





Seroprevalence of Hepatitis B Virus and Associated Factors Among Pregnant Women Attending Antenatal Care in Public Health Facilities in Jigjiga Town, Eastern Ethiopia

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Background: Hepatitis B virus (HBV) remains a major global public health problem affecting millions of people across the world. The risk of developing a chronic hepatitis B virus infection is affected by the age at the time of acquiring infection. For instance, around 95% of these infections are acquired during the perinatal period. Although evidences indicate the wider effects of hepatitis B virus and its negative consequences, there are limited studies and a scarcity of data in Eastern Ethiopia. Therefore, this study was aimed at determining seroprevalence of HBV and associated factors among pregnant women attending antenatal care in the public health facilities of Jigjiga town, Eastern Ethiopia, from March 4 to April 4, 2019.

Methods: A facility-based cross-sectional study was employed among pregnant women in the public health facilities of Jigjiga town, Eastern Ethiopia. A total of 589 pregnant women were enrolled in the study using a systematic sampling technique. Data were collected using a pretested interviewer administered questionnaire. Five milliliters of venous blood samples was collected and tested for HBV using ELISA diagnostic test. The collected data were entered in to Epidata version 3.1 and exported to SPSS version 20 for statistical analysis. Descriptive statistics was carried out using frequency tables and summary measures. Multivariable analysis was done to identify the true effects of the selected predictor variables on the outcome variable after controlling for possible confounders. Statistical significance was declared at p-value <0.05.

Results: Overall, 8.5% (95% CI: 6.5–10.7) of the study participants were seropositive for HBsAg. Having any surgical history [AOR = 3.41, 95% CI (1.26–9.24)], family history of HBV [AOR = 4.96, 95% CI (2.11–10.60)], history of sharing sharps [AOR = 2.78, 95% CI (1.13–6.83)] and having multiple sexual partners [AOR = 6.12, 95% CI (2.12–17.64)] were significant predictors of HBV infection.

Conclusion: The seroprevalence of HBV was relatively high in this study area. Having a history of surgery, family history of hepatitis, history of sharing sharps and multiple sexual partners were significantly associated with HBV infection. Therefore, health information dissemination and awareness creation on mode of transmission of HBV are very crucial.

Keywords: HBV, associated factors, ANC, pregnancy, Eastern Ethiopia

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Introduction

Viral hepatitis is the principal cause of chronic liver disease, liver cirrhosis and hepatocellular carcinoma in the world.¹ There are five common causes of viral hepatitis out of which three can cause persistent infection and chronic hepatitis such

as hepatitis B virus (HBV), hepatitis C virus (HCV) and hepatitis D virus (HDV). The other two viruses such as hepatitis A and hepatitis E can cause acute, but self-limited disease.² Hepatitis B and C viruses are the top two most serious and fatal forms of chronic hepatitis which cause around 96% of hepatitis related deaths.³ Hepatitis B is a potentially life-threatening liver infection caused by the hepatitis B virus (HBV). It is a major global health problem that causes chronic infection and puts people at high risk of death from cirrhosis and liver cancer.⁴ HBV has three different antigens (HBsAg, HBeAg and HBcAg). Both HBsAg and HBeAg can be detected in the serum, while HBcAg can only be detected in the liver tissue of persons with acute or chronic HBV infection.⁵ Hepatitis B surface antigen is used to diagnose and monitor the progress of HBV infection while HBeAg is an indication of high HBV infectivity.¹

According to the estimates of the World Health Organization (WHO), viral hepatitis was considered as one of the public health challenges. In 2015 alone, approximately 1.34 million deaths and mortality from viral hepatitis are comparable to annual deaths caused by tuberculosis and higher than those caused by HIV and malaria.⁴ Globally, the prevalence of HBV infection in the general population is 3.5% and the geographical distribution of HBV is the highest in WHO western Pacific and Africa regions with a prevalence of 6.2% and 6.1% respectively.⁶

Worldwide, approximately 65 million women of reproductive age are infected with HBV and 9 in every 10 mothers with hepatitis B infection transmit the disease to their babies at or around the time of birth.^{3,4,7} Similarly, other study findings revealed that 90% of the neonates born to HBV infected mothers can develop chronic hepatitis B if they do not receive hepatitis B immune globulin and hepatitis B vaccine at the time of birth.¹ Researchers have also reported that the possibility of developing chronic hepatitis B infection among individuals who acquire the infection during the perinatal period was around 90%, but only 5% was reported in adulthood.⁸ Moreover, researchers have indicated HBV infected pregnant women are a potential source of infection for their sexual partners as well as for health care providers during labor and delivery.⁹ The infection of hepatitis B virus during pregnancy can cause serious obstetrics complications such as miscarriage, preterm labor, gestational diabetes, and low birth weight.^{10–12}

