



## Original Research

## Hepatitis B Virus Infection and Its Associated Factors Among Pregnant Mothers Attending Antenatal Care in Dire Dawa, Eastern Ethiopia: Overlooked Public Health Problem

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### Abstract

**Background:** Hepatitis B virus (HBV) infection poses significant health risks, particularly among vulnerable populations such as pregnant women. This study aimed to assess the prevalence of HBV infection and its associated factors among pregnant mothers attending antenatal care in Dire Dawa, Eastern Ethiopia.

**Methods:** A facility-based cross-sectional study was conducted in Dire Dawa from September 1 to October 30, 2023, involving 362 pregnant women selected through systematic random sampling from public and private hospitals. Data were gathered using structured questionnaires and analyzed using SPSS version 26. Bivariable and multivariable logistic regression analyses were employed to identify factors associated with HBV infection, with a significance level set at  $P < 0.05$  and a 95% confidence interval.

**Results:** The overall prevalence of HBV infection among the study population was found to be 6.9% (95% CI = 4.90-7.96). Factors significantly associated with HBV infection included educational status (AOR = 6.59; 95% CI = 1.49-28.27), history of previous delivery at a health facility (AOR = 0.15; 95% CI = 0.027-0.85), and being HIV positive (AOR = 13.6; 95% CI = 1.104-167.3).

**Conclusion:** The prevalence of HBV infection among pregnant women in Dire Dawa is notable, highlighting the need for targeted interventions, particularly focusing on education and screening for at-risk populations. Enhanced awareness and preventive measures are essential to mitigate the transmission of HBV in this vulnerable group.

**Keywords:** Hepatitis B, Pregnant Mothers, East Ethiopia, Dire Dawa

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## 1. Introduction

The term "Hepatitis" is a combination of the Greek words "hepatos" (liver) and "itis" (inflammation), representing a liver disease typically caused by viral infections [1]. Viral hepatitis is caused by five different types of hepatitis viruses (A-E) [2]. One of these viruses, Hepatitis B virus (HBV), belongs to the Hepadnaviridae family and is an enveloped, partially double-stranded DNA virus [1].

Hepatitis B is an infection caused by the enveloped DNA virus HBV, which affects the liver and can lead to complications such as cirrhosis and Hepatocellular Carcinoma (HCC) [2]. The incubation period for HBV ranges from 45 days to 6 months. Approximately 10% of children and 30-50% of adults with acute infection are clinically diagnosed, presenting symptoms such as anorexia, vague abdominal discomfort, nausea, vomiting, arthralgia, rash, and jaundice [3].

Transmission of HBV primarily occurs through exposure to infected blood and bodily fluids such as saliva, vaginal and seminal fluids, percutaneously or at the mucosal level. This can happen through mother-to-child transmission, unprotected sexual intercourse, accidental injection of infected blood or fluid during medical procedures, use of poorly sterilized needles and syringes, drug abuse, tattooing, acupuncture, and body piercing [4]. In cases of maternal transmission, HBV can be passed through trans-placental transmission during pregnancy, natal transmission during delivery, or postnatal transmission during infant care or breastfeeding. Vertical transmission rates are up to 10% and 80–90% in neonates when infection occurs in the first and third trimester, respectively [5].

Mother-to-child transmission (MTCT) accounts for more than half of chronic HBV infections worldwide, despite existing immunoprophylaxis regimens. Children born to hepatitis B surface antigen-positive (HBsAg+) and hepatitis B envelope antigen-positive (HBeAg+) mothers have a 70-90% chance of prenatal acquisition of HBV infection, with 85-90% becoming chronic carriers. Additionally, viral hepatitis during pregnancy poses a high risk of maternal complications and mortality [6]. The World Health Organization's guidelines for preventing, caring for, and treating chronic hepatitis B infection do not currently recommend additional antiviral therapy to prevent mother-to-child HBV transmission due to limited evidence and ongoing trials [5].

The World Health Organization (WHO) has identified Ethiopia as a country with intermediate to hyper-endemic viral hepatitis infections, but it lacks a national strategy for the surveillance,

prevention, and control of viral hepatitis. [7, 8]. In 2007, Ethiopia updated its immunization policy to include childhood immunization against Hepatitis B virus (HBV) in a pentavalent form at 6, 10, and 14 weeks after birth [9]. However, despite recommendations for antenatal screening for HBsAg in pregnant women and vaccination of their babies at birth, these practices are not routine in most health settings in Ethiopia [3, 10].

