: The objective this study was to assess the seroprevalence of hepatitis B and C virus infection and associated factors among adults in Wolaita Zone, Southern Ethiopia, 2022.

Methods: A community-based cross-sectional study was conducted among 770 individuals in Wolaita Zone, Southern Ethiopia, from December 1 to February 30, 2022. Whole blood sample was aseptically collected and tested for Hepatitis B surface antigen (HBsAg) and anti-HCV antibodies using a rapid serological test kit. Multivariable binary logistic regression model was used to assess the factors associated with the seroprevalence of hepatitis B and C, and statistical significance was determined at P-value <0.05.

Result: The overall prevalence of HBsAg and anti-HCV among adults was (7.5%; 95% CI 5.8- 9.6) and 0.4%; 95% CI 0.1-1.1), respectively. History of contact with a jaundiced person, (AOR=5.84; 95% CI 3.00-11.37), history of abortion (AOR= 3.20; 95% CI 1.18-8.66), having multiple sexual partners (AOR=4.86; 95% CI 1.61-14.64), history of surgical procedure (AOR 2.73; 95% CI 1.05-7.09), having a history of alcohol consumption (AOR=2.68; 95% CI 1.31-5.48), and having chronic diseases (AOR=10.73; 95% CI 4.33-26.55) were significantly associated with hepatitis B virus infection.

Conclusion: According to this study, infection of adults with hepatitis B and C virus is low and intermediate endemic in the community, respectively.

Key words: Adult community members, Anti-HCV Antibody, HbSAg, Seroprevalence

Introduction

Hepatitis viruses, specifically hepatitis A, B, C, D, and E viruses, can induce potentially fatal liver inflammation. Hepatitis B virus (HBV) and Hepatitis C virus (HCV) are the most prevalent hepatitis-causing agents among these, respectively causing acute and chronic liver disease (Elserag 2012). HCV is four times more infectious than the human immunodeficiency virus (HIV), while HBV is 50-100 times more contagious (Weinbaum et al. 2009; Madhava et al. 2009).

Sexual, parental, and vertical transmissions of HBV and HCV are all possible. People who have several sexual partners, people who require blood transfusions, and babies born to mothers who have HBV or HCV infection are at a greater risk of contracting the virus (Onwuakor et al. 2014; Locarnini et al. 2015). Hepatitis B and hepatitis C virus causes substantial disease and death worldwide. According to the WHO report, globally, about 296 million people were living with HBV infection, and 56 million people were living with HCV infection in 2019. About 1.1 million people die each year from cases related to viral hepatitis (CDC 2020).

HBV infection rates range from low to high endemicity (Lavanchy 2004). Africa, which is regarded as a high-endemicity region, has the second-highest number of chronic HBV carriers after Asia (Hwang & Cheung, 2011). About 8% of people in sub-Saharan Africa have HBV (WHO, 2017). HBV results in 19 (14–24) per 1,000 fatalities and 26% of liver cancer cases (Lavanchy 2004; Abdel-Hady and Kelly 2013).

Like HBV infection, the endemicity of HCV infection varies from a very low incidence (5%) (Derese et al. 2021). The majority of sub-Saharan regions have the greatest global prevalence of HCV. HCV is present in between 1% and 6% of people (WHO 2017). The global goals for 2030 are to identify 90% of those with HBV and HCV infections and treat 80% of those who are eligible (WHO 2017). However, only 30.4 million people (10.5%) and 15.2 million (21%), respectively, were diagnosed with HBV and HCV infections in 2019 and were aware of their condition. Only 6.6 million (22%) of those 30.4 million people tested positive for HBV infection and received treatment. Similarly, of the 15.2 million HCV-positive individuals, around 9.4 million (62%) received treatment (CDC 2020). Hepatitis predominates in

Ethiopia, where it is responsible for 31% of hospital fatalities and 12% of hospital admissions.

More than 60% of chronic liver disease and up to 80% of hepatocellular carcinoma in Ethiopia are caused by persistent HBV and HCV infections (Bane et al. 2014). According to the WHO, viral hepatitis is widespread in Ethiopia, where the prevalence of HBV and HCV is currently 6% and 2%, respectively (Yazie and Tebeje 2019; Deress et al. 2021). Ethiopia is thought to be a nation without a comprehensive plan for monitoring, preventing, and controlling viral hepatitis (Shiferaw and Letebo 2016). Data on HBV and HCV epidemiology are scarce in local communities.