Further, researchers have found that the burden of hepatitis HBV can be reduced if certain interventions are

accessibly used. For instance; screening of HBV for all pregnant women, universal HBV birth dose within one day of delivery and hepatitis B vaccination are effective methods and can decrease mother to child transmission of the disease by 90%.¹³ However, HBV birth dose and vaccine coverage are still low in most developing countries.^{14,15} For instance; in Africa, only 11 countries have incorporated the HBV birth dose vaccine as part of a routine expanded program of immunization (EPI). In contrast, currently all East African countries are not implementing this EPI program.¹⁶ Although WHO recommended routine antenatal screening for HBV, vaccination of HBV birth dose and universal hepatitis B vaccination are still lacking in Ethiopian public health facilities.^{8,17,18} However, some private owned health facilities are currently providing HBV vaccination which is expensive for the community at large.^{19,20}

In Ethiopia, national representing data on seroprevalence of HBV in the general population including pregnant women is limited. However, press conferences released by the ministry of health indicated that the prevalence of HBV is about 8% in the general population.²¹ Previous studies conducted in different parts of Ethiopia indicated the seroprevalence of HBV as 8.4% in Dire Dawa, 6.9% in Oromia, 6.3% in Harar, 5.5% in Tigray and 3.5% in Southern Nation Nationalities and Peoples. Moreover, researchers have also reported the seroprevalence of HBV in pregnant women is associated with a history of blood transfusion, any surgical procedural, dental extraction, abortion, genital mutilation, noise and ear piercing.^{22–26} In contrast, one similar study conducted in Southern Ethiopia showed that no factor was significantly associated with the seropositivity of HBV in pregnant women.²⁷

In the Somali region, particularly in Jigjiga town, although some health facilities are currently screening HBV for pregnant women as a routine test, data related to seroprevalence of HBV are limited. Therefore, this study aimed to fill these gaps by collecting the primary data from pregnant women and to investigate the seroprevalence of HBV and its associated factors among pregnant women who attended ANC in public health facilities of Jigjiga town, Eastern Ethiopia.

Methods

Study Setting, Period and Design

A facility based cross-sectional study design was employed among pregnant women attending antenatal care at the public health facilities of Jigjiga town from

March 4 to April 4, 2019. Somali Regional state is one of the nine regions of the Federal Democratic Republic of Ethiopia. Geographically it is situated in the eastern Ethiopian lowlands and has boundaries with Djibouti, Somalia, and Kenya, locally bordering with Oromia and Afar regions.²⁸ Regarding health facilities, the town has one public referral hospital and one general hospital, 3 health centers, and 20 health posts. There is one private general hospital, 27 higher clinics, and 10 medium clinics. The study was conducted at Jigjiga University Sheik Hassen Bare Referral Hospital (JUSYRH), Karamara hospital (KH), and Jigjiga health center from March 4 to April 4, 2019.

Study Population, Inclusion and Exclusion Criteria

Eligible pregnant women who attended ANC services at randomly selected public health facilities of Jigjiga town during the data collection period, whose pregnancy was confirmed by clinical history and physical examination or an obstetric ultrasound scan were enrolled in to study. Those pregnant women who were unable to provide appropriate information because of severe disability and critical illness, and those who came for another ANC visit for the second time during the data collection period were excluded from the study.

Sample Size Determination and Sampling Techniques

The minimum required sample size of this study was determined by using Statistical Software Epi-info version 7.0 by considering the following assumptions. The proportion of hepatitis B virus ($p = 6.3\%$) was taken from a previous study report in Harar town, Eastern Ethiopia,²⁴ precision or degree of error 2%, 95% confidence level and 5% contingency for non-response rate, the final sample size was 595. A systematic sampling technique was used to select eligible study participants. First, Jigjiga town was selected purposely. In Jigjiga town, currently there are five public health facilities that are providing ANC services. From the total of five health facilities, three public health facilities (Two public hospitals and one health center) were randomly selected (using a lottery method). According to the previous information obtained from 6 months ANC followers' registry, an estimated 1451 pregnant women visit these public health facilities. Accordingly, the total sample size was proportionally allocated for each health facility based on ANC client load,

obtained from ANC registry of each health facility. Eligible pregnant women attending ANC clinic at the time of data collection were carefully chosen using a systematic sampling method (Figure 1). To decide the interval (k) estimated total number of ANC attendants was divided to y allocated sample size of the study, ie, $K = N/n$, where N = total ANC attendants, n = required sample size, K = sampling interval. Thus, $K = 1451/595 = 2.4 \approx 2$, so that every 2nd eligible pregnant woman was enrolled and interviewed until the required sample size was achieved.