HBV infection is a significant public health issue in Ethiopia, with an estimated 360 million people affected globally [11]. The majority of individuals acquire the infection during the perinatal period and early childhood, with a high risk of becoming chronic carriers and facing complications such as liver cirrhosis and hepatocellular carcinoma [12]. Although the Global Health Sector Strategy on viral hepatitis aims to eliminate viral hepatitis as a public health threat by 2030, progress towards this goal has been slow, particularly in sub-Saharan Africa where the burden of hepatitis B is high [5, 1]).

Globally, there are numerous initiatives aimed at preventing the transmission of hepatitis B virus from mother to child, including the implementation of antiviral prophylaxis guidelines during pregnancy and studies examining the prevalence and determinants of the infection in various settings. Despite these efforts, HBV infection remains a persistent public health concern [16, 1]). In Ethiopia, there is a lack of comprehensive data on the prevalence and associated factors of HBV infection among pregnant women, particularly in Dire Dawa [14]. This study seeks to address this gap by providing data to support the need for additional measures to prevent hepatitis B virus transmission from mother to child throughout Ethiopia.

The prevalence and associated factors of HBV infection among pregnant women in Ethiopia have been found to vary across different studies [10, 15]. Therefore, conducting research in diverse settings is essential to accurately assess the magnitude of the issue and make well-informed decisions. The current status of HBV infection among pregnant women in Dire Dawa is not well-documented, and local information about the associated factors of the infection is outdated. Consequently, this study aims to evaluate the prevalence and associated factors of HBV infection among pregnant women receiving antenatal care services at both public and private hospitals in Dire Dawa city administration, Ethiopia.

## 2. Methods

### 2.1. Study design, setting and period

A health facility-based cross-sectional study was carried out from September 1st to October 30th, 2023 in both public and private hospitals within the Dire Dawa City Administration. Established in 1902, Dire Dawa is located in the eastern part of Ethiopia, approximately 515 km from Addis Ababa, with coordinates of 9°36'N 41°52'E. It is situated 311 km west of Djibouti and 55 km from Harari town. The city is bordered by the Oromia regional state in the west, north, and south, and by the Somali regional state in the east. At present, the city covers an area of 644.9 square kilometers, with an altitude ranging from 960 to 1200 meters above sea level. Dire Dawa has a hot climate, with its primary economic activities revolving around industry and trade. The annual rainfall varies from 400ml to 1000ml, and the average annual temperature is 25.3°C. The total population of the Dire Dawa Administration stands at 521,000, with Dire Dawa city itself housing 333,000 residents distributed across nine urban kebeles. The city is equipped with a total of six hospitals, comprising two governmental and four private hospitals, along with 14 private clinics, 15 health centers, and 33 health posts [14].

### 2.2. Study Participants

The study's source population encompassed all pregnant women attending antenatal care at public and private hospitals within the Dire Dawa city administration, while the study population comprised randomly selected pregnant women receiving antenatal care during the data collection period.

### 2.3. Eligibility Criteria

Pregnant women who were attending antenatal clinics at public and private hospitals within the Dire Dawa city administration during the study period were included in this study. However, those referred from other listed hospitals during the data collection period, individuals making a second visit within the study period, and pregnant mothers who had been vaccinated against HBV were excluded from the study.

### 2.4. Sample Size Determination and Sampling Procedures

The sample size was determined using a single population proportion formula. And with considering the following assumptions; confidence interval 95% ( $\alpha=0.05$ ,  $Z_{1/2}=1.96$ ), with 3% marginal error ( $d$ ) and non-response rate 10% And  $P_1$  = Prevalence of hepatitis B surface antigen among pregnant women was 8.4% from the study conducted in Dire Dawa [20].

$q_1$  = complementary probability  $(1-p) = (1-0.084) = 0.916$ .

Then sample size (n) =  $(Z_{\alpha/2})^2 pq/d^2$

$n=1.96*1.96(0.084*0.916)/ (0.03)^2$

n=329

Considering the non-response rate, we add 10 %.

i.e.  $=n+10\%(n)$

$n=328+10\%$

n=362

Therefore, the final sample size for this study consisted of 362 pregnant mothers who had attended antenatal care in the hospitals.

The sampling technique employed was systematic random sampling. A two-month data from the previous year (the same months as the current data collection period) was extracted from the antenatal care follow-up registration log book at each of the six hospitals. According to the registration log book, the number of pregnant women who attended antenatal care at each hospital was as follows: Dilchora = 401, Sabian = 189, Delt = 101, Eftu = 98, ART = 81, and Bilal = 103, totaling 968 pregnant mothers as the source population. To determine the Kth interval for each hospital, the formula (source population / sample size) =  $(N / n)$  was used, resulting in a K-value of approximately 3 for all hospitals. The first pregnant woman was randomly selected using a lottery method, and then every third participant was interviewed until the sample size was reached.

