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Seroprevalence of Hepatitis B Virus Infection among people Living with HIV Attending at the Dangila Health Center, Northwest Ethiopia

***Bogale Desta*[1], *Abaineh Munshia*[1, 2], *Desalegn Adisu* [2, 3], *Alemayehu Abate*[4*]**

[1] *Biology Department, Bahir Dar University, P.O. Box 79, Bahir Dar, Ethiopia*

[2] *Biotechnology Division, Institute of Biotechnology, Bahir Dar University, P.O. Box 79, Bahir Dar, Ethiopia*

[3] *Faculty of Chemical and Food Engineering, Bahir Dar Institute of Technology, Bahir Dar University, P.O. Box 26, Bahir Dar, Ethiopia*

[4] *Research Development Directorate, Amhara Public Health Institute, Bahir Dar P.O. Box 477*

***Correspondence:** alexu2love@gmail.com*

ABSTRACT

Background: Hepatitis B virus (HBV) co-infection remains a significant cause of liver-related morbidity and mortality among people living with HIV/AIDS. Shared transmission routes increase the risk of co-infection, and HIV accelerates the progression of HBV-related liver disease despite widespread antiretroviral therapy (ART). However, there is limited up-to-date evidence on the seroprevalence and associated factors of HBV among HIV patients in the study area.

Objective: To assess the seroprevalence of HBV infection and identify associated risk factors among adults living with HIV attending at the Dangila Health Center, Northwest Ethiopia.

Methods: An institution-based cross-sectional study was conducted from June to August 2020 among 384 HIV-positive adults. Socio-demographic, behavioral, and clinical data were collected using a structured questionnaire and medical record review. Serum samples were tested for hepatitis B surface antigen (HBsAg) and anti-HCV antibodies using rapid test kits. Logistic regression analyses were performed to identify factors independently associated with HBV infection. A p-value <0.05 was considered statistically significant.

Results: The prevalence of HBV infection was 4.4% (17/384), indicating intermediate endemicity. No HCV infection was detected. In multivariate analysis, history of tooth extraction (AOR=3.17; 95% CI: 1.03–9.82), sexually transmitted diseases (AOR=3.53; 95% CI: 1.09–11.47), and multiple sexual partners (AOR=9.68; 95% CI: 2.45–38.24) were independently associated with HBV infection.

Conclusion: HBV co-infection remains a public health concern among HIV-positive individuals in this setting. Routine HBV screening, vaccination, and targeted behavioral interventions should be strengthened within HIV care programs.

Keywords: Hepatitis B, HIV, Co-infection, Risk factors, Ethiopia

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INTRODUCTION

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are hepatotropic viruses that infect liver cells and cause hepatitis, an inflammatory condition of the liver (1). The clinical spectrum of these infections ranges from asymptomatic carriage and acute self-limiting disease to fulminant hepatitis and chronic liver disease. Chronic HBV and HCV infections are major global public health problems due to their strong association with liver cirrhosis and hepatocellular carcinoma (HCC) (2). Globally, over 2 billion people have been infected with HBV, with approximately 360 million living with chronic infection and at increased risk of cirrhosis and HCC (3). In 2019, HBV caused an estimated 820,000 deaths (4). The prevalence of chronic HBV infection varies geographically, with high endemicity (>8%) in Africa, Asia, and the Western Pacific; intermediate prevalence (2–7%) in Southern and Eastern Europe; and low prevalence (<2%) in North America, Western Europe, and Australia (5).

HBV and HCV share common transmission routes, including exposure to infected blood, sexual contact, and use of contaminated instruments, which increases the likelihood of co-infection or superinfection (6). Individuals co-infected with HBV and HCV usually experience more severe liver disease and have a higher risk of HCC (7). Among people living with HIV/AIDS (PLWHA), HBV infection is a leading cause of non-AIDS-related morbidity and mortality (8).

In Ethiopia, hospital-based studies have reported that HBsAg prevalence among HIV-positive individuals ranges from 3.9% to 14% (9), while HIV/HCV co-infection rates in major urban centers vary from 1.3% to 18.9% (10). Despite the burden of HBV and HCV among PLWHA, routine HBV screening is not consistently implemented in many primary health-care settings, even though it is recommended in the national HIV care guidelines. Moreover, there is limited evidence on the prevalence and risk factors of HBV and HCV infections among HIV -positive individuals in this setting.

