INNSPUB

International Journal of Microbiology and Mycology | IJMM |
pISSN: 2309-4796
http://www.innspub.net
Vol. 17, No. 1, p. 1-13, 2023

Open Access RESEARCH PAPER

Prevalence of hepatitis B virus transmission from mother-to-child in Parturient women in Plateau State, Nigeria

TS. Vem*[1], J. Anejo-okopi[2], EM. Agbo[3], Y. Agabi[2], KM. Thomas[2], DM. Maktu[4], P. Lar[2]

[1]*Department of Medical Laboratory Science, Faculty of Health Sciences and Technology, University of Jos, Nigeria*

[2]*Department of Microbiology, Faculty of Natural Sciences, University of Jos, Nigeria*

[3]*Department of Microbiology, ATBU Bauchi, Nigeria*

[4]*General Hospital Garaku, Nasarawa State Hospital Management Board, Lafia, Nigeria*

Keywords: Hepatitis B virus, Mother-to-child transmission, Parturient women, Hepatitis B surface antigen, Associated risk factors

Publication date: July 27, 2023

Abstract

High prevalence of hepatitis B virus (HBV) infection in parturient women is the primary source of infection for their children and the general population. Mother-to-child transmission (MTCT) is the primary mode of transmission in endemic areas. The aim of this study is to determine the prevalence rate of MTCT of HBV in parturient women in Plateau state, north central Nigeria, and associated risk factors among delivering mothers. This health facility-based cross-sectional study was conducted in different hospitals covering the three (3) senatorial zones of Plateau state among 260 parturient women. Structured questionnaires and laboratory results were used to collect the data. The data were checked for completeness and entered into the statistical package for social science (SPSS) version 26 software versions. Significant association was considered at $p < 0.05$. A total of 260 mothers were enrolled. The prevalence rate of HBV infection among the parturient women and the rate of MTCT of the infection were 9.2% and 25.0%, respectively. Among 260 parturient women, only 12.7 (9.1%) had a history of multiple sexual partners, of which 18.2% were positive for HBsAg. There was no Statistically significant association between HBV infection and having multiple sexual partners (p = 0.193). HBV infection among parturient women has become highly endemic, and the rate of MTCT is high. Therefore, administering hepatitis B vaccine to all neonates within 24 h of birth is mandatory to prevent MTCT of HBV infection and related complications.

* **Corresponding Author:** TS. Vem ✉ tabitha_vem@yahoo.com

Introduction

Hepatitis B virus (HBV) is considered to be the main etiological agent for chronic liver disease (CLD) worldwide. About 2 billion persons are presently being infected with HBV and roughly 350 million of them are chronically infected, with annual death of more than 1 million of HBV-related CLD (Shimelis *et al.*, 2008; Lemoine *et al.*, 2015; El-Serag, 2012). HBV is partially a double stranded Deoxyribonucleic Acid (DNA) (Ryu, 2017), circular in shape and consist of an outer envelope containing hepatitis B surface antigen (HBsAg) and also inner nucleocapsid consisting of hepatitis B envelope antigen (HBeAg). It possesses antibodies to each of these antigens such as; anti hepatitis B surface antigen (HBsAb), Hepatitis B core antibody (HBcAb) and Hepatitis B envelope antibody (HBeAb) (Brooks *et al.*, 2010). There are several genotypes of hepatitis viruses with different implications and distinct geographic distribution. HBV is classified into 10 genotypes base on sequencing and genetic material which has become the standard, A-J across the world and 40 sub genotypes (Rajoriya *et al.*, 2017).

HBV genotype E is hyper endemic in West Africa while genotype B and C are found in Asia, genotype A and D are predominant in north America, F in south America, G and H in central and south America, while genotype I is identified in Laos and J in Japan. The disease pathogenesis and response to treatment mostly depend on the virus genotype. It is acknowledged that, HBV genotype infection is most commonly identified with chronicity, while, genotype D is associated with high frequency of mutation that affect response to therapy. Genotype D and C mostly associated with liver cirrhosis and hepatocellular carcinoma, compared to other type of the genotypes (Petruzziello, 2018; Sunbul, 2014). Treatment of HBV genotype A and B using interferon is more effective compared to C and D. Genotype E have the worst response to treatment with interferon (Petruzziello, 2018; Sunbul, 2014).

Mother-to-child transmission (MTCT) is responsible for approximately one-half of chronic hepatitis B (CHB) infection worldwide (Navabakhsh *et al.*, 2011). In endemic areas, where carrier rates are greater than 5%, perinatal transmission is common, especially when HBV-infected mothers are also HBeAg positive (Zhang *et al.*, 2014; Wright, 2006). Without any prophylaxis or antiviral therapy, women who are acutely infected with HBV or are chronic carriers of HBV are likely to transmit the virus to their offspring at the time of delivery (Chang, 2007). HBV transmission majorly occurs through vertical transmission (contact with infected blood and body fluids (Zhang *et al.*, 2014) or through horizontal transmission (exposure to infected blood/ body or other fluids) particularly from an infected child to an uninfected child during the first five years of life or adults (Wang *et al.*, 2019). The risk of MTCT among infants born to HBV-infected mothers ranges from 10 to 40% in HBeAg negative mothers and to as high as 90% in HBeAg-positive mothers with HBV DNA level (>200,000IU/ml, equivalent to 6 log copies/ml). The majority (> 95%) of perinatally acquired infection results in CHB infection, due to induction of an immune tolerant state of variable duration (Lamberth *et al.*, 2015; Bertoletti *et al.*, 2015) and has a 15-25% risk of dying in adulthood from cirrhosis or liver cancer (Camvulam *et al.*, 2010). Africa has shown high prevalence or endemicity of >8% of HBsAg in some African Countries. Burkina Faso recorded prevalence of 14.5%, Cameroon 10.1%, Gabon 9.5%, Ghana 13.5%, Mali 15.5%, Mauritania 10.9%, Nigeria 13.6%, Senegal 13.8%, Zambia 6.5% and Zimbabwe 25.0% (Florent *et al.*, 2012; Tao *et al.*, 2014). Therefore, occurrence of chronic HBV infection is complicated and is mostly chronic if they occur early in life and the highest rate of chronicity is in newborn. Usually infants who acquired HBV in utero or during delivery (perinatally) from their infected mothers, become chronic carriers compared to children that acquire infection later in child hood.