## 2.5. Study Variables

The dependent variable was The outcome variable of the study is test result of pregnant women for HBV (positive/negative) (yes, no) and independent variables were Socio-demographic characteristics: like Age, sex, religion, residence, marital status of family, mother education level, mother's occupation, fathers education level, fathers occupation; Obstetric histories: like Gravidity, Parity, abortion, place of delivery, History of contraceptive use; Cultural/cosmetic practice like Ear piercing, Ethnic scar, Tattooing; Medical-Surgical history, History of Surgery, blood transfusion, Tooth extraction, HBV test result; Sexual history like Having history multiple sexual partner, STI.

## 2.6. Operational Definitions

**HBV positive:** those pregnant mothers whose HBsAg result is positive [5]

**HBV negative:** those pregnant mothers whose HBsAg result is negative [5]

**Seroprevalence:** The proportion of pregnant women with hepatitis B surface antigen positive status [1, 17].

### **2.7. Data Collection Tools and Procedures**

A pre-tested structured questionnaire was utilized to gather socio-demographic and other exposure variables from the study participants through face-to-face interviews and document reviews. The outcome variable was categorized into pregnant mothers with a positive HBV result and those with a negative HBV result. During the interviews, the first authors sought permission from hospital administrators to collect data. Respondents were briefed on the research's purpose and provided with essential health information regarding HBV. Subsequently, the mothers were interviewed, and at the conclusion of data collection, respondents were encouraged to provide honest responses, and gratitude was expressed.

### **2.8. Data Quality Control**

Before actual data collection, the questionnaire was adapted and assessed for reliability. Subsequently, it was translated into the three local languages of the city – Amharic, Afan Oromo, and Somali – by a language expert. Following this, the Amharic, Afan Oromo, and Somali versions were translated back into English by another language expert to verify consistency. Data collectors received brief orientations on the assessment tools, and a pretest was conducted on 5% of the sample size in public hospitals not included in the study site. The pretest results were not included in the final analysis. Investigators provided supervision during data collection to ensure accuracy and clarity. Incomplete data was not entered into Epi Info version 7.0, and data clean-up and cross-checking were conducted before analysis.

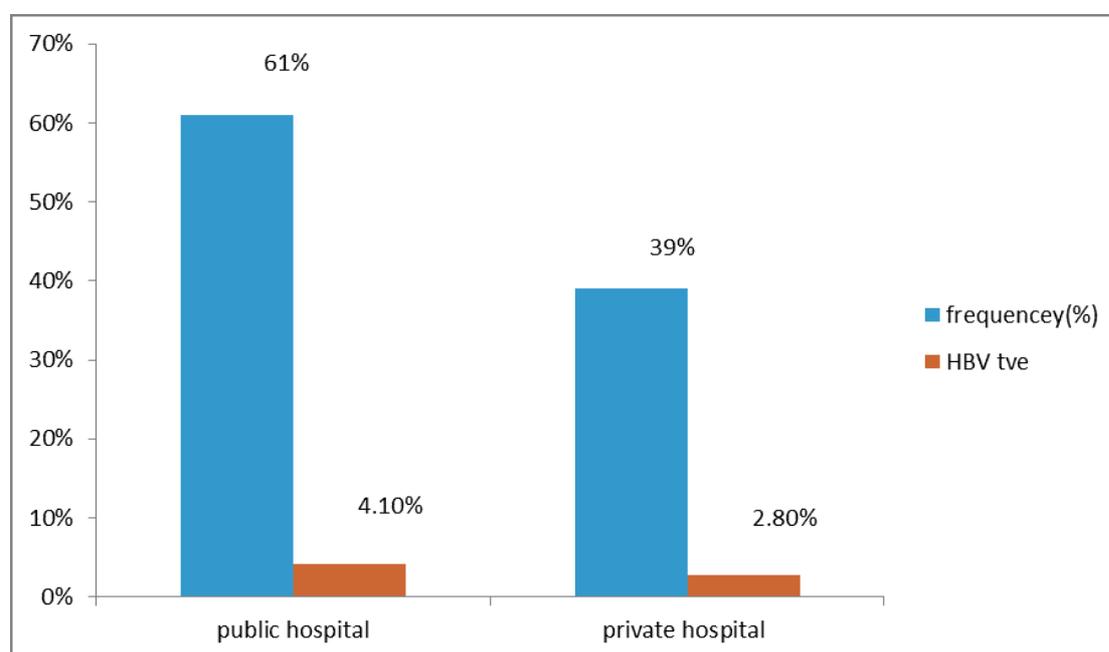
### **2.9. Data Processing and Analysis**