Therefore, this study aimed to determine the sero-prevalence of hepatitis B surface antigen (HBsAg) and anti-HCV antibodies and to identify risk factors associated with HBV and HCV infections among people living with HIV/AIDS attending Dangila Health Center, Awi Zone, Northwest Ethiopia.

MATERIAL AND METHODS

Study area

This study was conducted at Dangila Health Center. Dangila is a district in the Awi Zone of the Amhara National Regional State, located in northwestern Ethiopia. It is the largest of three towns within the Dangila District, with an estimated population of 53,225 in 2021 (11). The town's health care delivery system represents the first level of the district health system and includes one primary hospital (serving 60,000–100,000 people, including rural areas), one health center (serving 15,000–25,000 people), and ten satellite health posts (each serving 3,000–5,000 people).

Study design and period

A health institution-based cross-sectional study was conducted from June 2020 to August 2020 to determine the sero-prevalence of HBV and HCV infections and associated risk factors among HIV-positive individuals attending the ART clinic at Dangila Health Center, northwest Ethiopia.

Source and study population

All HIV-positive individuals who visited the ART clinic at Dangila Health Center during the study period constituted the source population. HIV-positive adults who met the inclusion criteria and provided informed consent were the study population.

Inclusion and exclusion criteria

Adults with HIV/AIDS aged ≥18 years and willing to provide a blood sample, were included. Individuals younger than 18 years or those who were severely ill were excluded.

Study variables

The independent variables included socio-demographic factors (age, sex, marital status, occupation, educational status, and income) and potential risk factors (history of unsafe injections, multiple sexual partners, blood transfusion, surgical procedures, ear piercing, tattooing, tooth extraction, sexually transmitted diseases, history of HBV vaccination, and liver disease). The dependent variables were the HBV and HCV infections.

Sample size and sampling technique

The sample size was determined using a single population proportion formula. As the prevalence of HBV and HCV in the study area was unknown, a prevalence of 50% was as-

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sumed. At a 95% confidence interval (Z = 1.96) and a 5% margin of error (d = 0.05), the calculated sample size was 384. After adding 10% to account for potential non-response, the final sample size was 422 participants.

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where:

□ = required sample size

□ = critical value at 5% level of significance (1.96)

□ = expected prevalence of HBV or HCV infection (assumed 50% due to lack of prior data)

□ = margin of error (0.05)

Data collection procedure

Questionnaire survey

Data on socio-demographic characteristics, lifestyle factors, sexual behavior, and potential clinical risk factors were collected using a pre-tested structured questionnaire. The questionnaire was administered by trained nurses working at Dangila Health Center. To ensure clarity and consistency, the tool was pretested on 5% of the sample (n = 21) among HIV-positive individuals who were not included in the main study.

Anthropometric measurements, ART status, and WHO clinical staging

HIV-related clinical data, including World Health Organization (WHO) clinical staging, CD4 T-cell counts, and antiretroviral therapy (ART) status, were retrieved from patients' medical records by trained nurses.

Anthropometric measurements were conducted following standard procedures. Body weight was measured using a calibrated beam balance to the nearest 0.1 kg, with participants wearing light clothing. Height was measured to the nearest 0.1 cm using a standard measuring scale, with participants standing erect, feet together, knees straight, and looking horizontally, without shoes. Both weight and height measurements were taken twice, and the mean values were used for analysis. Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Standard adult BMI categories were applied: underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥30.0).

Blood sample collection, serum separation, and storage

Three milliliters of venous blood were collected from the median cubital vein of each participant into a plain tube by a trained laboratory technologist. To prevent duplicate sampling, a mark was placed on each participant's follow-up card. Blood samples were allowed to clot at room temperature, and serum was separated by centrifugation. The serum was transferred to labeled Nunc tubes and transported to the Microbiology and Biomedical Sciences Laboratory, Biology Department, Bahir Dar University, in an icebox maintained at 2–8°C. Samples were tested within 48–72 hours. Standard procedures were strictly followed for collection, storage, and analysis.