Regardless of whether parturient women have been previously tested or vaccinated, screening of all pregnant women for HBV infection at the first prenatal visit is important in view of the morbidity and mortality of pregnant women, its effect on the pregnancy outcome, and the risk of vertical transmission from mother to child (Mast *et al.*, 2005). In Jos metropolis, the prevalence of HBsAg among women at delivery has been reported to be 12.77% while that of cord blood is 2.2% (Ozele, 2012). This prevalence rate does not truly represent the reality in Plateau state as it was only considered in Jos metropolis. Therefore, there is need to find out the prevalence rate of the virus from MTCT in the entire state covering the three senatorial zones. Since there is no recent research conducted in the state to the best of our knowledge to do that, this research is aimed at finding out the prevalence rate of HBV MTCT in parturient women in the entire Plateau state. This will help in suggesting ways to prevent MTCT of HBV in the state and Nigeria at large.

Materials and methods

Ethical consideration

This research work was reviewed and approved by the ethical committee of Jos University Teaching Hospital (JUTH), Bingham University Teaching Hospital and Plateau State Hospital Management Board to cover the three senatorial zones of the state. The relevance of the research was explained to each study participant ensuring confidentiality of information and anonymous typing for every study participant. The participants were interviewed alone to keep their privacy without charging them for all the tests conducted. Test results were given to the clinicians who are working in the clinic of the hospitals and board making sure that all women who tested positive for HBsAg were counseled on their status, the route of disease transmission, the need for immunization to their neonate at birth, and close-contact screening against hepatitis. Finally, they were referred to internal medicine for further diagnosis and management.

Study design, area, and period

The study is a hospital based descriptive, cross-sectional study. This was carried out between May, 2020 and March 2021. This study is a facility based-study, conducted at six antenatal units in Plateau State covering Shendam, Mangu, Pankshin, Jos South, Jos North, and Jos East. The health facilities selected provides specialist services in maternal, child and new born delivery to a large population. The centers are all located in Plateau State, north central region of Nigeria. According to Plateau state ministry of establishment, internal affairs and information, Jos is located at $9^{o}56'N$ $8^{o}53'E$, at an altitude of 4,062 feet (1,217m) above sea level. Jos has an average monthly temperature range from $70^{o}F$ – 770F or $21^{o}C$ – $25^{o}C$. Jos has a population of 510, 300, 000, making it the 10^{th} largest city in Nigeria. Two weather seasons are distinct about the state: the wet season, which lasts from April to October; and dry/cold season from November to March. Wet season is characterized by heavy rains and subsequent flooding of banks of rivers, streams, ponds and other hydrological resources, while the dry season is characterized by cool/dry temperatures between October to February, and high temperature in February and March. The Mean annual rainfall is 131.75cm on the Plateau.

Population

Sample size was estimated to be 260 (11 from Jos North, 38 from Jos South, 60 from Jos East, 46 from Mangu, 65 from Pankshin and 40 from Shendam) using single population proportion formula, assuming 50% HBsAg prevalence (infectivity) in pregnant women, 5% precision, and 95% level of confidence covering the entire state. However, in attempting to enhance the statistical power of detecting the rate difference by exposure status, we investigated a total of 300 pregnant women, prospectively. 260 consecutive pregnant women attending antenatal care (ANC) clinic in all the hospitals were considered. Pregnant women who are healthcare workers and refused to give consent for the blood test were exempted from the study.

Data collection

After obtaining a written informed consent from the participants, a careful explanation about the concept of the study was given to each pregnant woman before they were included in the research. Two nurses were given a 2-day training on study procedures, facts on HBV infections and transmission, counseling, and safety issues. Data on socio-demography and potential risk factors were collected via structured questionnaires. STI result and Anti-Retroviral Therapy (ART) status were obtained from their medical records.

Specimen collection and handling

About 5 milliliters (5ml) of intravenous blood was aseptically collected by venipuncture from every pregnant mother and cord blood taken from their infants and transferred into a labeled tube containing ethylene diamine tetra-acetic acid (EDTA) in line with the already administered questionnaire. All samples were labeled alongside the completed questionnaire with a code for each facility, and unique number of each participant. All samples were centrifuged within an hour of collection and the plasma separated was transferred into a new labeled tube and immediately placed in a refrigerator at 3.3°C. The samples were shipped from the selected primary health facilities to APIN laboratory Jos University Hospital (JUTH) for final storage at -20°C until used.

Laboratory testing

Detection of HBV Serological Markers using the 5-Panel Test Kit for Serological Markers (COMBO TEST)

All frozen Plasma samples were brought out and allowed to thaw at room temperature. The one-step HBV 5- panel rapid test cassette kit (serum/plasma) by SKYtec Rapid Diagnostic Test with Lot no: Sky 2020QTec made in China, was used for the detection. The HBV rapid test cassette employs a colloidal gold and membrane chromatographic technology for the qualitative detection of HBsAg and HBeAg serological marker for HBV in Plasma. The plastic cassette has 5 wells into which the plasma sample was placed and the antigen- antibody reaction occurred within 15 minutes at room temperature. Using a small straw, a drop (equivalent to 25ul) of subject's Plasma sample was placed into each of the 5 wells, then one drop of the buffer (sample buffer) was added into the 5 sample wells after which the reaction in the cassette was read within 15 minutes.

