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Hepatitis B virus infection and infectivity status among pregnant women in Nigeria

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Abstract

Objectives: To determine the seroprevalence of hepatitis B surface antigen (HBsAg) and the infectivity status (HBeAg) among pregnant women. **Methods:** A cross sectional study carried out among pregnant women attending antenatal clinic or delivering at Federal Medical Center, Umuahia, Nigeria was done by simple random sampling using a computer generated table of random numbers. HBsAg screening was done using an immunochromatographic test kit. The main outcome measure was detection of hepatitis B virus (HBV) carrier and infectivity statuses by detecting the presence of HBsAg and HBeAg respectively in the sera. Statistical analysis was done using Epi Info 2008 version 3.5.1 and statistical significance was set at $p<0.05$ providing 95% confidence interval. **Result:** A total of 300 pregnant women were recruited into the study. Of these, 5 tested positive to HBsAg, giving a seroprevalence of 1.7%. None of the five HBsAg positive pregnant women tested positive to HBeAg. The HBV/HIV co-infection rate was 0.7%. Although 40% of HBsAg positive women were in the upper socio-economic class, no bio-social characteristic was found to be associated with hepatitis B serostatus. Forty percent of the HBsAg positive pregnant women were nulliparous. Of the expected risk factors, only a previous history of contact with one with jaundice was statistically significant ($p=0.003$, $d=1$). **Conclusion:** The prevalence of the hepatitis B virus among the pregnant women in the study area is 1.7% and transmission is likely horizontal. Strengthening of universal infant immunization with emphasis on joint-immuno prophylaxis of infants born to HBV-carrying mothers should be implemented.

Keywords: Hepatitis B; Transmission; seroprevalence; HBsAg.

INTRODUCTION

Infection with hepatitis B virus (HBV) remains a major public health problem worldwide [1]. Approximately a third of the world's population have serological evidence of infection with hepatitis B virus (HBV) [1, 2]. Nigeria is a hyper-endemic area with infected population of 18 million though the rates of carrier states vary widely [2]. However, despite an effective immunization programme initiated by the World Health Organization (WHO), Nigeria is still grappling with high prevalence of HBV infection [3], with prevalence of the infection in pregnant women ranging from 2 to 15% [4, 5].

Transmission of HBV from carrier mothers to their babies during the perinatal period is the most important factor in determining the prevalence of infection in high endemicity areas [6]. In the absence of immunoprophylaxis, a vertical transmission rate of 2-15% has been documented for infants of mothers who were HBsAg positive ($HBsAg^+$) but hepatitis B e antigen negative ($HBeAg^-$) [5]. Conversely, there is up to 90% chance of acquiring perinatal HBV infection if the mother is simultaneously $HBsAg^+$ and $HBeAg^+$ [7]. Although the presence of HBeAg reflects continued viral replication, HBeAg is only a qualitative marker while HBV-DNA is quantitative indicator [8, 9]. Though HBV DNA load is the most important predictor of HBV transmission from mother to child, HBeAg remains an important marker for potential infectivity in pregnant women, particularly in those situations in developing countries where viral load estimates may not be accessible and inexpensive [10]. HBeAg testing is simple to implement, not expensive and may still be useful in resource poor settings to identify those women at augmented risk of transmitting HBV leading to viral persistence in their offspring.

Due to its significant economic and public health impact, control and prevention of hepatitis B virus infection remains an important public health priority hence the need to continue to update its epidemiology [4]. Prenatal screening does not only identify infected mothers but also seeks to establish their infectivity status

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thus allowing immunization of their newborns with hepatitis B immune globulin (HBIG) and hepatitis B vaccine. But in spite of these advantages, antenatal screening for hepatitis B infection is not widely practiced in Nigerian hospitals [4]. The need for catch up vaccination is itself determined by the baseline epidemiology of HBV infection in the population [11].

The benefits of detecting infected pregnant women include not only identification of infants who may require prophylaxis, but of women who might need treatment, sexual and household contacts that will benefit from testing, counselling, vaccination or therapy if indicated [12]. Although studies on epidemiology of viral hepatitis are available from different regions in Nigeria [3-5, 13], none of these studies have included women undergoing labor. The implication is that infants born to $HBsAg^+$ mothers not registered for prenatal care will not be identified within the optimal 12-hour period for HBIG administration [14]. This cohort of women therefore, represent a high risk group that require careful evaluation to establish optimal prevention and control strategies including screening at the time of admission for child birth.