Serological detection of hepatitis B surface antigen (HBsAg)

Serum samples were brought to room temperature prior to testing. HBsAg was qualitatively detected using the HBsAg Rapid Test Kit (CTK Biotech, Inc., San Diego, USA) with a reported sensitivity and specificity of 100%. The test is a lateral flow chromatographic immunoassay. The test cassette contains a conjugate pad with mouse anti-HBsAg antibody conjugated to colloidal gold and a nitrocellulose membrane with a test line (T) and control line (C).

When serum is added to the test device, any HBsAg present binds to the labeled antibody conjugates and subsequently captured at the test (T) line, forming a burgundy-colored line that indicates a positive result. The absence of the colored line at the T-line indicates a negative result. The control (C) line serves as an internal control; if the C-line does not develop, the test is invalid and must be repeated.

Serological detection of anti-hepatitis C antibody (anti-HCV)

Anti-HCV antibodies were detected using the HCV-Ab Plus Rapid Test Cassette (CTK Biotech, Inc., San Diego, USA), with a sensitivity of 98.7% and specificity of 99.6%. This is a double antigen lateral flow immunoassay. The conjugate pad contains recombinant HCV fusion antigen (core, NS3, NS4, NS5) conjugated with colloidal gold, and the membrane strip has a test line (T) coated with the same antigen and a control line (C).

When serum is applied, any anti-HCV antibody present binds to the conjugated antigens and are captured at the T-line, forming a burgundy-colored line indicates a positive result. Absence of the T-line indicates a negative result. The C-line serves as an internal control; tests with an absent C-line are considered invalid and must be repeated.

Quality control

To ensure reliable and accurate data, the questionnaire and laboratory materials were pre-tested before the data collection period. Interviews were conducted by trained personnel. Standard operating procedures (SOPs) were strictly followed for specimen collection and processing. The principal investigator supervised the data collection regularly, and 10% of samples were randomly selected and rechecked blindly to maintain quality control.

Data analysis and interpretation

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics were used to summarize the socio-demographic and clinical characteristics of study participants and the prevalence of HBsAg and anti-HCV antibodies. Associations between HBV infection and socio-demographic or clinical variables were initially assessed using the chi-square test.

Univariate logistic regression analysis was performed to estimate crude odds ratios (COR) for each potential risk factor. Variables with p-values <0.25 in univariate analysis were included in a multivariate logistic regression model to identify independent predictors of HBV infection. A p-value <0.05 was considered statistically significant in all analyses.

Ethical considerations

The study was approved by the Ethical Clearance Committee of the College of Science, Bahir Dar University (RCS/869/2020). A support letter was obtained for Dangila Health Center prior to data collection. Study participants were informed about the purpose and procedures of the study, and written informed consent was obtained before collecting blood samples. Personal information and laboratory results were kept confidential by assigning unique codes to each participant. Participation was voluntary, and participants were free to withdraw from the study at any time without any consequences.

RESULTS

Scio-demographic characteristics and Seroprevalence of HBV and HCV

Of the 422 HIV/AIDS patients initially recruited, 384 of them participated in the study, with a response rate of 91.0%. Majority of the participants, 246 (64.1%) were females. Participants' ages ranged from 18 to 73 years, with a median age of 35 years and a mean (±SD) of 35.9 ± 10.2 years. The largest age group was 31–40 years, comprising 152 participants (39.6%). Regarding marital status, 172 participants (44.8%) were married. About one-third of the participants were privately employed (147, 38.3%) and illiterate (122, 31.8%). Majority of the participants had a monthly income of less than 500 Ethiopian Birr (248, 64.6%). Among the 384 study participants, 17 individuals (4.4%) tested positive for hepatitis B surface antigen (HBsAg). All participants (100%) tested negative for hepatitis C virus (HCV) antibodies (**Table 1**).