Data Collection Methods and Procedures

The data were collected using a pretested interviewer administered questionnaire that was adapted from the Ethiopian Demographic and Health Survey (EDHS) data collection tools.²⁹ The questionnaires were initially prepared in English and then translated into Somali language. Then, the information on variables such as socio-demographic characteristics; risky socio-cultural behavior and practices, health care related factors were collected.

Data Collectors, Blood Sample Collection and Procedure

Three midwives and three senior laboratory technologists (one midwife and one laboratory technologist for each health facility) were recruited in the respective ANC clinics and laboratory departments. Similarly, one Bachelor of Science (BSc) in midwifery and one senior laboratory technologist were also assigned to respective health facilities in order to monitor and supervise the data collection processes. In addition, one senior laboratory technologist was employed to investigate HBsAg serum using a HEUMAN ELISA machine. The 5 mL of venous blood was drawn under aseptic conditions in disposable vacutainer tubes by experienced laboratory personnel. These tubes were labelled and processed at the time of sample collection. The blood samples taken from the participants were centrifuged at 3000 revolutions per minute (RPM) for at least 15 minutes at room temperature. All serum samples had been tested for HBsAg using the wondfo rapid test method according to the manufacturer's instructions. Based on the result screened women received the result as usual. The leftover serum collected in to other plain tubes using micropipette, was then stored at -20°C at respective study health facilities (JUSRH, KH, and

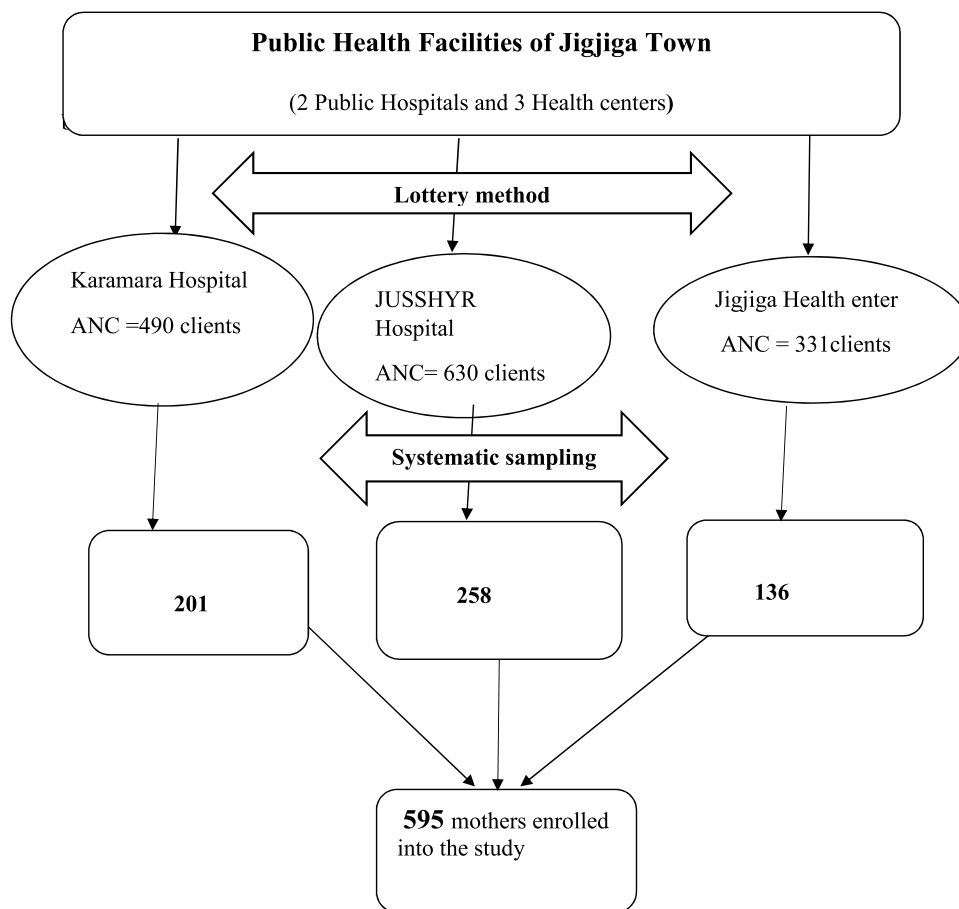


Figure 1 Schematic of sampling procedure of seroprevalence of Hepatitis B virus and associated factor among pregnant women attending ANC clinic in public health facilities of Jigjiga town, Eastern Ethiopia, 2019