As a result, the absence of information on the epidemiology of hepatitis at the community level in Ethiopia may affect the goals for the global control of HBV and HCV infection. To create measures to lower transmission among community members, it is essential to understand the sero-prevalence and transmission risk of viral hepatitis at the community level. So, the goal of this study was to determine the sero-prevalence and transmission risk of viral hepatitis among adult community members in Wolaita Zone, Southern Ethiopia.

Materials and Methods

Study design, area, and period: Between December 1 and February 28, 2022, a cross-sectional community survey was carried out in the Wolaita Zone, Southern Ethiopia. Six city administrations make up Wolaita Zone's sixteen districts. According to the Central Statistical Agency of Ethiopia's (CSA) prediction of the population for the year 2020, the zone had a total population of 5,385,782 people and a land area of 451,170.7 hectares. Males made up 2,687,021 of the total population, while females made up 2,698,261.

Study participants: Residents of the study region who were volunteers and at least 18 years old were the only participants. Residents of the study area who were in critical condition, however, were excluded from the study.

Sample size determination and sampling technique: A multistage sampling technique was used to recruit study participants. From the 16 Wolaita Zone Districts, five (Sodo, Damote Gale, Damote Wayde, Humbo Tebela, and Kindo Koysha) were selected. From the five districts, 15 kebeles (the lowest administration unit in Ethiopia) (three from each district) were selected using simple random sampling technique. The sample size was calculated by using a single population proportion formula, $n = \frac{Z\alpha/2^2 \times p(1-p)}{d^2}$ was used to estimate the sample size.

Where; n = sample size, Z -standard normal distribution corresponding to a significant level at $\alpha = 0.05$, the prevalence of HBV from a previous study conducted in Southwest Ethiopia among adults (Belay et.al, 2020), and d = margin of error. The following assumptions were made while calculating the sample size; the margin of error $d=0.03$, $z\alpha/2$ is $=1.96$, and the prevalence of HBV = 0.09. Since the sampling procedure involved a multistage sampling technique, we multiplied by the design effect of 2. Finally, by adding 10% non-response rate, the final sample size was 770.

Households from each of the selected kebeles were selected using systematic random sampling after calculating the K^{th} value by dividing the total number of households by the sample size. From each selected household, one participant aged 18 or above was randomly recruited using a lottery method. In case there was an eligible respondent not available at the time of the survey, a revisit was made.

The outcome variable of interest was the prevalence of HBV and HCV infection and independent variables were socio-demographic factors, clinical and behavioral characteristics, and knowledge about hepatitis.

Data collection tool and process: After evaluating past comparable studies, a pre-tested, standardized questionnaire was created (Belay et al. 2020; Beykaso et al. 2021; Woldegiorgis et al. 2019; Ayele et al. 2020) and, organized according to the objective of the study. To gather information via a face-to-face interview, four certified health officers were given the task. Three ml sample of venous blood was also taken from each study participant by four skilled laboratory technologists (BSc).

Blood sample: After receiving the study participants' signed agreement, a laboratory expert took a sample of 3ml of venous blood and transferred into tubes aseptically. Unique identification numbers were written on the labels of the blood samples. The participants' blood samples were centrifuged for at least 10 minutes at a speed of 5000 rpm. Each serum sample was tested using the HBsAg and anti-HCV antibody rapid test kit.

Data quality assurance: The questionnaire was written in English, translated into Amharic, and then returned to English. Two weeks before the actual data collection, a pre-test on 5% of the sample size was conducted in Areka town. The gathering of the data was strictly supervised, and it was daily reviewed for accuracy, consistency, and completeness.

During the collection and preservation of blood samples, standardized protocols were rigorously

adhered to. In addition, it was verified that the equipment used to take blood samples was functional and unexpired (alcohol, cotton, blood collection tube, and syringe). The functionality of the kits was confirmed using a sample from Wolaita Sodo Comprehensive Specialized Hospital that was known to be HBsAg and HCV positive.

Data management and analysis: The collected data was coded and checked for consistency and completeness up to the end of each data collection period. Epi-data software version 3.2.0 was used for data entry and the entered data were exported to SPSS version 25 for windows for analysis. Descriptive statistics of numeric variables were presented in medians with Interquartile Range (IQR) and categorical variables were presented using frequency and percentages.

The bivariate analysis was done to check the existence of crude association and to select candidate variables, those variables which are clinically important and have ($P < 0.25$) were included in the final model. The summary measures of the estimated crude (COR) and adjusted odds ratios (AOR) with a 95% confidence interval were presented and P-value less than 0.05 were used to declare statistical significance and the goodness of fit of the model was assessed by using Hosmer and Lemeshow goodness of fit test.