Clinical, behavioral risk factors and seroprevalence of HBV

A total of 384 adults living with HIV/AIDS were screened to determine the seroprevalence of hepatitis B surface antigen (HBsAg) and its association with clinical and behavioral risk factors. Of the participants, 17 (4.4%) were positive for HBsAg, indicating HBV and HIV co-infection. The HBV and HIV co-infection was observed across all CD4 T-cell count categories, except those with severe immunosuppression (CD4 <200 cells/µL). The highest prevalence was observed in participants with CD4 counts of 200–349 cells/µL (9.84%), followed by those with ≥500 cells/µL (4.79%). Among ART-naïve individuals, 5.26% were HBsAg-positive compared to 4.28% of those on ART. A gradual increase in the HBsAg sero-positivity was observed in study participants with advancing WHO clinical stage: Stage I (3.94%), Stage II (5.33%), Stage III (5.88%), and Stage IV (7.69%). Co-infection rates were similar across BMI categories: underweight (4.55%), normal weight (4.59%), and overweight (2.94%) (**Table 2**).

Univariate and multivariate logistic regression analysis

In the univariate analysis, sex, educational status, monthly income, and occupational categories showed no statistical significance association with HBV infections ($p > 0.05$). Several behavioral and clinical factors showed significant associated with HBV infection in univariate analysis. Study participants with history of tattooing had approximately three times higher odds HBV infections (COR = 3.08; 95% CI: 1.13–8.38; p = 0.03). A history of tooth extraction was associated with nearly fourfold increased odds (COR = 3.97; 95% CI: 1.45–10.88; p = 0.01), Participants reporting a history of sexually transmitted diseases had about three times greater odds of infection (COR = 3.22; 95% CI: 1.08–9.61; p = 0.04). History of multiple sexual partners had more than sixfold increased odds (COR = 6.34; 95% CI: 1.87–21.50; p = 0.01).

Additionally, history of hospital admission was associated with approximately threefold higher odds of infection (COR = 3.09; 95% CI: 1.10–8.71; p = 0.03). In the final multivariate model, three of the factors remained independently associated with HBV infection (p < 0.05). Adults with a history of tooth extraction had over three times higher odds of HBV infection compared to those without such history (AOR = 3.17; 95% CI: 1.03–9.82; p = 0.04). Those with a history of STDs were 3.5 times more likely to be HBV-positive (AOR = 3.53; 95% CI: 1.09–11.47; p = 0.03). Notably, participants reporting multiple sexual exposures had nearly tenfold higher odds of HBV infection (AOR = 9.68; 95% CI: 2.45–38.24; p = 0.01) compared to those without such exposure **(Table 3).**

Table 1: Frequency distribution of socio-demographic variables and Sero-prevalence of HBV among HIV positive individuals attending Dangila Health Center from June 2020 to August 2020

Characteristics	Category	Frequency n (%)	Sero-prevalence of HBsAg	
			Positive n (%)	Negative n (%)
Sex	Male	138 (35.90)	8 (5.80)	130 (94.20)
	Female	246 (64.10)	9 (3.66)	237 (96.34)
Age category (Years)	18-30	77 (20.10)	2 (2.60)	75 (97.40)
	31-40	152 (39.60)	6 (3.95)	146 (96.05)
	41-50	97 (25.30)	3 (3.09)	94 (96.91)
	51-60	50 (13.00)	4 (8.00)	46 (92.00)
	>60	8 (2.10)	2 (25.00)	6 (75.00)
Marital status	Single	94 (24.50)	4 (4.26)	90 (95.74)
	Divorced	71(18.50)	3 (4.23)	68 (95.77)
	Widowed	47(12.20)	5 (10.64)	42 (89.36)
	Married	172 (44.80)	5 (2.91)	167 (97.09)
Occupational status	Housewives	102 (26.60)	8 (7.84)	94 (92.16)
	Private employed	147(38.30)	1(0.68)	146 (99.32)
	Self-employed	78(20.30)	5 (6.41)	73 (93.59)
	Govt. employed	57 (14.80)	3 (5.26)	54 (94.76)
Educational status	Illiterate	122 (31.80)	5 (4.10)	117 (95.90)
	Primary education	114 (29.70)	4 (3.51)	110 (96.49)
	Secondary education	102 (26.60)	5 (4.90)	97 (95.10)
	College education	46 (12.00)	3(6.52)	43 (93.48)
Monthly income in Ethiopian Birr (ETB)	< 500 ETB	248 (64.60)	11(4.44)	237 (95.55)
	500-1000 ETB	79 (20.60)	2 (2.53)	77 (77.47)
	>1000 ETB	57 (14.80)	4 (7.02)	53 (92.98)
Religion	Christian	344 (89.60)	13 (3.78)	331 (96.22)
	Muslim	40 (10.40)	4 (10.00)	36 (90.00)