Data were coded, edited, and then entered and cleaned using Epi version 7 and exported to Statistical Package for Social Sciences (SPSS) software version 26. The association between independent factors and the outcome variable was determined by bivariable and multivariable logistic regression. Bivariable analysis was used to evaluate the association between the independent and the outcome variable. Variables with a p-value less than 0.25 in the bivariable logistic regression analysis were considered for multivariable analysis. After checking for multicollinearity, multivariable analyses were performed to adjust for confounders and to produce significant predictors. Odds ratios and their 95% Confidence Intervals were computed and Variables which had P value of  $< 0.05$  with 95%CI were used to express the statistical significance of the variables.

### 3. Results

#### 3.1. Baseline Socio Demographic Characteristics of Study Participants

The study involved a total of 362 pregnant women, resulting in a response rate of 100%. The average age of the participants was 30 years, with over half (51.7%) falling within the 20-30 years age group. Of the participants, 217 (59.9%) resided in urban areas, while the remainder lived in rural areas. The majority of the respondents (55.5%) identified as Muslim, and 41 (11.3%) reported being unable to read and write (Table 2). Additionally, the study found that the majority of respondents (69%) and approximately 60% of HBV-positive women were from public hospitals (Figure 1).



**Figure 1:** Distribution by facility type and association with HBV infection among ANC Attending pregnant mothers in public and private hospitals of Dire Dawa, 2023 (n=362).

Regarding age groups, HBV positivity rates for the 15-20-, 20-30-, and 30-40-year categories were 0%, 9%, and 12.5% respectively. However, the Pearson chi-square test did not show a statistically significant association for age category ( $\chi^2 = 2.235$ , p-value = 0.327). In terms of residence, 1.4% of urban dwellers tested positive for HBV, while 15% of rural dwellers were HBV positive. The Pearson chi-square test indicated a statistically significant association with residence ( $\chi^2 = 27.05$ , p-value = 0.000). The prevalence of HBV infection was 10.9% among Muslims and 3% among Orthodox religion followers. The Pearson chi-square test showed a statistically significant association with family size ( $\chi^2 = 12.22$ ; p-value = 0.02).

The study also revealed that HBV prevalence was higher among housewives (10%) compared to government employees and farmers (4% each). However, the Pearson chi-square test did not

show a statistically significant association with occupation ( $\chi^2 = 10.57$ ,  $p$ -value = 0.066). In terms of educational status, the positivity rate for HBV was 31.7% among those unable to read and write, and 7.9% among those who attended primary education. Chi-square test shows a statistically significant association with education status ( $\chi^2 = 48.7$ ;  $p$ -value = 0.00) (Table 1).

**Table 1:** Distribution of socio-demographic characteristics and HBV infection among ANC attending pregnant women in public and private in Dire Dawa eastern Ethiopia, 2023(n=362).

Variables	Response category	Frequency (%)	HBV, n (%)	$\chi^2$	$p$ -value
Age	15-20	26(7.2)	0	2.235	0.327
	20-30	187(51.7)	13 (9)		
	30-40	149 (41.2)	12 (12.5)		
Residence	Urban	217 (59.9)	3(1.4)	27.05	0.000
	Rural	145 (40.1)	12 (12.5)		
	Diploma & above	94(26.)	3(3.2)		
Educational Status	Secondary	126(34.8)	1(0.7)		
	Primary	101(27.9)	8(7.9)		
	not read and write	41(11.3)	13(31.7)		
Religion	Orthodox	96(26.5)	3(3)	10.57	0.060
	Muslim	201(55.5)	22(10.9)		
	Protestant	65(18)	0		
Occupation	House wife	189(52)	19(10)	48.7	0.00
	Gov't employee	74(20.4)	3(4)		
	Farmer	24(6.6)	3(4)		
	Merchant	56(15.5)	0		
	Student	13(3.6)	0		
	daily laborer	6(1.7)	0		
Facility type	Public	221(61)	15 (4.1)	0.012	0.97
	Private	141(39)	10(2.8)		