JHC) until transported to regional blood banks to perform the ELISA test.³⁰

Blood Sample Processing and Testing

Five mL of venous blood were collected in plain tubes under aseptic conditions from a peripheral vein by experienced laboratory personnel from all eligible pregnant women consecutively. Routine standard operating procedures for sample collection were strictly followed. The blood samples were taken from the individuals and centrifuged at 3000 revolutions per minute (RPM) for at least 15 minutes at room temperature.^{30,31} The rapid HBsAg was performed to deliver the women's results immediately. Then, left over serum blood was separated using a micropipette in to another sterilized plain tube, and kept frozen at -20°C until it was transported from each health facility. Lastly, the collected serum was sent to the blood bank of the regional laboratory using an ice box to test the serum for the presence or absence of HBsAg using enzyme-linked immunosorbent assay (ELISA Human

type, Germany product) based on the manufacturer's manual instructions.

Variables and Measurements

Dependent Variable

In this study, the outcome variable of interest was serostatus of hepatitis B virus. Independent variables: the explanatory variables were socio-demographic characteristics such as: maternal age, marital status, educational level, family income, ethnicity, religion, occupation, gravidity and parity were taken as socio-demographic variables. Health care related characteristics like: surgical procedures, working in hospital, blood transfusion and dental extraction were taken as health related variables. Risky behavior and practice related characteristics such as: body tattooing, nose piercing, ear piercing, genital mutilation, abortion and sharing sharps materials, contact with infected person, polygamous marriage and multiple sexual partners were taken as risky behaviors and practice variables.

Rapid HBsAg Screening Test

Rapid HBsAg screening test has a sensitivity of 99.8% and specificity of greater than 99.7%.³⁰ It is a qualitative, solid phase, two-site sandwich immunoassay for the detection of HBsAg in serum. The membrane was precoated with anti-HBsAg antibodies on the test band region and anti-mouse antibodies on the control band region. During testing, the serum sample reacts with the dye conjugate (mouse anti HBsAg antibody colloidal gold conjugate) that was coated on the test strip. Then, the mixture by capillary action reacts with anti-HBsAg antibodies on the membrane and generates a red band. Presence of this red band indicates a positive result while its absence indicates a negative result.

ELISA Method Test

WANTAI HBV diagnostic kit which has a sensitivity of 100% and specificity of 99.92%.³¹ It uses an antibody sandwich ELISA method in which polystyrene micro-well strips are precoated with monoclonal antibodies specific to HBsAg. A patient's serum sample was added to the micro wells together with a second antibody conjugated with horseradish peroxidase (HRP) and formed in case of the presence of HBsAg in the sample, which is captured on the solid phase. The amount of color was measured as it was proportional to the amount of antigen in the sample. Wells containing samples which were negative for HBsAg remain colorless. Every procedure was followed according to the manufacturer's instructions. The standard procedures of HBsAg and AiD™-HBsAg ELISA tests were performed. First reactive results were repeated using AiDTM HBsAg ELISA to declare the results as a positive.³¹

Operational Definitions

Hepatitis B surface antigen (HBsAg):- A marker presents in persons who are currently infected with HBV (ie, persons with both acute and chronic infection).³² Prevalence:- Is the number of cases of a disease in a specific place at a specific time.³³ Seronegative:- Is the status of an individual who gives a negative reaction to a serological test.³³ Seropositive:- Is the status of an individual who gives a positive reaction to a serological test.³⁴ Risky behavioral and practice factors: - Refers to some of the behavioral malpractice and some of the social and cultural activities of the subjects that exposed them to the risk of acquiring HBV infection from different sources like abortion in the past, ear or nose piercing, contact with

family members during visiting and caring of the sick in the past.^{35,36}

Data Quality Control

First, the data collection tools were prepared in English versions. Then, they were translated to a local language (Somali language) that can be understandable by study participants. Finally, the questionnaires were translated back to English versions to ensure their consistence with the previous initial version. Data collectors, along with supervisors, were trained on the data collection procedure. The questionnaire pretest was conducted on 5% (30 samples) before the actual data collection process in another health center in the town. The result was used to correct the questionnaires. The collected data were checked by supervisors and the principal investigator on a daily basis for completeness and consistency. Codes were given for the completed questionnaires. Double data entry verification was done. Serological data quality was assured following all health facilities' Standard of Procedure (SOP). Standardized procedure was strictly followed during the blood sample collection, storage, and analytical process. Positive and negative controls were run according to the test manual and quality assurance were followed.