A positive reaction indicates the presence of the antigen or antibody which confirms the presence of infection. The cassette shows two purple bars (control line) in the control T zone. A negative reaction indicates absence of Hepatitis B Virus infection. The cassette shows only purple bar (control line) in the control C zone. The results for 260 samples out of the 275 from Pregnant mothers were taken and recorded as consistent participants.

Qualitative detection of hepatitis B Surface antigen among infants born to mothers infected with hepatitis B virus in Plateau State

All infants' samples were subjected to an Enzyme Linked Immunosorbent Assay (ELISA test) for the qualitative detection of HBsAg manufactured by Hightop HBV Surface Antigen (HBsAg) ELISA Test Kit for serum/plasma (Catalog Number:H312) Shandong, China. The microtiter plate of this kit uses double antibody sandwich ELISA principle. A Purified Hepatitis B surface antibody (HBsAb) was pre-coated on the microplate, the HBsAg in the study sample reacted with HBsAb first, then reacted with enzyme-labeled HBsAb complex (HBsAg- Anti-HBs complex) formed on the wells, and shows blue color in the microplate. A color developed in proportion to the amount of a Hepatitis antibodies (anti-HBs) bound to HBsAg. The reaction was stopped by addition of the stop solution to the wells. The optical density was read with a suitable photometer at 450nm wavelength within 10 minutes. Cut off values were calculated according to recommendations of the manufacturer and interpreted accordingly.

ELISA procedure for qualitative detection of hepatitis B virus in infants

The reaction was performed in a 96 well micro titer plate using ELISA test kit for qualitative detection of HBsAg manufactured by Hightop. serum/plasma, reagents include, 2 positive, 3 negative controls and 1 blank control, manufacturers instruction was used. 260 frozen plasma samples were allowed to thaw at room temperature. The washing solution was diluted 1:40 with deionized water. 20µl each of the sample diluent was added into 90 corresponding wells excluding the positive, negative controls and the blank well. 100µl of each sample was added into 90 corresponding wells and was thoroughly mixed by using the pipette. 100µl of negative control, and positive control was added into 2 and 3 wells respectively, and nothing was added to the last blank well. It was gently shaken to mix, and incubated at 37^{o}C for 60 minutes while sealed with the membrane seal.

After incubation, the seal was removed and discarded. The Plate was taken out, and the wash buffer was added into each well for 20 seconds and discarded and this was repeated 5 times. After the final washing cycle, the plate was turn over onto blotting paper or clean towel, and tapped to remove any remaining liquid. 50µl conjugate was added to all the wells except the blank well, it was gently mixed and incubated at 37^{o}C for 30 minutes with the plate sealed with the sealing membrane. Next, 500µl of the stop solution was added to all the wells and gently mix by shaking to terminate the substrate reaction. The plate reader was calibrated with the blank well and the absorbance read at 450 nm. The wavelength reference was set at 630nm, cut off value was calculated and the results evaluated. Using chronometry, the optical density (OD) was read at 450nm with a micro plate reader. A mean negative control OD value <0.1, mean positive control OD value >0.8 and a Cut off value equal to the mean negative control OD value x 2.1 were used to interpret the results.

Quality assurance

The correctness and completeness of the data were checked by the trained supervisor daily. The performance of the rapid HBsAg test kit was evaluated using known positive and negative controls obtained from enzyme linked immunosorbent assay (ELISA) tested blood donors and have consistent result. Sera of positive HBeAg of 3 subjects were retested by the same method and gave the same result. In addition, the presence of colored band to the control (C) line acts as a procedural control and serves to make the result more valid.

Data analysis

The research data were coded, entered, and analyzed using statistical package for social science (SPSS) version 26 (IBM Corp., Armonk, NY, USA). We described data using either proportion or mean with standard deviation (SD). Association between participant characteristics and outcome variables (HBsAg positivity) was assessed using X^2 test (or Fisher's exact test as appropriate) for categorical predictors. All explanatory variables with a p-value ≤ 0.05 in the bivariate analysis were included in the multivariate logistic regression model to identify variables which have been associated independently. Odds ratios (OR) with their 95% confidence intervals (CI) served to investigate the influence of various factors on the occurrence of HBV infection. A p-value of < 0.05 was considered to be significant.

Results

Sociodemographic characteristics

Out of the 300 expected population of parturient women approached during the study period, 30(10.0%) were excluded because they refused to participate and 10(3.3%) could not continue to the end. Thus, a total of 260 parturient women aged 18 - 44 years were enrolled into the study. The mean (standard deviation, SD) age of the study group was 27.9±3.2 years, and HBV infection rate

increased as the age increased. A total of 93(35.8%) of the women had primary school education, 110(42.4%) had secondary education and only 57(21.9%) attended tertiary education. A large proportion of the women, 255(98.1%), were currently married (209 were monogamous, 46 were polygamous), but those who were not married were 5(1.9%) only. Exactly 77.7% of the study participants were housewives and unemployed and all of them had no history of drug intake. Participants who were vaccinated for HBV were 145(55.8%) while 234(90.0%) had no history of jaundice as shown in Table 1.