### 3.2. Medical and Surgical Characteristics

The majority of respondents (94.2%) reported no history of surgery other than cesarean section, and 96.6% of mothers tested negative for HIV. Most mothers also had no history of contact with a jaundiced patient, with 96.1% reporting no such contact, and 93.6% reporting no family history of hepatitis. Among those who had surgery other than cesarean section, all tested negative for HBV, while 7.3% of those who had not undergone surgery tested positive. The Pearson chi-square test did not show an association ( $\chi^2= 1.645$ ,  $p=0.198$ ). Regarding blood transfusion history, 4% of HBV-positive mothers had a history of blood transfusion, while 96% of those without such a history were HBV positive. The chi-square test did not show an association with blood transfusion ( $\chi^2= 0.52$ ,  $p=0.469$ ). Additionally, 24% of HBV-positive respondents were also positive for HIV, and the Pearson chi-square test showed an association with HBV ( $\chi^2= 32.38$ ,  $p=0.00$ ) (See table 2).

Among mothers with a history of hospitalization, 8% tested positive for HBV, while 99% of HBV-positive women reported no such history. The Pearson chi-square test showed an association ( $\chi^2= 5.06$ ,  $p=0.024$ ). Furthermore, 12% of HBV-positive women reported a history

of injection service, and the Pearson chi-square test was associated with ( $\chi^2= 4.29, p=0.038$ ). Lastly, among those who had contact with a jaundiced patient, 12% were positive for HBV, while 88% of those without such contact were positive for HBV. The Pearson chi-square test indicated an association ( $\chi^2= 4.77, p=0.029$ ) (Table 2).

**Table 2:** Distribution of Medical and surgical characteristics and HBV infection among ANC attending pregnant women in public and privates in Dire Dawa eastern Ethiopia, 2023(n=362)

Variables	Response category	Frequency (%)	HBV, n (%)	$\chi^2$	p-value
history surgery apart from Cs	Yes	21 (5.8)	0	1.645	0.198
	No	341 (94.2)	25(100)		
blood transfusion	Yes	28(7.7)	1 (4)	0.52	0.469
	No	334 (92.3)	24 (96)		
tooth extraction service	Yes	36 (9.9)	3 (12)	0.127	0.722
	No	326 (90.1)	22 (88)		
HIV test result	Positive	13(3.4)	6(24)	32.38	0.00
	Negative	349(96.6)	19(76)		
History of hospitalization	Yes	99(27.3)	2(8)	5.06	0.024
	No	263(72.7)	23(92)		
history of injection services	Yes	110(30.4)	3(12)	4.29	0.038
	No	252(69.6)	22(88)		
contact with jaundice patient	Yes	14(3.9)	3(12)	4.77	0.029
	No	348(96.1)	22(88)		
family history of hepatitis	Yes	23(6.4)	4(16)	4.20	0.04
	No	339(93.6)	21(84)		

### 3.3. Cultural and Related Practices

The prevalence of ear or nose piercing history among pregnant women was 91.7%. All pregnant women who tested positive for HBV had a history of ear or nose piercing. The study also revealed that 90% of pregnant women did not have any tattoos. Among the participants who had no history of ear/nose piercing, all tested negative for HBV, while 7.5% of HBV-positive pregnant mothers had a history of ear/nose piercing. The Pearson chi-square test did not show an association ( $\chi^2= 2.42, p=0.119$ ). Additionally, 8% of the participants had ethnic scars, accounting for 4% of HBV positivity, but the Pearson chi-square test did not show an association ( $\chi^2=0.58, p=0.44$ ). The majority (88%) of HBV-positive mothers had no tattoos, and the Pearson chi-square test did not show an association ( $\chi^2= 0.012, p=0.72$ ) (Table 3).

**Table 3:** Distribution of Medical and surgical characteristics and HBV infection among ANC attending pregnant women in public and privates in Dire Dawa eastern Ethiopia, 2023(n=362).

Variable	Response category	Frequency (%)	HBV, n (%)	$\chi^2$	p-value
Ear /nose piercing	Yes	332 (91.7)	25 (100)	2.427	0.119
	No	30 (8.3)	0		
Have Ethnic scar	Yes	29 (8)	1 (4)	0.586	0.444
	No	333(92)	24(96)		
Tattoo on your body	Yes	36(9.9)	3 (12)	0.127	0.722
	No	326 (90.1)	22 (88)		

### 3.4. Obstetric Characteristics

Among the HBV-positive mothers, none had a history of abortion, and 44% had delivered at home. Interestingly, the majority (92%) of HBV-positive patients had not undergone a cesarean section. Conversely, all 54 participants with a history of abortion tested negative for HBV. Statistical analysis did not reveal a significant association between abortion history and HBV status. Further analysis showed that 29.7% of those who had previously delivered at home were positive for HBV, compared to 5.3% of those who delivered at a health facility. Additionally, 3.4% of primigravida individuals or those without a prior delivery history tested positive for HBV. A significant association was found between the place of delivery and HBV infection status. Regarding previous cesarean section history, 4.2% of individuals delivered by c-section were HBV-positive, while 7.3% of those without a c-section history tested positive. However, statistical analysis did not indicate a significant association between cesarean section history and HBV status. (Table 4).