Results

A total of 770 willing volunteers agreed to take part in the study. They were all subjected to the analysis and provided both questionnaire answers and blood samples.

Table 1: Socio-demographic characteristics of study participants in Wolaita Zone, Southern Ethiopia, December to January 2021/2022 (N=770)

Participant profile	Categories	Frequency	Percentage
Age, median(IQR), years		32(25,45)	
Age	18-24	143	18.6
	25-34	265	34.4
	35-44	144	18.7
	≥ 45	218	28.3
Gender	Male	305	39.6
	Female	465	60.4
Place of residence	Urban	302	39.2
	Rural	468	60.8
Level of education	Unable to read and write	183	23.8
	Primary (1-8)	193	25.1
	High school (9-12)	205	26.6
	Collage and above	189	24.5
Occupation	Civil servant	135	17.5
	Farmer	100	13.5
	Daily laborer	45	5.8
	Housewife	262	34.0
	Self-employer	140	18.2
	Student	88	11.4
Marital status	Single	158	20.5
	Married	559	72.6
	Widowed	41	5.3
	Divorced	12	1.6
Number of family size	<2	136	17.7
	2-3	184	23.9
	4-5	242	31.4
	>5	208	27.0
Monthly income	<500 ETB	60	7.8
	501-1000 ETB	169	21.9
	1001-2000 ETB	251	32.6
	≥ 2001 ETB	290	37.7

Abbreviation: ETB= Ethiopian birr

Socio-demographic characteristics of study participants: The median age of respondents was 32 years, with an IQR (25, 45) years, and 467 (60.6%) of the participants were female. The majority of study participants, 262 (34%) were housewives followed by 140 (18.2%) self-employed individuals. Rural residents made up 468 (60.8%) study participants and 559 (72.6%) study participants were married. In terms of education, 183 women (23.8%) were unable to read and write (Table 1).

Clinical and behavioral characteristics of study participants: Out of all study participants, only 32 (4.2%) had had an HBV vaccination and 25.7% of the study participants had a history of hospital admissions. Among 465 female study participants, 53 (11.4%) have previously had an abortion and 27 participants reported having a self-reported chronic illness. Out of 27 study participants with chronic illnesses, 18 (66.7%) had diabetes mellitus and 8 (29.6%) had HIV (Table 2).

Table 2: Clinical and behavioral characteristics of study participants in Wolaita Zone, Southern Ethiopia, December to January 2021/2022 (N=770)

Variables	Responses	
	Yes (%)	No (%)
Multiple sexual partner	55 (7.1)	715 (92.9)
Sharing sharp materials	71 (9.2)	699 (90.8)
Blood transfusion	39 (5.1)	731 (94.9)
Tooth extraction	179 (23.2)	591 (76.8)
blood contact with bear hand	69 (9.0)	701 (91.0)
needle stick injury	185 (24.0)	585 (76.0)
Abortion	53 (11.4)	412 (88.6)
Hospital admission	197 (25.6)	573 (74.4)
Circumcision	740 (96.1)	30 (3.9)
Tattooing on the body	71 (9.2)	699 (90.8)
Contact with jaundice patient	77 (10.0)	693 (90.0)
Frequent alcohol consumption	79 (10.3)	699 (90.8)
Unprotected sex	14 (1.8)	756 (98.2)
Uvulectomy	406 (52.7)	364 (47.3)
HBV vaccination	4 (0.52)	766 (99.5)
self-reported comorbidities	27 (3.5)	743 (96.5)
HIV	8 (1.0)	762 (99)
Diabetes Miletus	18 (2.3)	752 (97.7)
Cancer	0 (0)	770 (100)
Heart disease	1 (0.1)	769 (99.9)
Ear- piercing	397 (51.6)	373 (48.4)
Intravenous medication	288 (37.4)	482 (62.6)

Abbreviation: HBV= hepatitis B virus, HIV= human immune deficiency virus

Prevalence of HBV and HCV infection: From a total of 770 study participants, 58 (7.5%) and 3 (0.4%), respectively, tested positive for HBsAg and anti-HCV antibodies. In laboratory tests, the remaining 726 (92.7%) and 797 (99.6%) were negative for HBsAg and anti-HCV antibodies, respectively. There were no HBV and HCV co-infections among the study participants (Figure 1 and Figure 2).