Table 1. HBsAg in relation to socio-demography in parturient women attending antenatal in the selected hospitals in Plateau state

Risk factors	Total Women (N = 260)	Women with HBsAg (N = 24)	COR (95%CI)	P-value
Education				
Primary	93(35.8)	14(5.4)	1	
Secondary	110(42.3)	6(2.3)	0.348(0.96-1.284)	0.067
Tertiary	57(21.9)	4(1.5)	1.141(0.262-4.968)	0.101
Occupation				
Employed	58(22.3)	2(0.8)	1	
Non-employed	202(77.7)	21(8.1)	0.334(0.076-1.473)	0.148
Sharing toothbrush				
Yes	11(4.2)	3(1.2)	1	
No	249(95.8)	21(8.1)	5.439(1.266-23.286)	0.023*
Marital Status				
Monogamous	209(80.4)	22(8.5)	0.211 (0.212 to 0.243)	0.070
Polygamous	46(17.7)	2(0.8)	1.432 (0.535 to 0.957)	0.082
Single	5(1.9)	0(0.0)	1	
Drugs intake				
Yes	0(0.0)	0(0.0)	1	
No	260(90.8)	24(9.2)	0.121(0.016-1.010)	0.062
Vaccination				
Yes	145(55.8)	3(1.2)	1	
No	115(44.2)	21(8.1)	0.095(0.028-0.328)	<0.001*
History of Jaundice				
Yes	26(10.0)	8(3.1)	1	
No	234(90.0)	16(6.2)	95.044(11.044-823.635)	<0.001*

Identification of HBsAg Positive Parturient Women

The overall prevalence of HBsAg in parturient women was 24(9.2%). Among the 24 HBsAg positive women, 14(5.4%), 6(2.3%) and 4(1.5%) attended primary, secondary and tertiary schools respectively (Fig. 1). The highest prevalence rate of HBsAg was observed in monogamous women 22(8.5%) followed by women who were not vaccinated for HBV 21(8.1%), however, no statistically significant difference was observed with their level of education. All of the participants with HBsAg positivity were married and only 0.8% of them were from polygamous marriage, while 8.1% of the HBsAg positive women were not gainfully employed. Only participants who shared toothbrush, received HBV vaccination and had jaundice in this study were significantly associated with HBsAg positivity (Table 1).

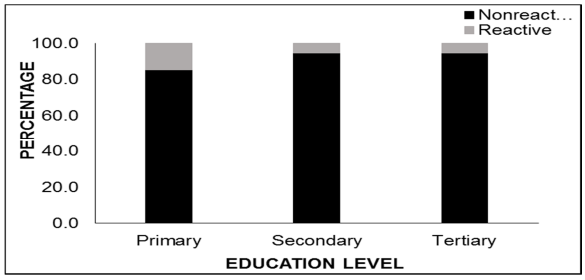

Fig. 1. Percentage of women who tested reactive *vs* nonreactive to HBsAg test across different education levels

Associated Risk Factors of HBV Infection

Among 260 parturient women, only 12.7 (9.1%) had a history of multiple sexual partners, of

which 18.2% were positive for HBsAg (Fig. 2). There was no Statistically significant association between HBV infection and having multiple sexual partners (p = 0.193). Women having history of multiple sexual partners had higher odds of HBsAg positivity (aOR = 1.77, 95% CI = 9.21-11.60) as compared to those without history of multiple sexual partners. In this study, 46(17.7%) of the women were having sexually transmitted infections (STI), out of which 10(21.7%) of them are positive for HBsAg while 35(78.3%) of them were non-reactive to it. In a bivariate analysis, those pregnant women infected with STI were roughly 11 times (aOR = 11.06, 95% CI = 1.08-112.82) more likely to be HBsAg positive than those who were not having STI (Table 2). A statistically significant relationship (p = 0.001) was established between HBsAg positive women with their parents' history of being positive for HBV. However, sharing of cutters, a history of previous surgery, history of blood transfusion, a history of tattoos and Ear-piercing were not found to be significantly associated with the HBsAg status. In multivariate analysis of selected variables for independent predictors of HBV in pregnant women, parents' history of being positive for HBV and STI women remained statistically significant (p = 0.043, 0.001 respectively) predictors of HBV among parturient women.

Table 2. Relationship between predictor variables and HBsAg status of the study subjects

Predictor variables		Reactive (%)	Non-Reactive (%)	COR (95% CI)	P-value	AOR (95% CI)	P-value
Age in years [Median (IQR)]		27.5 (7.0)	28.0 (10.0)	1.022 (0.951 to 1.098)	0.554	0.900 (0.757 to 1.071)	0.235
Multiple sexual partners	1	19 (8.4)	208 (91.6)	1		1	
	>1	6 (18.2)	27 (81.8)	0.493 (0.170 to 1.49)	0.193	1.768(9.214 to 11.600)	0.997
Blood transfusion	Yes	4 (16.7)	20 (83.3)	1		1	
	No	21 (8.9)	215 (91.1)	2.221 (0.688 to 7.168)	0.182	2.52 (0.15 to 42.86)	0.524
STI	Yes	10 (21.7)	36 (78.3)	1		1	
	No	15 (7.0)	199 (93.0)	0.255 (0.105 to 0.617)	0.002*	11.06 (1.08 to 112.82)	0.043 *
Tattoo mark	Yes	9 (11.4)	70 (88.6)	1		1	
	No	14 (7.7)	167 (92.3)	0.681 (0.281 to 1.646)	0.393	26.05 (1.57 to 431.77)	0.023 *
Parents' history of HBV	Yes	14 (70.0)	6 (30.0)	1		1	
	No	10 (4.2)	230 (95.8)	52.967 (16.821 to 166.785)	<0.001 *	42.25 (4.43 to 402.72)	0.001 *
Surgery	Yes	7(16.3)	36(83.7)	.61(0.46-5.63)	0.149	0.52 (0.05 to 2.82)	0.218
	No	16(7.4)	201(92.6)	1			
Sharing Cutters	Yes	17(10.8)	141(89.2)	1.05(0.39-2.82)	0.393	1.23 (0.21 to 4.12)	0.103
	No	6(5.9)	96(94.1)	1			
Ear Piercing	Yes	24(9.6)	227(90.4)	4.42(1.97-9.93)	0.510	2.10 (0.32 to 7.25)	0.317
	No	0(0.0)	9(100.0)	1			