This study is therefore designed to determine the seroprevalence of hepatitis B surface antigen (HBsAg) among pregnant women attending Ante natal Clinic or delivering in Umuahia, Nigeria; determine infectivity status of chronic carrier women thereby identifying pregnancies at increased risk of perinatal transmission of HBV infection. This will provide baseline information for future research and reappraisal of present global prevention and control strategies.

METHODS

This study was cross–sectional in design and carried out on antenatal attendees of the obstetrics and gynecology department and women who delivered in the labor wards of Federal Medical Centre, Umuahia, Nigeria**.** The Federal Medical Centre, Umuahia, is located in Umuahia, the capital city of Abia State, south eastern Nigeria. It is one of the two tertiary hospitals in the state. The centre offers training of post graduate doctors in obstetrics and gynaecology and serves as a referral centre for both private and government health institutions in Abia state and its environs. The study received ethical approval from the Federal Medical Center, Umuahia, Nigeria Ethics Review Board (approval number=FMC/QEH/G.596/vol.4.01).

Pregnant women seen at the antenatal clinic and in the labor ward of FMC Umuahia, Nigeria and gave consent was included in the study. Women who withheld consent were excluded. The main outcome measure was the detection of HBV carrier and infectivity statuses by detecting the presence of HBsAg and HBeAg respectively in the sera of pregnant women.

In a previous study by Obi *et al* [15] involving pregnant women screened for hepatitis B virus in Enugu, the prevalence rate of Hepatitis B surface antigen (HBsAg) was 4.6%. To achieve a power of 80% to detect a difference between 7.0% (assumed) and 4.6% (actual) using the χ^2 test (2-sided) with continuity correction and a significance level of 0.05, Stata PASS version 10 (NCSS; Kaysville, Utah, USA) and Epi Info version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, GA, USA) both yielded a sample size of 270. To account for a potential loss to follow-up of 10%, 300 women were enrolled for the study.

A self-administered structured questionnaire was given to each participant. The completed questionnaires were then retrieved from the participant prior to sample collection. The information retrieved included personal and socio-demographic data such as age, ethnicity, educational status, occupation and religion of the woman and her partner, type of marriage and history of tattooing and contact with a jaundiced person. Relevant past medical and surgical histories including past history of hepatitis, jaundice, HIV status, blood transfusion, intravenous drug use and dental procedures were elicited. The number of sexual partners since the sexual debut and past history of sexually transmitted infections were explored. Obstetric information included the last menstrual period, gestational age, and parity, booking status of the patient, place of previous deliveries and history of previous abortions. To maintain confidentiality, use of names for identification of study subjects was avoided.

The procedure for specimen collection and preparation as well as the technique of testing for HBsAg antigen and HBeAg antigen was carried out under the guidance and supervision of a registered laboratory scientist.

Pregnant women found to be HBsAg-positive, were tested for the presence of hepatitis B e antigen (HBeAg) which is a marker of relative infectivity and higher risk of perinatal transmission. The specimens that were used for this method were the remaining sera of the pregnant women who are HBsAg-positive. Fresh specimens were not be collected except otherwise indicated.

The testing for hepatitis B e antigen (HBeAg) for those pregnant women found to be HBsAg-positive was done using HBeAg test kits by Global laboratories, USA. The HBeAg test is an immunochromatography based one step in vitro test. It is designed for qualitative determination of HBeAg in human serum [16].

HBeAg test is a sandwich immunoassay. When serum is added to sample strip, it moves through the conjugate strip and mobilize gold anti-HBeAg antibody conjugate that is coated on the conjugate strip. The mixture moves along the membrane by capillary action and reacts with HBeAg that is coated on the test region.

If HBeAg is present, the result is the formation of a coloured band in the test region. If there is no HBeAg in the sample, the area will remain colourless. The sample continues to move to the control area and forms a pink to purple colour, indicating the test is working and the result is valid.

For each subject, all information obtained was recorded in the coded study data sheet specifically designed for the study. The variables were entered into and subjected to analysis using Epi Info 2008 version 3.5.1. The results were expressed as absolute values and percentages. Cross tabulation was used to explore statistical relationship between variables. Chi square test was used to explore statistical relationships between groups. Statistical significance was set at $p < 0.05$ providing 95% confidence interval.