Table 4: Distribution of Obstetric characteristics and HBV infection among ANC attending pregnant women in public and privates in Dire Dawa eastern Ethiopia, 2023 (n=362).

Variable	Response category	Frequency (%)	HBV, n (%)	$\chi^2$	p-value
Abortion Hx	Yes	54 (14.19)	0	0.777	0.378
	No	308 (85.1)	25(100)		
Place of delivery	Health facility	186(51.4)	10 (40)	34.282	0.00
	Home	37(10.2)	11(44)		
	Both	52 (14.4)	1 (4)		
	Not delivered	87 (24)	3 (12)		
History of CS	Yes	48(13.3)	2(8)	0.64	0.422
	No	314 (86.7)	23 (92)		

### 3.5. Prevalence of HBV Infection Among ANC Attending Pregnant Mothers

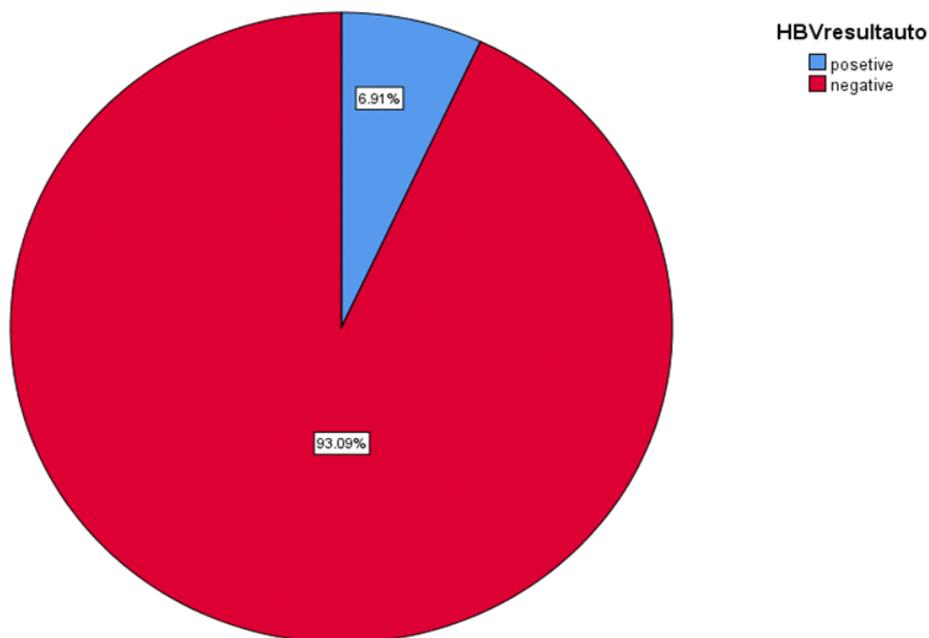
The current study involving 362 participants, it was observed that 25 individuals (6.9%) tested positive for HBV, with confidence interval of 95% ranging from 1.90% to 1.96%. The majority of the participants, specifically 337 (93.1%), were negative for HBV infection (Figure 2).

### 3.6. Factors Associated with HBV Infection in ANC Attended Pregnant Mothers

A total of 25 independent variables were assessed to determine their association with HBV status among pregnant women attending antenatal care. Each variable underwent bivariate analysis to identify statistically significant associations with the outcome of interest. Seven variables had a p-value of less than 0.25 and were selected for multivariable analysis.

In the bivariate analysis, residence, educational status, place of delivery, HIV status, history of hospitalization, history of injection services, and history of contact with a jaundiced person

showed a p-value of less than 0.25. Subsequently, in the multivariable analysis, three variables—educational status, place of delivery, and HIV status – had a p-value of less than 0.05 and were deemed statistically significant factors for HBV infection.



**Figure 2:** Prevalence of HBV infection among ANC attending pregnant mothers in public and private Hospitals in DD, eastern Ethiopia, 2023(n=362).