IQR: Interquartile range; COR: Crude odds ratio; AOR: Adjusted odds ratio

Fig. 2. Percentage of women who tested reactive *vs* nonreactive to HBsAg test with respect to history of STI infection

Serological markers in infants

The test results for the serological markers collected from infants were analyzed using SPSS software to find out relationships among the variables. The logistic regression analyses (Table 3) showed that the HBsAg result and vaccination status of mothers were significant predictors of the immunological status of their

infants. In addition, Table 4 shows the analyzed results of relationship between HBV status of mothers and their infants. Results indicate that all infants that tested negative belonged to mothers who were non-reactive to HBsAg test, whereas in mothers who were reactive to HBsAg test, 34.8% of their infants tested positive and 65.2% of their infants tested negative (Fig. 3). Also, all infants that tested negative belonged to vaccinated mothers while 7.0% of infants that tested positive and 93.0% that tested negative had non-vaccinated mothers (Fig. 4).

Table 3. Result of logistic regression testing the association between the immunological results of infants (positive/negative) with HBsAg result, age, vaccination status of mothers controlling for site differences

		Infant immunological result		
Variables		Negative (%)	Positive (%)	*P*
HBsAg of mothers	Non-reactive	236(100.0)	0 (0.0)	<0.001
	Reactive	18 (75.0)	6 (25.0)	
HBeAg of mothers	Non-reactive	236(100.0)	0 (0.0)	
	Reactive	6(100.0)	5 (83.3)	
Age of mothers	Mean (SD)	28.3 (6.0)	27.7 (5.3)	0.799
Site	Jos North	73 (28.1)		0.46
	Jos South	43 (16.5)	1 (0.4)	
	Mangu	45 (17.3)	1 (0.4)	
	Pankshin	59 (22.7)	3 (1.2)	
	Shendam	34 (13.1)	1 (0.4)	

Table 4. Relationship between HBV status of mothers and their infants in Plateau State

Mothers'HBV Status	No.of sample (%)	HBsAg Infant		χ^2	*p*-value†
		Positive (%)	Negative (%)		
Positive	24 (9.2)	6 (25.0)	18 (75.0)	NA	<0.001**
Negative	236 (100.0)	0 (0.0)	236 (100.0)		
Total	260	6 (2.3)	254 (97.7)		

†: Fisher's exact test; NA = Not applicable

*= statistically significant association exists at p ≤ 0.05

**= statistically significant association exists at p ≤ 0.01

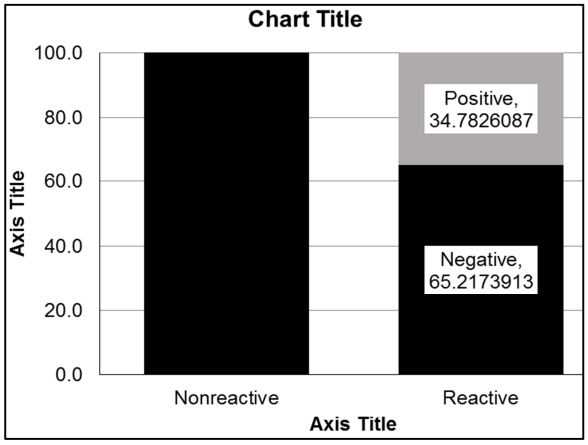

Fig. 3. Relationship between Mothers' Vaccination status and their infant's immunological results

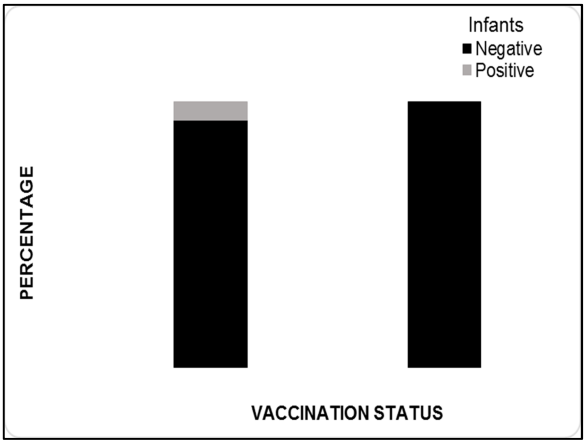

Fig. 4. Relationship between Mothers' Vaccination status and their infant's immunological results

Discussion

Early screening of pregnant women for HBV infection will have a significant importance in discovering the infection and to put in place a solution based medical intervention. Since most of the pregnant women are not aware of their HBV infection status, they may serve as an important reservoir to fuel HBV transmission (Frambo *et al.*, 2014). The prevalence of HBsAg among the parturient women in this study is 9.2%, which is close to the studies conducted in Addis Ababa, Central Ethiopia (6.0%)(Desalegn *et al.*, 2016; Anteneh *et al.*, 2018), Deder Hospital, Eastern Ethiopia (6.9%) (Umare *et al.*, 2016), and Southern Ethiopia (6.1%- 7.8%)(Metaferia *et al.*, 2016; Ramos *et al.*, 2011). In addition, the finding is also similar with the findings of research conducted in Yaounde, Cameroon (7.7%) (Fomulu *et al.*, 2013), in Mali (8.0%) (MacLean *et al.*, 2012), and in Nigeria (6.67%-8.3%) (Pennap *et al.*, 2011; Eke *et al.*, 2011). However, it was higher than previous studies carried out in other parts of Ethiopia (3%-4.4%) (Tegegne *et al.*, 2014; Zenebe *et al.*, 2014; Molla *et al.*, 2015; Desalegn *et al.*, 2016; Yohanes *et al.*, 2016) and in Dares Salaam, Tanzania (3.9%) (Rashid *et al.*, 2014). The high HBsAg positivity rate observed in this study may possibly be because of lack of timely vaccination, multiple sexual practices and low level of awareness of the different modes of HBV transmission.