RESULTS

A total of 327 women were recruited for the study. However, 314 pregnant women consented and were interviewed. Fourteen questionnaires were rejected because of incompleteness, hence 300 questionnaires were subsequently analysed giving a response rate of 91.7%.

Table 1 shows socio-demographic characteristics of all the pregnant women studied. The mean age of the women was 29.9±4.9 years. Most of the respondents were of Abia State origin (73.7%), had tertiary education (64.4%), were married (99.3%), monogamous (95.7%), Christian (99.3%) and in social class II (50.3%).

A total of 5 out of the 300 pregnant women studied were positive for HBsAg. Hence, the seroprevalence of hepatitis B among them was 1.7%. None of the patients was found to be positive for HBeAg.

Table 2 shows association between the women's bio-social characteristics and hepatitis B sero-status. Most of the pregnant women (80.0%) that were found to have positive Hepatitis B surface antigen were aged between 25-34 years and the mean age was 31.0±3.7 years, compared to the mean of 29.8±4.9 years of those who were negative.

Table 1: Socio-demographic characteristics of the subjects

Characteristic	Frequency (n=300)	Percentage (%)
Age (years)		
15 -19	4	1.3
20– 24	30	10.0
25 –29	116	38.7
30-34	95	31.7
35-39	51	17.0
40-44	4	1.3
Mean±SD	29.9±4.9	
Educational Level		
Primary	7	2.3
Secondary	100	33.3
Tertiary	193	64.4
Marital Status		
Single	2	0.7
Married	298	99.3
Type of marriage		
Monogamous	287	95.7
Polygamous	13	4.3
Religion		
Christianity	298	99.3
Islam	2	0.7
Place of Origin		
Abiriba/Ohafia	31	10.3
Arochukwu	11	3.7
Bende/Isuikwuato	47	15.7
Isuochi	5	1.7
Umuahia/Ikwuano	96	32.0
Ukwa/Ngwa	31	10.3
Others	79	26.3
Social class*		
Class I	33	11.0
Class II	151	50.3
Class III	88	29.3
Class IV	25	8.4
Class V	3	1.0

*Social classes were determined based on mother's education and father's occupation. Social class I was termed as "upper", II or III as "middle" and IV or V as "low"

Table 2: Relationship between respondents' socio-demographic characteristics and hepatitis b sero-status

Characteristic	Frequency n=300(%)	HBsAg+ n=5(%)	HBsAg- n=295(%)	P-VALUE
Age (years)				
15 -19	4(1.3)	0(0.0)	4(1.4)	
20– 24	30(10.0)	0(0.0)	30(10.2)	
25 –29	116(38.7)	2(40.0)	114(38.6)	
30-34	95(31.7)	2(40.0)	93(31.5)	
35-39	51(17.0)	1(20.0)	50(16.9)	
40-44	4(1.3)	0(0.0)	4(1.4)	
Marital Status				
Single	2(0.7)	0(0.0)	2(0.7)	
Married	298(99.3)	5(100.0)	293(99.3)	
Type of marriage				
Monogamous	287(95.7)	5(0.0)	282(95.6)	
Polygamous	13(4.3)	0(0.0)	13(4.4)	
Educational Level				
Primary	7(2.3)	0(0.0)	7(2.3)	1.00
Secondary	100(33.3)	2(40.0)	98(33.2)	df=1
Tertiary	193(64.4)	3(60.0)	190(64.4)	
Educational Level of spouse				
Primary	13 (4.3)	0(0.00)	13(4.4)	1.00
Secondary	123 (41.0)	2(40.0)	121(41.0)	df=1
Tertiary	164 (54.7)	3(60.0)	161(54.6)	

Religion				
Christianity	298(99.3)	5(100.0)	293(99.3)	
Islam	2(0.7)	0(0.0)	2(0.7)	
Social Class*				
Class I	33(11.0)	2(40.0)	30(10.2)	
Class II	151(50.3)	2(40.0)	149(50.7)	0.097
Class III	88(29.3)	1(20.0)	87(39.6)	df=2
Class IV	25(8.4)	0(0.0)	25(8.5)	
Class V	3(1.0)	0(0.0)	3(1.0)	

*Social classes were determined based on mother's education and father's occupation.[101] Social class I was termed as "upper", II or III as "middle" and IV or V as "low".