Data Processing and Analysis

The collected data were checked, coded and entered into Epi-data version 3.1 and exported to SPSS version 20 for analysis. Descriptive statistics was done using frequencies tables. Bivariable logistic regression analysis were carried out using cross tabulation to see the association between HBsAg serostatus and independent variables. Variables having a p-value less than 0.25 were included in the multiple logistic regression analysis. The multivariable logistic regression was done to control for possible confounders and identify the true effect of the selected predictor variables. The model adequacy was checked using Hosmer and Lemeshow goodness of fitness tests. Finally, the strength of associations between outcome and predictor variables was assessed using adjusted odds ratio (AOR) with 95% confidence and the significance of the association was declared at a p-value of less than 0.05.

Ethical Consideration

An ethical clearance was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University, College of Health and Medical Sciences. A copy of the ethical letter was submitted to Jigjiga University Institutional Review Board of College of Medicine and Health Science and Somali regional

health bureau. Official letters were written to Jigjiga University Sheik Hassan Yabare Referral Hospital and the Somali regional health bureau. Somali regional health bureau wrote supporting letters to Karamara Hospital and Jigjiga health center. The informed, voluntary, written and signed consent was obtained from each study participant. In addition, informed, voluntary, written and signed assent was also obtained from the guardians and parents if a mother's age was less than 18 years. Participation in the study was on a voluntary basis and participants were informed about their right to withdraw/refuse at any stage of the study if they did not want to participate. Moreover, confidentiality of the information was assured. The data collectors interviewed the participants in separated areas and the testing was done free of charge.

Results

Socio-Demographic Characteristics of Study Participants

A total of 589 pregnant women attending ANC were enrolled in to the study with a response rate of 98.8%. The participant's ages ranged between 17 and 42 years with a mean and standard deviation of 26.9 and ± 4.85 respectively. About 239 (40.6%) women were in the age group of 25–29 years. About 169 (28.7%) of the women attended primary school and only 35 (5.9%) of the women attended above grade 12. The majority, 426 (72.3%), of the women were housewives and only 14 (2.5%) women were health care workers (Table 1).

Health Related and Risk Behaviors of Study Participants

From the 589 pregnant women who participated in the study, only 14 (2.7%) participants had a history of ever working in health institutions. Around 458 (77.8%) had a history of ear piercing and the majority, 477 (81%) of the women had a history of circumcision or FGM. Out of the total 589 study participants, 46 (7.8%) women had a history of contact with an infected person in the family and 44 (7.5%) of the women shared sharp materials (Table 2).

Seroprevalence of HBV Among Pregnant Women Attending ANC Services

Of 589 pregnant women tested for HBsAg, 50 (8.5%) were seropositive for HBV (95% CI, 6.5–10.7). The highest seroprevalence of HBsAg was observed among the 20–24 years age group (11.2%) and lowest (3.1%) in

Table 1 Socio-Demographic Characteristics of Pregnant Women Who Attended ANC Follow Up in Public Health Facilities of Jigjiga Town, Eastern Ethiopia (N=589), April 2019

Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	< 21	57	9.7
	21–25	190	32.3
	26–30	229	38.9
	>30	113	19.2
Marital status	Single	22	3.7
	Married	528	89.6
	Divorced and widowed	39	6.6
Educational Level	Cannot read and write	155	26.3
	Can read and write (informal)	134	22.8
	Primary (1–8)	169	28.7
	Secondary	96	16.3
	≥ 12	35	5.9
Religion	Muslim	549	93.2
	Non-Muslims	40	6.8
Ethnicity	Somali	523	88.8
	Non Somali	66	11.2
Occupation	Employed	426	72.3
	Unemployed	163	27.7
Income	<1501ETB (<50 USD)	13	2.2
	1501–3000ETB (50–100 USD)	202	36
	>3000ETB (>100 USD)	364	61.8
Gravidity	Multigravida	511	86.8
	Primigravida	78	13.2
Parity	Multipara	430	73.0
	Nulliparous	159	27.0

Abbreviations: ETB, Ethiopia Birr; USD, US dollar.

the 15–19 years age category. The prevalence of HBsAg was highest in those who were health care workers (21.4%) followed by those who working as daily laborers (20%). Regarding education status, seroprevalence of HBV was highest among those who attended above 12 grades (14.3%) and lowest in those who attended primary school (5.3%). The seroprevalence of HBV was 9% and 8.4% in primigravida and multigravida respectively (Table 3).