Table 2: Frequency distribution of clinical data and potential risk factors of HBV among HIV positive individuals attending Dangila Health Center from June 2020 to August 2020

Variable	Categories	Total n (%)	Sero-prevalence of HBsAg	
			Positive n (%)	Negative n (%)
CD_4 T cell count/µl of blood	< 200	46 (12.00)	0 (0)	46 (100)
	200-349	61(15.90)	6 (9.84)	55 (90.16)
	350-499	110 (28.60)	3 (2.72)	107 (97.28)
	≥500	167 (43.50)	8 (4.79)	159 (95.21)
ART status	ART naïve	57 (14.80)	3 (5.26)	54 (94.74)
	On ART	327 (85.20)	14 (4.28)	313 (95.72)
HIV/AIDS stage	I	279 (72.70)	11(3.94)	268 (96.06)
	II	75 (19.50)	4 (5.33)	71 (94.66)
	III	17 (4.40)	1 (5.88)	16 (94.22)
	IV	13 (3.40)	1 (7.69)	12 (92.31)
BMI (kg/m^2)	< 18.5	132 (34.40)	6 (4.55)	126 (95.44)
	18.5-24.9	218 (56.80)	10(4.59)	208 (95.41)
	25-29.9	34 (8.80)	1 (2.94)	33 (97.06)
Unsafe injection	Yes	14 (3.60))	1(7.10)	13 (92.90%)
	No	370 (96.40)	16 (4.30)	354 (95.70)
Multiple sexual practice	Yes	21(5.50)	4 (19.00%)	17 (81.00%)
	No	363 (94.50)	13 (3.60%)	350 (96.40%)
Having pierced ears	Yes	38 (9.90)	4 (10.50%)	34 (89.50%)
	No	346 (90.10)	13 (3.80%)	333 (96.20%)
Tattoo on body	Yes	75 (19.50)	7 (9.30%)	68 (90.70%)
	No	309 (80.50)	10 (3.20%)	299 (96.80%)
Blood transfusion	Yes	23 (6.00)	1 (4.30%)	22 (95.70)
	No	361 (94.00)	16 (4.40%)	345 (95.60)
Tooth extraction	Yes	62 (16.10)	7(11.30%)	55(88.70%)
	No	322 (83.90)	10(3.10%)	312(96.90)
General surgery	Yes	17 (4.40)	2 (11.80%)	15(88.20)
	No	367 (95.60)	15 (4.10%)	352(95.90)
Liver disease	Yes	18 (4.70)	1 (5.60%)	17 (94.40)
	No	366 (95.30)	16 (4.40%)	350 (95.60)
HBV vaccination	Yes	0 (0.00%)	0 (0.00%)	0 (0.00%)
	No	384 (100)	17 (4.40)	367 (95.60)
STD	Yes	47 (12.20)	5 (10.60%)	42 (89.40%)
	No	337 (87.80)	12(3.60%)	325 (96.40%)
Sex without condom	Yes	13(3.40)	1 (7.70%)	12 (92.30%)
	No	371(96.60)	16 (4.30%)	355 (95.70%)
Hospital admission	Yes	61 (15.90)	6 (9.80%)	55 (90.20%)
	No	323 (84.10)	11(3.40%)	312 (96.60%)
Sharing needles	Yes	8 (2.10)	1 (12.50%)	7 (87.50%)
	No	376 (97.90)	16 (4.30%)	360 (95.70%)

Table 3: Univariate and multivariate logistic analysis of risk variables for sero-prevalence of HBsAg among HIV positive individuals attending Dangila Health Center from June to August 2020