Risk Factors of Hepatitis B Virus and Hepatitis C Virus Infection: After controlling for potential confounders with multivariable logistic regression analysis, no significant associations were found between the place of residence, history of unprotected sex, history of tattooing, history of blood transfusion,

history of hospital admission, needle stick injury, and blood transfusion with both HBV and HCV. Women with an abortion history were three times more likely to be affected than women who had never had an abortion (AOR=3.2; 95% CI 1.18-8.66), having multiple sexual partners is approximately five times more likely to affect than not having multiple sexual partners (AOR=4.86; 95% CI 1.61-14.64). A person who had a surgical procedure was approximately three times more likely to be affected than someone who had no history of surgical procedure (AOR=2.73; 95% CI 1.05-7.09) and people with chronic illnesses are eight times more likely to be affected than people who do not have chronic illnesses (AOR= 8.56; 95 CI 2.52-29.04) (Table 3).

Table 3: Bivariable and multivariable logistic analysis for factors associated with HBV among study participants in Wolaita Zone, Southern Ethiopia 2022 (N=770)

Variables		HBV infection		COR	P-value	AOR (95% CI)	P-value
		Positive (58)	Negative (712)				
Place of residence	urban	29 (50%)	273 (38.3%)	1.60	0.08	1.66 (0.73,3.76) Reference group	0.21
	rural	29 (50%)	439 (61.7%)				
Needle stick injury	Yes	23 (39.7)	162 (22.8)	2.23	0.005	0.99 (0.41, 2.40) Reference group	0.99
	No	35 (60.3)	550 (77.2)				
Contact with jaundice patient	Yes	22 (37.9)	55 (7.7)	7.30	0.000	9.49 (3.85, 23.39) Reference group	0.00*
	No	36 (62.1)	657 (92.3)				
alcohol consumption	Yes	15 (25.9)	64 (9.0)	7.36	0.000	3.15 (1.03, 9.59) Reference group	0.04*
	No	43 (74.1)	648 (91.0)				
Surgical procedure	Yes	12 (20.7)	57 (8.0)	3.53	0.002	2.73 (1.05,7.09) Reference group	0.03*
	No	46 (79.3)	655 (92.0)				
Chronic illness	Yes	10 (17.2)	17 (2.4)	8.51	0.000	8.56 (2.52, 29.04) Reference group	0.00*
	No	48 (82.8)	695 (97.6)				
Multiple sexual partner	Yes	11 (19%)	50 (7%)	3.09	0.002	3.02 (1.18, 14.64) Reference group	0.005*
	No	47 (81%)	662 (93%)				
Blood transfusion	Yes	6 (10.3)	33 (4.6)	2.37	0.06	1.34 (0.26,6.76) Reference group	0.72
	No	52 (89.7)	679 (95.4)				
Abortion	yes	8 (23.5%)	45 (10.4%)	2.63	0.02	3.29 (1.18,8.66) Reference group	0.02*
	No	26(76.5%)	386 (89.6%)				
Tattooing	yes	9 (15.5%)	62 (8.7%)	1.92	0.09	0.90 (0.28,2.89) Reference group	0.87
	No	49(84.5%)	650 (91.3%)				
Hospital admission	Yes	22(37.9%)	175 (24.6%)	1.87	0.03	0.96 (0.40, 2.31) Reference group	0.93
	No	36(62.1%)	537 (75.4%)				
Unprotected sex	Yes	5 (8.6%)	9 (1.3%)	7.36	0.001	4.66 (0.62, 35.05) Reference group	0.13
	No	53 (91.4%)	703 (98.7%)				

A person who had a history of alcohol consumption, on the other hand, was three times more likely to be affected than a person who had no history of alcohol consumption (AOR= 3.15; 95% CI 1.03-9.59). A person who came into contact with a jaundiced patient was nine times more likely to be affected than a person who did not come into contact with a jaundiced patient (AOR= 9.49, 95% CI (3.85, 23.39).

Discussion

The overall prevalence of HBV and HCV infection among adults in the community was 7.5% (95% CI 5.8-9.6) and 0.4% (95% CI 0.1-1.1), respectively.

There were no HBV and HCV co-infections among the study participants. This indicates intermediate HBV endemicity, according to the WHO classification (CDC 2020). The observed seroprevalence was nearly identical to the study conducted in Gambella and South Omo, Ethiopia, where it was 7.2% and 7.3%, respectively (Woldegiorgis et al. 2019; Ayele et al. 2020).