On the other hand, the prevalence of HBsAg in parturient women in this study was lower than prevalence rates of 9.7% and 10.2% reported in Cameroon (Frambo *et al.*, 2014; Noubiap *et al.*, 2015), 10.8% in Yemen (Murad *et al.*, 2013), and 11.8% in northern Uganda (Bayo *et al.*, 2014). These differences may be due to differences in the study population, whereby a selected population exposed to no condom sexual intercourse in a post-conflict region with high rates of HIV infection were studied in Uganda (Murad *et al.*, 2013). Other reasons could be because of cultural practices such as circumcision in Yemen (Bayo *et al.*, 2014), and natural difference linked with various geographical situations. HBeAg status and HBV viral load are both risk factors already established to be linked with vertical HBV transmission (Kfutwah *et al.*, 2012). We have accessed the presence of HBeAg as a marker of high infectivity and proxy measure for the risk of vertical transmission of HBV.

Out of all HBsAg positive patients, 5(20.8%) were positive for HBeAg (Table 3). This finding was significantly lower as compared to other studies with 28.0% and 26.7% (Fomulu *et al.*, 2013; Anaedobe *et al.*, 2015). This may be due to differences in diagnostic methods which used ELISA kit. It has been a known fact that the risk of vertical transmission and resulting chronic infection from HBsAg positive mother to her baby is approximately 90% in HBeAg positive pregnant women (Lamberth *et al.*, 2015). In this research, out of the 24(9.2%) positive mothers, 6 of their infants were HBsAg positive giving a prevalence rate of HBV transmission from mother to child as 25.0% Out of the 6 infected infants, 5(83.3%) of them are from the rural areas of Mangu, Pankshin and Shendam (Table 3). This suggests that vertical transmission is an important means of HBV transmission in the study area where there is no birth dose vaccination program for newborn of HBsAg carrier mothers. The prevalence rate of MTCT of HBV in this study is close to a study conducted in Ghana (34.7%) (Dun-Dery *et al.*, 2017), but higher compared to a research conducted in Jos (Ozele, 2012). However, it is very much lower than the rate in Ethiopia, Nigeria, and Libya, where MTCT was 75.0%, 51.6%, and 60.9%, respectively (Tegegne *et al.*, 2014; Eke *et al.*, 2011; El-Magrahe *et al.*, 2010). Generally, MTCT of HBV infection is still high in Plateau state, this might be due to inadequate treatment for HBsAg carrier mothers and inadequate vaccination coverage for pregnant mothers. Therefore, preventing MTCT is essential to achieving the WHO goal of HBV elimination by 2030 (Jourdain *et al.*, 2019).

This can be achieved through the antiviral treatment of HBeAg-positive pregnant women and birth dose vaccination for newborns from HBsAg carrier mothers (Amsalu *et al.*, 2018; Sheng *et al.*, 2018).

In the present study, sociodemographic variables like age, marital and educational status, blood transfusion, surgery, sharing of cutters, ear-piercing and occupation of participants were not significantly associated with the risk of HBV infection. This finding agrees with the study conducted in Felege Hiwot Referral Hospital, Ethiopia (Molla *et al.*, 2015) and Nigeria (Rabiu *et al.*, 2010). However, it is different from previous study which revealed that pregnant women with no formal education had higher odds of HBV infection (Camvulam *et al.*, 2010). Parturient women who had multiple sexual partners and are having STI were almost eleven (11) times more likely to have risk of acquiring HBV infection as compared to their counterparts. This is in line with the outcomes in other parts of Ethiopia (Bertoletti *et al.*, 2015; Umare *et al.*, 2016) and in Africa (Anaedobe *et al.*, 2015; Dun-Dery *et al.*, 2017). Since a larger population of the participants (88.1%) had low level of education and awareness on routes of HBV transmission and importance of vaccination, there is need for further health education to protect pregnant women from being infected. In this study, variables such as sharing of toothbrush, vaccination, jaundice, parent's history of HBV infection and STI are significantly correlated with HBsAg in parturient woment. Among these variables, sharing of toothbrush and jaundice are novel discoveries in this research as predictors of HBsAg in parturient women. Previous studies reported that a body tattoo is a potential risk factor for HBV infection (Zenebe *et al.*, 2014; Desalegn *et al.*, 2016; Kolawole *et al.*, 2012), this agrees with our findings because a significant relationship ($p = 0.023$) was discovered between tattoo mark and HBsAg positive women.

Conclusion

The high prevalence rate of HBsAg, HBeAg, MTCT in Plateau state, as well as low awareness and practices of HBV prevention methods suggests that perinatal transmission of HBV might be the prevailing mode of HBV transmission in the study area. HBV infection among delivering women is becoming highly endemic, and the rate of MTCT was high. Having body tattoos, sharing personal care materials, insufficient knowledge of HBV, STI, Vaccination, jaundice and having parents' history of HBV infection were determinant factors for raising the prevalence of HBV infection among delivering mothers. Thus, screening of all pregnant women, administering hepatitis B vaccine to all neonates within 24 h of birth is mandatory to prevent MTCT of HBV infection and related complications. Furthermore, health education and dissemination of information about HBV for the pregnant mothers are needed, giving special consideration to young women of child-bearing age to reduce HBV infection and MTCT in Plateau state is recommended. Further studies using a larger sample size will be essential to determine the significant risk factors of MTCT.