The study revealed that pregnant women who were unable to read and write were 6.5 times more likely to test positive for HBV compared to those with a Diploma or higher education [AOR=6.5; 95%CI=0.027-0.85], with a p-value of 0.012. Additionally, women who previously delivered at a health facility were 0.15 times more likely to be HBV positive compared to those who delivered at home [AOR=0.15; 95%CI=0.027-0.85], with a p-value of 0.03. Furthermore, HIV-positive status was found to be statistically significant in relation to HBV infection, with HIV-positive pregnant women being 13.6 times more likely to test positive for HBV compared to HIV-negative individuals [AOR=13.6; 95% CI=1.104-167.3], with a p<0.04 (Table 5).

**Table 5:** Regression analysis of factors associated with HBV infection among ANC attending pregnant mothers in public and private hospitals of Dire Dawa, 2023 (n=362).

Variable	Response category	HBV		95%CL	
		Yes	No	COR	AOR
Residence	Urban	3	217	1	1
	Rural	22	123	12.76(3.74-43.5)	2.7(.327-23.1)
Educational status	Diploma & above	3	91	1	1
	Secondary	1	125	3.2(0.76-13.8)	3.4(0.278-41.85)
	Primary	8	93	2305(00--)	11.8(0.6-217.3)
	Unable to Read & write	13	28	0.79(0.24-2.5)	6.59(1.49-28.27)
Place of delivery	Health facility	10	57	0.30(0.009-0.09)	0.153(0.027-0.85)
	Home	11	26	3671(00)	823(0.000)

	Both	1	51	1.90(0.18-17.3)	2.3(0.246-21.7)
	Not delivered	3	84	1	1
HIV test result	Positive	6	7	14.88(4.55-48.66)	13.6(1.104-167.3)
	Negative	19	330	1	1
Hx of hospitalization	Yes	2	97	0.21(0.5-0.93)	0.17(0.002-12.1)
	No	23	240	1	1
history of injection	Yes	3	107	0.29(0.08-1.00)	0.36(0.007-19.8)
	No	22	230	1	1
contact with jaundice	Yes	3	11	0.24(0.06-0.09)	0.17(0.002-12.1)
	No	22	326	1	1

#### 4. Discussion

The study found that the overall prevalence of HBV infection was 6.9% [95% CI: 4.90-7.96], which falls within the intermediate range. This result aligns with a study conducted at Deder hospital in eastern Ethiopia [30], but is lower than the national overall prevalence of the disease (7.4%), as well as lower than specific regional prevalence rates such as Dire Dawa (8.4%) [14], public hospitals of Wolaita Zone (7.3%) [27], North West Ethiopia (8.3%) [22], Gambella hospital (7.9%) [24], and Adigrat General Hospital (9.2%) [25]. However, it is higher than prevalence rates reported in other countries, including Nigeria (6.08%) [18], South Sudan (6.8%) [2], and Iran (0.59%) [20].

The variations in prevalence rates may be attributed to differences in sociodemographic characteristics of the study participants, geographical locations, implementation of health policies related to hepatitis prevention, cultural practices, sexual behaviors, as well as differences in sampling methods, sample sizes, and laboratory testing techniques used to detect HBsAg. Poor adherence to the national immunization program, known as the expanded program on immunization (EPI) in Ethiopia, could also contribute to these differences.

Educational status, previous place of delivery, and HIV status were identified as statistically significant factors associated with HBV infection among pregnant women in multivariate logistic regression analyses. The study revealed that 31.2% of illiterate, 7.9% of those who attended primary school, and 3.2% of pregnant mothers with a diploma and above were positive for HBV, while those with a secondary school education had the lowest rate of positivity. Pearson's chi-square test showed a statistically significant association between educational status and HBV infection, consistent with a study conducted in Iran [20]. This could be attributed to factors such as lack of awareness about transmission methods, sharing of sharp instruments, prevalence of traditional practices, limited access to screening, and healthcare facilities.

Residence was not found to be significantly associated with HBV status in this study, similar to findings from a study at public hospitals in Hararghe, Eastern Ethiopia [23], but in contrast to a study conducted in Iran where place of residence was identified as a contributing factor [20]. However, a higher prevalence of HBV infection was observed among individuals living in rural areas compared to urban areas, with 15% of rural dwellers testing positive for HBV compared to 1.4% of urban dwellers. Pearson's chi-square test did not show an association. The variation in study area, period, and sample size may explain these differences.