Factors Associated with Seroprevalence of HBV

Bivariable and Multivariable Analysis

In bivariable analysis, history of surgery, HBV infected person in the family and sharing sharp materials, body

Table 2 Health Related and Risk Behavior of the Pregnant Women Who Attended ANC Follow Up in Public Health Facilities of Jigjiga Town, Eastern Ethiopia (N=589), April 2019

Variables	Categories	Frequency (n)	Percentage (%)
Ever worked in health institution	Yes	16	2.7
	No	573	97.3
History of surgery	Yes	29	4.9
	No	560	95.1
History blood transfusion	Yes	33	5.6
	No	556	94.4
History tooth extraction	Yes	38	6.5
	No	551	93.5
HBV infected person in the family	Yes	46	7.8
	No	543	92.2
Nose piercing	Yes	65	11
	No	524	89
Ear piercing	Yes	458	77.8
	No	131	22.2
Circumcision or FGM	Yes	477	81
	No	112	19
Sharing sharp materials	Yes	44	7.5
	No	545	92.5
Body tattooing	Yes	49	8.3
	No	540	91.7
Unsafe abortion	Yes	23	3.9
	No	566	96.1
Husband polygamous	Yes	47	8
	No	542	92
Multiple Sexual partner	Yes	26	4.4
	No	563	95.6

Abbreviations: FGM, female genital mutilation; HBV, Hepatitis B virus.

tattooing and ever had multiple sexual partners were significantly associated with HBsAg seropositivity. However, other predictors were selected as candidate variables for multivariable analysis when a p-value <0.25. However, in the final model of multivariable analysis: Having a surgical history, a HBV infected person in the family, sharing sharp materials and history of multiple sexual partners were significantly associated with seropositivity of HBsAg. The odds of having HBV infection was about 3 times higher among pregnant women who had a history of surgical procedures [AOR = 3.01, 95% CI (1.2–8.00)] compared to those who had no history of surgery.

Table 3 Hepatitis B Virus Distribution in Relation to Socio-Demographic Characteristics Among Pregnant Women Attending ANC Follow Up in Public Health Facilities of Jigjiga Town, Eastern Ethiopia (N = 589), April 2019

Variables	Categories	HBsAg Seropositivity	
		Frequency (n)	Percentage (%)
Age (years)	< 21	4	5
	21–25	19	10
	26–30	19	8.2
	>30	8	7
Marital status	Single	3	13.6
	Married	45	8.5
	Divorced and Widowed	2	5.1
Educational Level	Cannot read and write	14	9
	Can read and write	16	11.9
	Primary (1–8)	9	5.3
	Secondary(9–10)	6	6.2
Religion	≥12	5	14.3
	Muslim	47	8.6
Ethnicity	Other	3	7.5
	Somali	46	8.8
Occupation	Others	4	6.1
	Health care workers	3	21.4
	Housewife	33	7.7
	Merchant	6	6.6
	Daily laborer	5	20.8
Family income	Private employee	3	8.8
	<1501ETB(<50 USD)	1	7.7
	1501–3000ETB (50–100USD)	22	10.4
Gravida	>3000ETB(>100 USD)	27	7.4
	Multigravida	43	8.4
Parity	Primigravida	7	9.0
	Multipara	32	7.4
Nulliparous	Nulliparous	18	11.3

Abbreviations: ETB, Ethiopia Birr; USD, US dollar.

Having a family history of HBV infection meant 5 times the chance to have HBsAg seropositivity [AOR = 4.96, 95% CI (2.11–10.60)] when compared to their counterparts. Mothers who shared sharp materials were 3 times more likely to be infected with HBV than those who did not share sharp materials [AOR = 2.78, 95% CI (1.13–6.83)]. The odds of seropositivity for HBsAg was about 6 times higher among pregnant women who had multiple sexual partners [AOR = 6.12, 95% CI (2.12–17.64)] when compared to those who had not had multiple sexual partners (Table 4).

Table 4 Bivariable and Multivariable Analysis of Factors Associated with HBV Infection of Pregnant Women Attending ANC Follow Up at Public Health Facilities of Jigjiga Town, Eastern Ethiopia, (N = 589), April 2019