Table 3: Obstetric characteristics of the subjects

Characteristic	**Frequency** n=300(%)	**HBsAg+** n=5(%)	**HBsAg-** n=295(%)	**P-VALUE**
Parity				
Nulliparous	127(42.3)	2(40.0)	125(42.4)	0.789
Primiparous	83(27.7)	2(40.0)	81(27.5)	
Multiparous	90(30.0)	1(20.0)	89(30.1)	
Booking Status				
Booked	275(91.7)	5 (100.0)	270(91.5)	
Unbooked	25(8.3)	0 (0.0)	25 (8.5)	
Gestational Age				
Ist trimester	44(14.7)	2(40.0)	42(14.2)	
2nd trimester	144(48.0)	2(40.0)	142(48.2)	0.287
3rd trimester	112(37.3)	1(20.0)	111(37.6)	
Place of delivery				
Church	5 (1.7)	0 (0.0)	5 (1.7)	
Home	1 (0.3)	0 (0.0)	1(0.3)	
Medical facility	176 (58.7)	3 (60.0)	173 (58.7)	
No Previous Delivery	118 (39.3)	2 (40.0)	116 (39.3)	

Table 4: Risk factors of HBsAg transmission among the respondents

Variable	**Frequency** n=300(%)	**HBsAg+** n=5(%)	**HBsAg-** n=295(%)	**P-VALUE**
Past history of hepatitis				
YES	29 (9.7)	1(20.0)	28(9.5)	
NO	271 (90.3)	4(80.0)	267(90.5)	0.401
Past history of jaundice				
YES	9 (3.0)	1(20.0)	8(2.7)	
NO	291 (97.0)	4(80.0)	287(97.3)	0.142
Past history of contact jaundiced Patient				
YES	22 (7.3)	3(60.0)	19(6.4)	
NO	278 (92.7)	2(40.0)	276(93.6)	0.003
Past history of blood transfusion				
YES	21(7.0)	0(0.0)	21(7.1)	
NO	279 (93.0)	5(100.0)	274(92.9)	
Past history of IV drug use				
YES	116 (38.7)	4(80.0)	112(38.0)	
NO	184 (61.3)	1(20.0)	183(62.0)	0.075
Past history of Scarification				
YES	67 (22.7)	1(20.0)	66(22.4)	
NO	232 (77.3)	4(80.0)	229(77.6)	0.899
Past history of dental/other surgery				
YES	30 (10.0)	2(40.0)	28(9.5)	0.080
NO	270 (90.0)	3(60.0)	267(90.5)	

No bio-social characteristic was found to be associated with hepatitis B sero-status. All the hepatitis B positive pregnant women 5 (100%) were married and in a monogamous relationship. Most of the respondents had tertiary education 193 (64.4%) while only 7 (2.3%) had only primary education. However, all of the hepatitis B positive women had either secondary education 2 (40%) or tertiary education 3 (60%). This was not statistically significant. (Fisher exact test; p=1.00, df=1)

Table 2 also shows that most of the patients studied were in the middle social class with 50.3% in social class II and 29.3% in class III. However, 40.0% of the pregnant women with Hepatitis B were found in upper socio-economic class I and class II respectively and did not differ significantly with those who were sero-negative.

On the parity distribution of the women, table 4 showed that 127 (42.3%) of them were nulliparous while 83 (27.7%) of them were primiparous**.** However, all of the sero-positive women who have had previous deliveries did so in a medical facility. Although 2 (40%) each, of the patients positive for HBsAg were nulliparous and primiparous respectively, no significant association was demonstrated between parity and hepatitis B serostatus (p=0.789) (table 3).