This lack of association may be due to factors such as limited awareness of transmission methods, sharing of sharp instruments, prevalence of traditional practices, and restricted access to screening and healthcare facilities. The place of delivery is a significant factor in HBV infection, as mothers delivered at a health facility were found to be 0.15 times less likely to test positive for HBV compared to those delivered at home. This suggests a higher likelihood of HBV positivity in home deliveries. This might be due to the fact that factors such as limited awareness of transmission methods, sharing of sharp instruments, prevalence of traditional practices, and restricted access to screening and healthcare facilities. However, a study conducted in public hospitals in Hararghe, Eastern Ethiopia did not find a significant association between place of delivery and HBV infection [23].

Among the HIV-positive pregnant mothers, 24% were also positive for HBV infection, which is lower than rates reported in studies conducted in Dire Dawa (47.1%) and Amhara National Regional State [26]. This indicates a shared route of transmission for HBV and HIV. Therefore, screening for HBV among HIV-positive pregnant women is crucial for the prevention of vertical transmission and the well-being of both the mother and child.

The study also demonstrated a significant association between HIV status and HBV infection, with a prevalence of HIV among pregnant mothers attending ANC services in the study area at 3.6%, which is lower than a previous study in the same area that reported a prevalence of 5.3% [14, 28]. Among the HIV-positive pregnant mothers, 24% were also positive for HBV infection, which is lower than rates reported in studies conducted in Dire Dawa (47.1%) [14] and in Amhara National Regional State [26]. This indicates a shared route of transmission for HBV and HIV. Therefore, screening for HBV among HIV-positive pregnant women is crucial for the prevention of vertical transmission and the well-being of both the mother and child.

The current study found that a previous history of hospitalization and receiving injection services was not linked to HBV positivity, which contrasts with findings from the Agena health center in South Ethiopia, where pregnant women with a history of hospitalization were 97% more likely to test positive for HBV [18, 30]. Similarly, a study in the West Oromia region indicated that a history of hospital admission was a significant factor [6]. This might be due to the likelihood of hospitalized women acquiring the infection during various procedures, unlike pregnant women without such a history.

Furthermore, in this study, a history of contact with jaundice was not significantly associated with HBV infection, contrary to studies conducted at Felege Hiwot Hospital [29] and Mizan-Tepi [21], which identified contact with jaundice patients as a major risk factor. Additionally, in Rubkona County, Niger States, South Sudan, having a history of jaundice was also identified as a risk factor [19]. These differences may be attributed to variations in behavioral and cultural practices among different populations. The factors associated with the study were evaluated through interviews, which may have introduced a recall bias. As the study was cross-sectional, it did not establish a definitive cause-and-effect relationship.

## 5. Conclusion

Maternal health is a fundamental concern for the global community. Efforts by global organizations such as the World Health Organization to uphold women's health are ongoing, but there is still a need for heightened attention. The prevalence of HBV infection among pregnant mothers attending antenatal care clinics in Dire Dawa public and private hospitals was categorized as intermediate according to the WHO classification, indicating that HBV is a significant public health issue in the study area. Factors such as educational status, mother's previous place of delivery, and HIV status were found to be associated with HBV virus infection. To reduce transmissions, it is recommended that the identified risk factors be addressed and that the government initiate HBV vaccination campaigns. Additionally, neonates born to HBV positive mothers should receive hepatitis B vaccine and immunoglobulin as soon as possible after birth, ideally within 72 hours, to minimize the risk of transmission from mother to child.

## Abbreviations

ANC: Antenatal Care, AOR: Adjusted Odds Ratio, CHB: Chronic Hepatitis B virus, DNA: Deoxyribonucleic acid, OR: Odds Ratio, CI: Confidence Interval, COR: Crude Odds Ratio, HbsAg: Hepatitis B surface Antigen, HBV: Hepatitis B Virus, HCC: Hepatocellular

Carcinoma, HIV: Human Immunodeficiency Virus, MTCT: Mother-To-Child Transmission, WHO: World Health Organization, STI: Sexual Transmitted Infection

### **Authors' 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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### **Competing interests**

The authors state that they have no competing interests

### **Funding**

Not applicable.

### **Ethical Approval and consent to participate**

In order to conduct this research, the authors tried to address the Declaration of Helsinki Ethical principles for medical research. Ethical clearance was obtained from the institutional review board (IRB) of Dire Dawa University before the start of the study. An official support letter was written to the selected Hospitals and permission for data collection was sought from the responsible authorities. Informed voluntary written and signed consent was obtained from all study participants, their parents and legally authorized representatives in this study. Finally, all collected information was coded and locked in an isolated room before entering the computer and locked by password after entering the computer. The confidentiality of the information was kept throughout the study process and the information was used only for the study purpose.

### **Consent for Publication**

Not Applicable.

### **Availability of Data and Materials**

Data will be available upon request from the corresponding author.

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