Variables	Categories	HBsAg Serostatus			
		Positive (%)	Negative (%)	COR (95% CI)	AOR (95% CI)
Educational Level	Cannot read & write	14(9)	141(91)	0.59(0.2–1.78)	1.13(0.33–3.91)
	Can read & write	16(11.9)	118(88.1)	0.81(0.276–2.4)	1.30(0.38–4.42)
	Primary (1–8)	9(5.3)	160(94.7)	0.34(0.11–1.1)	0.45(0.12–1.65)
	Secondary (9–10)	6(6.2)	90(93.8)	0.40(0.114–1.41)	0.58(0.14–2.4)
	>12	5(14.3)	30(85.7)	1	1
Occupation	Unemployed	33(7.7)	393(92.3)	1	–
	Employed	17(10.4)	146(89.6)	0.72(0.39–1.9)	–
Gravidity	Primigravida	7(9)	71(91)	1	–
	Multigravida	43(8.4)	468(91.6)	0.93(0.40–2.15)	–
Parity	Multipara	32(7.4)	398(92.6)	0.63(0.34–1.16)	0.58(0.3–1.11)
	Nulliparous	18(11.3)	141(88.7)	1	1
History of surgery	Yes	8(27.6)	21(72.4)	4.70(1.96–11.24)**	3.0(1.2–8.0)*
	No	42(7.5)	518(92.5)	1	1
Ever blood transfused	Yes	5(15.2)	28(84.80)	2.03(0.75–5.50)	2.1(0.68–6.20)
	No	45(8.1)	511(91.9)	1	1
HBV infected in the family	Yes	12(26.1)	34(73.9)	4.69(2.25–9.79)***	4.96(2.11–10.60)***
	No	38(7)	505(93)	1	1
Tooth extraction	Yes	5(13.2)	33(86.8)	1.7(0.63–4.57)	–
	No	45(8.2)	506(86.8)	1	–
Nose piercing	Yes	7(10.8)	58(89.2)	1.35(0.58–3.14)	–
	No	43(8.2)	481(91.8)	1	–
Ear piercing	Yes	36(7.9)	422(92.1)	0.713(0.37–1.366)	–
	No	14(10.7)	422(92.1)	1	–
FGM/circumcision	Yes	39(8.2)	438(91.8)	0.82(0.405–1.65)	–
	No	11(9.8)	101(90.8)	1	–
Sharing sharps	Yes	9(20.5)	35(79.5)	3.16(1.42–7.03)	2.78(1.13–6.83)*
	No	41(7.5)	504(92.5)	1	1
Body tattoo	Yes	8(16.3)	41(83.7)	2.31(1.02–5.25)*	2.14(0.86–5.31)
	No	42(7.8)	498(90.2)	1	1
Polygamous spouse	Yes	7(14.9)	40(85.1)	2.03(0.86–4.81)	1.75(0.66–4.64)
	No	43(7.9)	499(92.1)	1	1
Multiple sexual partners	Yes	6(23.1)	20(76.9)	3.54(1.35–9.27)*	6.12 (2.12–17.64)***
	No	44(7.8)	519(92.2)	1	1

Note: Statistically significant at $P < 0.001 = ***$, $P < 0.01 = **$ and at $P < 0.05 = *$.

Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval.

Discussion

In this study, the overall seroprevalence of HBV infection among pregnant women was 8.5%. This study also revealed that having a history of surgery, family history of hepatitis B virus, history of shared sharp materials and having a history of previous multiple sexual partners were significantly

associated with seropositivity of HBsAg. In this study, the seroprevalence HBV is relatively in line with previous studies such as: 8.4% in Dire Dawa, Eastern Ethiopia,²² 7.8% in Hawassa, Southern Ethiopia,²⁷ 6.9% in Deder hospital, Eastern Ethiopia,²³ 8.1% in Mekelle, Northern Ethiopia,³⁷ 7.2% in Yirgalem, Southern Ethiopia³⁸ and 8.5% from

Thailand.³⁹ In contrast, higher seroprevalence of HBV was observed in similar study populations in different parts of the world. For instance; the current study finding is considerably higher than other previous study reports such as: 2.26% from Bulgaria,⁴⁰ 2.78% from Pakistan,⁴¹ 2.04% from India,⁴² 4.6% from Nigeria⁴³ and 3.5% from Dawuro, Southern Ethiopia.²⁶ These differences in the seroprevalence might be due to differences in cultural and behavioral characteristics of the pregnant women. In contrast, the finding was lower than the reports from Juba Teaching Hospital, South Sudan 11%,⁴⁴ 16.6% in Nigeria⁴⁵ and 9.5% in Ghana.⁴⁶ This difference in estimates might be attributed to the time gap between study periods, geographical setting of study population and difference in sample size of the study.

In this study, the final model of multivariable analysis showed that the odds of being positive for HBV infection was 3 times higher among pregnant women who had a history of surgical procedure compared to those who had no history of surgery. This result is in agreement with the study report from Harare,²⁴ Addis Ababa,⁴⁷ Bahir Dar city⁴⁸ and Dader Hospital.²³ This may be due to poor infection prevention practice during the surgical procedures. However, contradictory results were reported from South Sudan,⁴⁴ Rwanda,¹⁰ Hawassa, Southern Ethiopia²⁷ and Dire Dawa, Eastern Ethiopia.²² The possible reasons for this discrepancy may be due to variation in the sample size and demographic features of the study population.