Variable	Category	Prevalence of HBsAg		COR (95% CI; P-value)	AOR (95% CI; P-value)
		Positive N(%)	Negative N(%)		
Sex	Male	8 (5.80)	130 (94.20)	1.62 (0.61-4.30; 0.32)	
	Female	9 (3.66)	237 (96.34)	1:00	
Age (year)	18-30	2 (2.60)	75 (97.40)	1:00	
	31-40	6 (3.95)	146 (96.05)	0.65 (0.13-3.29; 0.60)	0.93(0.17-5.18; 0.93)
	41-50	3 (3.09)	94 (96.91)	0.84 (0.14-5.13; 0.85)	1.20(0.18-8.29; 0.85)
	51-60	4 (8.00)	46 (92.00)	0.31 (0.05-1.74; 0.18)	0.46(0.07-3.00; 0.41)
	>60	2 (25.00)	6 (75.00)	0.08 (0.01-0.67; 0.02)	0.18(0.02-1.89; 0.15)
Marital status	Single	4 (4.26)	90 (95.74)	0.67 (0.18-2.57; 0.56)	0.47(0.12-1.93; 0.30)
	Divorced	3 (4.23)	68 (95.77)	0.68 (0.16-2.92; 0.60)	0.75(0.16-3.45; 0.71)
	Widowed	5 (10.64)	42 (89.36)	0.25 (0.07-0.91; 0.04)	0.37(0.09-1.43; 0.15)
	Married	5 (2.91)	167 -(97.09)	1:00	
Occupational status	Housewives	8 (7.84)	94 (92.16)	0.65 (0.17-2.57; 0.54)	0.76(0.18-3.21;0.71)
	Privately employed	1 (0.68)	146 (99.32)	8.11 (0.83-79.67; 0.07)	7.92(0.78-80.99; 0.08)
	Self employed	5 (6.41)	73 (93.59)	0.81 (0.19-3.54; 0.78)	0.93(0.20-4.30; 0.92
	Govt. employed	3 (5.26)	54 (94.76)	1:00	
Educational status	Illiterate	5 (4.10)	117 (95.90)	1.63 (0.37-7.13; 0.51)	
	Primary education	4 (3.51)	110 (96.49)	1.92 (0.41-8.91; 0.41)	
	Secondary education	5 (4.90)	97 (95.10)	1.35(0.31-5.92; 0.69)	
	College education	3 (6.52)	43 (93.48)	1:00	
Monthly income in Ethiopian Birr (ETB)	< 500 ETB	11 (4.44)	237 (95.55)	1.63(0.50-5.31; 0.42)	
	500-1000 ETB	2 (2.53)	77 (77.47)	2.91(0.51-16.44; 0.23)	
	>1000 ETB	4 (7.02)	53 (92.98)	1:00	
Religion	Christian	13 (3.78)	331 (96.22)	2.83 (0.88-9.14; 0.82)	
	Muslim	4 (10.00)	36 (90.00)	1:00	
Unsafe injection	Yes	1 (7.10)	13 (92.90)	1.70 (0.21- 13.82; 0.62)	
	No	16 (4.30)	354 (95.70)	1:00	
Multiple sexual practice	Yes	4 (19.00)	17 (81.00)	6.34(1.87-21.50; 0.01)	9.68(2.45-38.24; 0.01*)
	No	13 (3.60)	350 (96.40)	1:00	1:00
Having pierced ears	Yes	4 (10.50)	34 (89.50)	3.01(0.93-9.76; 0.07)	3.09(0.80-11.98; 0.10)
	No	13 (3.80)	333 (96.20)	1:00	1:00
Tattoo on body	Yes	7 (9.30)	68 (90.70)	3.08 (1.13-8.38; 0.03)	2.59(0.83-8.08;0.09)
	No	10 (3.20)	299 (96.80)	1:00	1:00
Blood transfusion	Yes	1 (4.30)	22 (95.70)	0.98 (0.12-7.73;0.98)	
	No	16 (4 .40)	345 (95.60)	1:00	

*Key: COR (Crude odd ratio), AOR (Adjusted odd ratio), *P value <0.05 significant, 1:00 = reference value*

Cont'd…….