Acknowledgement

The authors express their gratitude to the study participants and data collectors as well as the managements of JUTH, Bingham teaching hospital and Plateau state hospital management board for their support and approvals to carry out this research

Conflict of Interest

The authors declare that they have no conflicts of interest.

Reference

Amsalu A. 2018. Prevalence, infectivity, and associated risk factors of hepatitis B virus among pregnant women in Yirgalem Hospital, Ethiopia: implication of screening to control mother-to-child transmission. J Pregnancy 8435910.

Anaedobe CG, Fowotade A, Omoruyi CE, Bakare RA. 2015. Prevalence, socio-demographic features and risk factors of Hepatitis B virus infection among pregnant women in South-western Nigeria. Pan African Medical Journal **20(406).**

Anteneh A, Getachew F, Setegn E, Agete T, Demissie A. 2018. Prevalence, Infectivity, and Associated Risk Factors of Hepatitis B Virus among Pregnant Women in Yirgalem Hospital, Ethiopia: Implication of Screening to Control Mother-to-Child Transmission. Journal of Pregnancy 8435910 pp1-8.

Bayo P, Ochola E, Oleo C, Mwaka AD. 2014. High prevalence of hepatitis B virus infection among pregnant women attending antenatal care: A cross-sectional study in two hospitals in northern Uganda. BMJ Open **4(11).**

Bertoletti A, Kennedy PT. 2015. The immune tolerant phase of chronic HBV infection: new perspectives on an old concept. Cellular & Molecular Immunology **12,** pp. 258–263.

Brooks GF, Carrol KC, Butel SA, Mietziner TA, Jawetz MA. 2010. Medical Microbiology. U.S.A: McGraw Hill companies Inc.

Camvulam N, Gotsch P, Langan RC. 2010. Caring for Pregnant Women and Newborns with Hepatitis B or C," American Family Physician **82(10),** pp. 1225-1229.

Chang MH. 2007. Hepatitis B virus infection. Seminars in Fetal and Neonatal Medicine **12(3),** pp. 160-167.

Desalegn Z, Wassie L, Beyene HB, Mihret A, Ebstie YA. 2016. Hepatitis B and human immunodefciency virus co-infection among pregnant women in resource-limited high endemic setting, Addis Ababa, Ethiopia: Implications for prevention and control measures. European Journal of Medical Research **21(1).**

Dun-Dery F. 2017. Assessing the knowledge of expectant mothers on mother-to-child transmission of viral hepatitis B in the Upper West region of Ghana. BMC Infect Dis **17(1),** 416.

Eke AC, Eke UA, Okafor CI, Ezebialu IU, Ogbuagu C. 2011. Prevalence, correlates and pattern of hepatitis B surface antigen in a low resource setting. Virology Journal **8(12).**

El-Magrahe H. 2010. Maternal and neonatal seroprevalence of hepatitis B surface antigen (HBsAg) in Tripoli, Libya. J Infect Dev Ctries **4(3),** pp 168–170.

El-Serag HB. 2012. Epidemiology of viral hepatitis and hepatocellular carcinoma. Gastroenterology **142(6),** pp. 1264-1273.

Florent FY, Basila K, Jeanne HF, Nadego K, Sanrine M, Jarqueline DM. 2012. High rate of hepatitis B and C and HIV infection in Cameroon . A proposed blood screening Algorithm for blood donors in Resource limited setting. J Blood Transfu 458372.

Fomulu NJ, Morfaw FLI, Torimiro JN, Nana P, Koh MV, William T. 2013. Prevalence, correlates and pattern of Hepatitis B among antenatal clinic attenders in Yaounde-Cameroon: Is perinatal transmission of HBV neglected in Cameroon? BMC Pregnancy and Childbirth **13,** p. 158.

Frambo AAB, Atashili J, Fon PN, Ndumbe PM. 2014Prevalence of HBsAg and knowledge about hepatitis B in pregnancy in the Buea Health District, Cameroon: A crosssectional study, BMC Research Notes **7(1),** p. 394.

Jourdain G, Ngo-Giang-Huong N, Khamduang W. 2019. Current progress in the prevention of mother-to-child transmission of hepatitis B and resulting clinical and programmatic implications. Infect Drug Resist **12,** 977.

Kfutwah AKW, Tejiokem MC, Njouom R. 2012. A low proportion of HBeAg among HBsAg-positive pregnant women with known HIV status could suggest low perinatal transmission of HBV in Cameroon Virology Journal **9(62).**

Kolawole OM. 2012. Seroprevalence of hepatitis B surface antigenemia and its effects on hematological parameters in pregnant women in Osogbo, Nigeria Virol J. **9(1),** 317.

Lamberth JR, Reddy SC, Pan JJ, Dasher KJ. 2015. Chronic hepatitis B infection in pregnancy. World Journal of Hepatology **7(9),** pp. 1233-1237.

Lemoine M, Eholié S, Lacombe K. 2015. Reducing the neglected burden of viral hepatitis in Africa: strategies for a global approach. Journal of Hepatology **62(2),** pp. 469-476.

MacLean B, Hess, Bonvillain RF. 2012. Seroprevalence of hepatitis B surface antigen among pregnant women attending the hospital for women & children in Koutiala, Mali. South African Medical Journal **102(1),** pp. 47-49.

Mast EE, Margolis, Fiore HS. 2005. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP) part 1: immunization of infants, children, and adolescents. MMWR Recommendations and Reports **54(16),** pp. 1-23.