In this study, the prevalence of HBV infection was found to be higher than the previous national pooled prevalence of 6% North West Ethiopia (Yazie and Tebeje 2019; Zenebe et al. 2014). However, there was difference between these studies. The greatest

disparities could be attributed to the use of different generations of test kits with varying sensitivity and specificity, as well as differences in study design, population, occupations, and geographical factors. The finding was lower than that of previous studies among chronic patients in Addis Ababa and Oromia, Ethiopia, where seroprevalence was 35.8% and 10.9%, respectively (Ayele and Gebre-Selassie 2013; Betela et al. 2018). This variation could be attributed to differences in sample size, study period, study population, and study area. The overall seroprevalence of HCV in the study area was 0.4%. According to WHO criteria, this anti-HCV seroprevalence is classified as low endemicity (Lavanchy 2004; Te HS and Jensen 2010; WHO 2016). This finding is consistent with studies conducted in Bahir Dar (0.6%) and Southwest Ethiopia (0.42%) (Shiferaw et al. 2019; Hebo et al. 2019). On the other hand, the seroprevalence of anti-HCV reported in our study was lower than the pooled national prevalence of Ethiopia (Deress et al. 2021) and 7.5% of diabetes mellitus patients in a study conducted in Gondar, Ethiopia (Million et al. 2019). This could be attributed to differences in study period, design, and population.

All sociodemographic factors in this investigation failed to reach statistical significance. According to the multivariate analysis, having numerous sexual partners, a history of abortion, a history of surgery, a chronic illness, and a history of alcohol use are all independently linked to the presence of HBV serological markers (HBsAg) exposure status. The results of this study showed that participants were nine times more likely to test positive for HBsAg than their peers if they had contact with a jaundiced person.

The results of a line study carried out in Southwest, Northwest, and Southern Ethiopia revealed that study participants who had previously interacted with jaundiced patients were roughly twenty-one times, five times, and two times more likely to have HBV infection, respectively, than study participants who had not (Belay et al. 2020; Beykaso et al. 2021; Molla 2015). It might have happened as a result of family members spreading HBV to one another through the sharing of various personal and household items that were contaminated with the virus.

The chance of testing positive for HBsAg was around three times higher in participants with a history of alcohol use than it was in participants who did not. The results matched those of a study done in Southern, Oromia, and Northwest Ethiopia, which found that alcohol drinkers had nearly triple and twofold probability of testing positive for HBsAg, respectively (Beykaso et al. 2021; Betela et al. 2018; Asemahagn 2020). The connection between alcohol consumption

and HBV infection may be because alcohol can result in unprotected intercourse, which is one method of HBV virus transmission.

The results of this study showed that compared to their non-surgical counterparts, participants who underwent surgery had a roughly threefold increased risk of contracting HBV. The finding was in line with a study conducted in Northwest Ethiopia (Zenebe et al. 2014). It may be due to non-compliance with an aseptic technique like cross-contamination of medical equipment and devices like inadequately sterilized medical instruments.

Participants who had more than one sexual partner were five times greater chance of contracting HBV than their contemporaries. The results were comparable to those of a study carried out in Northwest Ethiopia (Asemahagn 2020). It might be because individuals who had several sexual partners were more likely than those who had a single partner to contract HBV through unprotected sex with various partners. Those with chronic illnesses had an almost nine-fold increased risk of HBV infection compared to healthy individuals. The results were comparable to those of a study carried out in Gondar town, Ethiopia (Feleke et al. 2020). This might be because chronic disorders require more care, which puts more strain on the liver and damages the liver cells more severely.

Conclusions and recommendation

According to this study, hepatitis C virus infection in adults is only mildly endemic in the community, but hepatitis B virus infection is intermediately endemic. The high HBV infection rate is caused by modifiable risk factors such as alcohol use, having several sexual partners, and coming into contact with someone who is jaundiced. These modifiable factors must be taken into account in behavioral education and communication programs intended to lower HBV infection. Additionally, a population-based screening policy, hepatitis treatment, integration with other health services, and raising awareness of the infection in the research area warranted to be carried out. Additional research should be conducted using more advanced diagnostic techniques such as ELISA and molecular HBV-Deoxyribonucleic acid testing.

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Data availability statement: The datasets generated and analyzed during the current study are available from the corresponding author at a reasonable request.

Ethics approval and consent to participate: The Institutional Health Research Ethics Review Committee (IHRERC) of Siloam Health Science College granted ethical permission. Each participant provided their written informed consent before the data collection process began. The study was carried out following the 1964 Helsinki Declaration, and all patient data was held anonymously.

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