Final multivariate analysis of this study also revealed that pregnant women who had a family history of HBV infection were 5 times more likely to have HBsAg seropositivity compared to their counterparts. The finding was incongruent with previous study reports from Turkey (Antioch, University Hospital),⁴⁹ Felege Referral Hospital,⁵⁰ Tigray Public Hospital⁵¹ and a survey reported from Ethiopian hospitals.⁴⁷ The possible explanation might be due to the fact that having contact with someone who is chronically ill or a carrier of hepatitis B virus may increase the probability of exposure to an infected person's body fluid which is believed to be a source of infection.

In addition, this study demonstrated that HBsAg seropositivity was statistically significant among pregnant women who had a history of shared sharp materials. The odds of having HBV infection was about 3 times higher among pregnant women who shared sharp material when compared with those who had not shared. This is supported by a similar study report from Uganda, Mulago National Referral Hospital.⁵² The conceivable justification for this may be due to poor practice on infection

prevention and control. In this regard, the sharp materials may have been contaminated with blood which might be a potential source of HBV infection.

Furthermore, this study revealed that the probability of acquiring HBV infection was higher among pregnant women with multiple sexual contacts. The odds of having HBsAg was 6 times higher among pregnant women who had a history of multiple sexual partners compared to their counterparts. This finding is consistent with previous study reports from Legos, Nigeria,⁵³ Dawuro, Southern Ethiopia²⁶ and Yirgalem Hospital.³⁸ The possible justification could be due to the fact that HBV might be found in blood, semen and other body fluids that are exchanged during sexual contact. For instance; women who had multiple sexual partners are more likely to have sexual contact that increases the risks of HBV and other sexually transmitted infections.

Strengths and Limitations

Strengths of the study: The blood samples were collected using ELISA diagnostic method which has high sensitivity and specificity instead of using only rapid test which have low sensitivity and specificity. The study also used a standardized questionnaire to collect information from the study participants. Limitations of the study: Since the study was conducted at a point in time, no causal association could be made. The study was conducted only in public health institutions; pregnant women who attended ANC services at private health facilities were not enrolled in to the study. Moreover, since the study is institutionally based, it may not be generalizable to the entire population.

Conclusion

The overall seroprevalence of HBV infection among pregnant women was relatively high. This result indicates that HBV infection may be a serious public health problem in Jigjiga town. Factors such as surgical history, family history of hepatitis, sharing sharp materials, and a history of multiple sexual partners were significantly and positively associated with HBV infection. Screening of pregnant women for HBV irrespective of the basis of risk factors and intensified prevention targeting this group may reduce mother to child transmission of HBV infection. Health education programs on the mode of HBV transmission, high-risk behaviors, and methods of prevention should be instituted at antenatal care clinics, aseptic technique should be followed during surgical procedures at health facilities. Awareness should be created among families to avoid contact with HBV infected people, sharing sharp materials

and sexual contact with multiple people. Other studies to determine the causal association with HBV should be done. Further, community-based studies should be conducted to determine the exact seroprevalence of HBV among the general population.

Abbreviations

ANC, antenatal care; CDC, Center for Disease Control; CSA, Central Statistical Agency; ELISA, enzyme linked immunosorbent assay; HBcAg, hepatitis B core antigen; HBeAg, hepatitis B e antigen; HBsAg, hepatitis B surface antigen; HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; IHRERC, Institutional Health Research Ethics Review Committee; JUSYRH, Jigjiga University Sheik Hassan Yabare Referral Hospital; KH, Karamara Hospital; WHO, World Health Organization.

Data Sharing Statement

The datasets used for analysis are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate

Ethical clearance was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of the College of Health and Medical Sciences, Haramaya University. Support letters were written to all public health facilities where the study was actually conducted. The informed, voluntary, written and signed consent was obtained from each study participant. In addition, informed, voluntary, written and signed assent was also obtained from the guardians and parents of mother's aged less than 18 years. Study participants were clearly informed about their right to withdraw/refuse at any stage of the study if they did not want to participate and confidentiality of the information was assured. The data collectors interviewed the participants in separated areas and the testing was done free of charge. Confidentiality of information and privacy of participants were respected. This study was conducted in accordance with the Declaration of Helsinki.

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Author Contributions

All authors have made a significant contribution to the conception, study design, acquisition, data analysis and interpretation of the result. They also took part in drafting the manuscript, critically reviewed and agreed on the journal to which the article has to be submitted. All authors read and approved the final version of the manuscript and agreed to be accountable for the all contents of the manuscript.

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Disclosure

The authors report no conflicts of interest in this work.

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