Variable	Category	Prevalence of HBsAg		COR (95% CI; P-value)	AOR (95% CI; P-value)
		Positive N(%)	Negative N(%)		
Tooth extraction	Yes	7 (11.30)	55 (88.70)	3.97 (1.45-10.88; 0.01)	3.17(1.03-9.82; 0.04*)
	No	10 (3.10)	312 (96.90)	1:00	1:00
General surgery	Yes	2 (11.80)	15 (88.20)	3.13 (0.66-14.94 ; 0.13)	1.85(0.27-12.57; 0.67)
	No	15 (4.10)	352 (95.90)	1:00	1:00
Liver disease	Yes	1 (5.60)	17 (94.40)	1.29 (0.16-10.28;0.81)	
	No	16 (4.40)	350 (95.60)	1:00	
HBV vaccination	Yes	0 (0.00)	0 (0.00)	NA	
	No	17 (4.40)	367 (95.60)		
STDs	Yes	5 (10.60)	42 (89.40)	3.22 (1.08-9.61; 0.04)	3.53(1.09-11.47; 0.03*)
	No	12 (3.60)	325 (96.40)	1:00	1:00
Sex without condom	Yes	1 (7.70)	12 (92.30)	1.85 (0.23-15.11;0.57)	
	No	16 (4.30)	355 (95.70)	1:00	
Hospital admission	Yes	6 (9.80)	55 (90.20)	3.09 (1.10-8.71; 0.03)	2.14(0.63-7.22; 0.22)
	No	11 (3.40)	312 (96.60)	1:00	1:00
Sharing needles	Yes	1 (12.50)	7 (87.5%)	3.21 (0.37-27.71;0.29)	
	No	16 (4.30)	360 (95.70)	1:00	
CD_4 T cell count/µl	< 200	0 (0)	46 (100)		
	200-349	6 (9.84)	55 (90.16)	2.17 (0.72-653;0.16)	
	350-499	3 (2.72)	107 (97.28)	0.55 (0.14-2.15;0.39)	
	≥500	8 (4.79)	159 (95.21)	1:00	
ART status	ART naïve	3 (5.26)	54 (94.74)	1.24 (0.35-4.67;0.74)	
	On ART	14 (4.28)	313 (95.72)	1:00	
HIV/AIDS stage	I	11 (3.94)	268 (96.06)	1:00	
	II	4 (5.33)	71 (94.66)	1.37 (0.42-4.44;0.60)	
	III	1 (5.88)	16 (94.22)	1.52 (0.19-12.54;0.69)	
	IV	1 (7.69)	12 (92.31)	2.03 (0.24-1704;0.50)	
BMI (kg/m^2)	< 18.5	6 (4.55)	126 (95.44)	1.10 (0.36-2.85; 0.91)	
	18.5-24.9	10 (4.59)	208 (95.41)	1:00	
	25-29.9	1 (2.94)	33 (97.06)	1.59 (0.20-12.80; 0.66)	

DISCUSSION

Since the introduction of highly active antiretroviral therapy (HAART), AIDS-related mortality has declined significantly, improving the quality of life for HIV-positive individuals. However, end-stage liver disease due to co-infection with hepatotropic viruses has emerged as a major cause of morbidity and mortality in this population (12). Co-infection with viral hepatitis also increases the risk of ART-related hepatotoxicity (13, 14). Globally, HBV/HIV or HCV/HIV co-infections result in substantially higher liver-related morbidity and mortality compared to HIV mono-infection, with approximately one-third of HIV-related deaths attributed to liver disease in the context of HBV/HCV co-infection (15, 16).

In this study, the prevalence of HBV/HIV co-infection was 4.4% and no HCV and HIV or HBV, HCV and HIV co-infections were detected. This prevalence aligns with the World Health Organization's classification of intermediate HBV endemicity (2–7%) (2) and is comparable to reports from China (4.9%) (17), the USA (4.5%) (18), Nepal (4.4%) (19), Uganda (4.1%) (20), and Addis Ababa, Ethiopia (3.9%) (21). It is lower than rates reported in Gondar, Ethiopia (10.9%) (22) and other countries, including Nigeria (30.4%) (23), Italy (15.4%) (24), Iran (14.5%) (25), Gambia (12.2%) (26), and Japan (11.9%) (27), but higher than in Tanzania (1.2%) (28) and Mali (1.13%) (29). The observed variations in the prevalence of HBV infection across the different nations and study settings may reflect differences in socio-economic conditions, healthcare access, living standards, and vaccination coverage.