Metaferia Y, Dessie W, Ali I, Amsalu A. 2016. Seroprevalence and associated risk factors of hepatitis B virus among pregnant women in southern Ethiopia: a hospital-based cross-sectional study. Epidemiology and Health **38,** p. e2016027.

Molla S, Munshea A, Nibret E. 2015. Seroprevalence of hepatitis B surface antigen and anti HCV antibody and its associated risk factors among pregnant women attending maternity ward of Felege Hiwot Referral Hospital, northwest Ethiopia: A cross-sectional study Hepatitis virus. Virology Journal **12(1),** p. 204.

Murad EA, Babiker SM, Gasim GI, Rayis DA, Adam I. 2013. Epidemiology of hepatitis B and hepatitis C virus infections in pregnant women in Sana'a, Yemen. BMC Pregnancy and Childbirth **13(127).**

Navabakhsh B, Mehrabi N, Estakhri A, Mohamadnejad M, Poustchi H. 2011. Hepatitis B Virus Infection during Pregnancy:Transmission and Prevention, MEJDD **3(2),** pp. 92-102.

Noubiap JJ, Nansseu JR, Ndoula ST, Bigna JJ, Jingi AM, Fokom-Domgue J. 2015. Prevalence, infectivity and correlates of hepatitis B virus infection among pregnant women in a rural district of the Far North Region of Cameroon. BMC Public Health **15,** p. 454.

Ozele KC. 2012. Mother-to-Child Transmission of Hepatitis B in Jos Metropolis. Faculty of Obstetrics and Gynaecology, National Postgraduate Medical College of Nigeria (NPMCN) pp. 66-69.

Pennap GR, Osanga ET, Ubam A. 2011. Seroprevalence of hepatitis B surface antigen among pregnant women attending antenatal clinic in federal medical center Keffi, Nigeria. Research Journal of Medical Sciences **5(2),** pp. 80-82.

Petruzziello A. 2018. Epidemiology of hepatitis B virus (HBV) and hepattitis C virus (HBC) Related Hepatocellular carcinoma. Open Virol J **12,** 26-32.

Rabiu KA, Akinola OI, Adewunmi AA, Omololu OM, Ojo TO. 2010. Risk factors for hepatitis B virus infection among pregnant women in Lagos, Nigeria. Acta Obstetricia et Gynecologica Scandinavica **89(8),** pp. 1024-1028

Rajoriya N, Combet C, Zoulim FJH. 2017. How viral genetic variants and genotypes influence disease and treatment outcome of chronic hepatitis B. Time for an indivilualised approach? J Hepatol **67,** 1287-1297.

Ramos JM, Toro C, Reyes F, Amor A, Gutierrez F. 2011. Seroprevalence of HIV-1, HBV, HTLV-1 and Treponema palllidum among pregnant women in a rural hospital in Southern Ethiopia. Journal of Clinical Virology **51(1),** pp. 83-85.

Rashid S, Kilewo C, Aboud S. 2014. Seroprevalence of hepatitis B virus infection among antenatal clinic attendees at a tertiary hospital in Dar es Salaam, Tanzania. Tanzania Journal of Health Research **1(16),** pp.. 1-8.

Sheng QJ. 2018. Hepatitis B virus serosurvey and awareness of mother-to-child transmission among pregnant women in Shenyang, China: an observational study. Medicine (Baltimore) **97(22),** e10931.

Shimelis TW, Torben, Medhin G. 2008. Hepatitis B virus infection among people attending the voluntary counselling and testing centre and anti-retroviral therapy clinic of St Paul's General Specialised Hospital, Addis Ababa, Ethiopia. Sexually Transmitted Infections **84(1),** pp. 37-41.

Sunbul M. 2014. Hepatitis B virus genotypes: global distribution and clinical importance. World J Gastroenterol **20,** 5427-5434.

Tao L, Paore TR, Diarra B, Djigma F, Zohoncon TM, Assih M, Quemi D, Pietra V, Karou SDSJ. 2014. Seroepidemiology of hepatitis B viruses in the general population of Burkina Faso. Hepat Res Treat 781-843.

Tegegne D, Desta K, Tegbaru B, Tilahun T. 2014. Seroprevalence and transmission of Hepatitis B virus among delivering women and their new born in selected health facilities, Addis Ababa, Ethiopia: A cross sectional study. BMC Research Notes **7(1),** p. 239.

Umare A, Seyoum B, Gobena T, Mariyam TH. 2016. Hepatitis B virus infections and associated factors among pregnant women attending antenatal care clinic at deder hospital, eastern Ethiopia. PLoS ONE, **11(11),** Article ID e0166936.

Wang H, Men P, Xiao Y. 2019. Hepatitis B infection in the general population of China: a systematic review and meta-analysis. BMC Infect Dis **19,** 811.

Wright TL. 2006. Introduction to chronic hepatitis B infection. American Journal of Gastroenterology, **101(1),** pp. S1-S6, 2006.

Yohanes T, Zerdo Z, Chufamo N. 2016. Seroprevalence and Predictors of Hepatitis B Virus Infection among Pregnant Women Attending Routine Antenatal Care in Arba Minch Hospital, South Ethiopia. Hepatitis Research and Treatment pp. 1-7.

Zenebe Y, Mulu W, Yimer M, Abera B. 2014. Sero-prevalence and risk factors of hepatitis B virus and human immunodeficiency virus infection among pregnant women in Bahir Dar city, Northwest Ethiopia: a cross sectional study. BMC Infectious Diseases **14(1),** p. 118.

Zhang Z., Chen C., Li Z., Wu Y.H., Xiao X.M, 2014. Individualized management of pregnant women with high hepatitis B virus DNA levels. World Journal of Gastroenterology, **20(34),** pp. 12056–12061.