Although not statistically significant the HBV and HIV co-infection was more common among males (5.8%) than females (3.7%). This observation is consistent with findings from Kenya and Nigeria (30–32). The higher prevalence in male participants may be due to higher exposure to horizontal HBV transmission routes and culturally accepted multiple sexual partnerships in sub-Saharan Africa (33, 34).

Age was significantly associated with HBV co-infection, with the highest prevalence observed among participants over 60 years (AOR = 0.08; 95% CI: 0.01–0.67), possibly reflecting chronic infection acquired earlier in life. Similar age-related trends have been reported in Brazil and Taiwan (35, 36), though contrasting findings exist from Kenya and Nigeria, where younger adults exhibited higher prevalence (37, 38). Although marital status was not significantly associated with HBV infection, widowed, single, and divorced participants had higher co-infection rates than married individuals, possibly due to increased sexual risk behaviors, consistent with findings United Kingdom (39). Occupational status was also significantly associated with HBV infection ($p = 0.04$), suggesting that varying exposure risks may be influenced by socio-cultural and behavioral factors (40, 41).

No significant association was observed between HBV co-infection and CD4+ T-cell counts, aligning with studies from Europe and Nigeria (42, 43). No HBsAg positivity was detected among participants with severe immunosuppression (CD4 <200 cells/μL), potentially reflecting reduced exposure or increased caution in this group, although other studies report higher HBV prevalence at lower CD4 counts (44–48).

Unsafe injection practices remain an important global risk factor for HBV transmission, particularly in resource-limited settings where reusing injection equipment is common (49). In this study, approximately 10% of participants with a history of unsafe injections tested positive for HBsAg, consistent with reports from Ethiopia and WHO data (50, 51).

Multivariate logistic regression identified three independent predictors of HBV infection: history of tooth extraction, sexually transmitted diseases (STDs), and multiple sexual partners. Traditional tooth extraction using unsterilized instruments is common in sub-Saharan Africa and represents a recognized HBV transmission route (52, 53). Participants with a history of tooth extraction had over threefold higher odds of HBV infection (AOR = 3.17; 95% CI: 1.03–9.82), consistent with previous Ethiopian studies (54), though findings are mixed in other reports (55, 56).

A history of STDs was associated with a 3.5-fold increased risk of HBV infection (AOR = 3.53; 95% CI: 1.09–11.47), supporting evidence that ulcerative STDs and gonorrhea facilitate HBV transmission (57–59). Notably, participants reporting multiple sexual exposures had nearly tenfold higher odds of HBV infection (AOR = 9.68; 95% CI: 2.45–38.24), reinforcing the importance of sexual transmission as a key route in HIV-infected populations (60, 61).

CONCLUSIONS

This study demonstrated an intermediate prevalence of HBV and HIV co-infection. Tooth extraction, multiple sexual partners, and STDs were identified as independent predictors of HBV infection in HIV patients. These findings emphasize the continuing role of sexual transmission and unsafe traditional medical practices in HBV spread among HIV-positive populations. Given the increased risk of liver-related complications and ART-associated hepatotoxicity among co-infected individuals, routine HBV screening and timely linkage to care are essential. Public health interventions should include community awareness campaigns, promotion of safer sexual practices, discouragement of unsafe traditional medical procedures, and expansion of HBV vaccination among high-risk groups, particularly people living with HIV.

Data availability: All data supporting the findings of this study are included within the article.

Conflicts of interests

The authors declare no conflicts of interest.

Authors' contributions

AM, BD, AA, and DA contributed to study conception, experimental design, data interpretation, and critical manuscript review. BD and AA collected samples and relevant data, performed laboratory work, and drafted the manuscript. All authors read and approved the final manuscript.

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