Analysis of the booking status of the women showed that most of them 275 (91.7%) were booked. Of these booked women, 144 (48.1%) were in the second trimester. All the women who tested positive for hepatitis B were booked. (Table 3)

Analysis of the gestational age showed that most of the women 4 (80%) with positive hepatitis serostatus were either in first or second trimester. However, there was no statistically significant association demonstrated between gestational age and presence of hepatitis B surface antigen in the blood (Fisher exact test; p=0.208). (Table 3)

Table 4 shows the association between some predisposing factors associated with HBV transmission and HBsAg positivity. Twenty two (7.3%) of the women gave a history of contact with a relative, a spouse, a friend or someone with jaundice in the past, while 278 (92.3%) never had contact with anyone with jaundice in the past. Among those who had a history of such contact, 3 women tested positive to HBsAg. This was statistically significant (p=0.003). The presence of tribal and other scarification marks, previous dental or surgical procedures, previous blood transfusion and parenteral drug use were not statistically significant routes of transmission of HBV.

Furthermore, considering history suggestive of previous sexually transmitted disease among the HBsAg+ respondents (Table 5) only 1 (20.0%) had previous history of genital ulcers while 3 (60.0%), 2 (40.0%) and none (0.0%) had previous history of vaginal discharge, lower abdominal pain and painful intercourse respectively. Analysis of previous induced abortions as a procedure which may increase the risk of acquisition of HBV, majority of them 3 (60.0%) that were HBsAg sero-positive had not had abortions.

Majority, 3 (60%), of women sero-positive for HBsAg had sexual debut by 21-25 years age and each of them had a single sexual partner afterwards. Three (40%) of those who were Hepatitis B sero-positive were also HIV sero-positive. However, there was no significant difference between the HIV sero-status of those who were HBsAg sero-positive and those who were sero-negative (Fisher exact test; p=0.201, df=1). The HIV/HBV co-infection rate from the study was therefore 2/300 or 0.7%.

Table 5: Relationship between respondents' gynaecological characteristics and hepatitis b sero-status

Characteristic	**Frequency** n=300(%)	**HBsAg+** n=5(%)	**HBsAg-** n=295(%)	**P-VALUE**
Genital ulcers				
Yes	44 (14.7)	1(20.0)	43(14.6)	p=0.550
No	256 (85.3)	4(80.0)	252(85.4)	
Virginal discharge				
Yes	98 (32.7)	3(60.0)	95(32.2)	
No	202 (67.3)	2(40.0)	200(67.8)	p=0.198
Lower abdominal pain				
Yes	107 (35.7)	2(40.0)	105(35.6)	
No	193 (64.3)	3(60.0)	190(64.4)	p=0.586
Painful intercourse				
Yes	53 (17.7)	0(0.0)	53(18.0)	
No	247 (82.3)	5(100.0)	242(82.0)	
Number of abortions				
0	199 (66.3)	3(60.0)	196(66.4)	
1	37 (12.3)	1(20.0)	36(12.2)	
≥2	50 (16.7)	1(20.0)	49(16.7)	
No response	14 (4.7)	0 (0.0)	14 (4.7)	

DISCUSSION

The result of this study showed that the prevalence of HBsAg among pregnant women that attended the antenatal clinic or delivered in the hospital was 1.7%. Hence, according to the WHO classification for Hepatitis B endemicity, Umuahia, Nigeria, is a low-endemicity area for hepatitis B virus infection [3, 17, 18]. The implication of this is that one in every 60 pregnant women in the hospital is a healthy carrier.

This prevalence is lower than that reported in other South-Eastern parts of Nigeria. For instance a prevalence of 8.3% [4] was reported in pregnant women in Nnewi, Nigeria and 4.6% [15] in the obstetric population in Enugu, Nigeria. It is also lower than 4.1% [19] and 9.1% [20] reported for Abakaliki, and Nsukka in Nigeria respectively, in non-obstetric populations. However, although in the same geopolitical zone, subtle socio-cultural and demographic differences exist between these populations. Prevalence rates of HBsAg among different subjects in Nigeria differ significantly at inter-state levels and these difference in endemicity may be attributable to differences in the populations studied [21, 22]. The studies in Nnewi, Nigeria and Enugu, Nigeria were hospital based studies in large referral hospitals while the study in Abakaliki, Nigeria involved adolescents and the study in Nsukka, Nigeria recruited prisoners and rural dwellers. These populations were not only considered to be at comparatively high risk for HBV infection, but also included males, in whom the prevalence of HBsAg is higher [23, 24]. Differences in the testing methods also exist between these studies. The

studies in Nnewi, Nigeria and Abakaliki, Nigeria utilized serial testing with third generation ELISA kits which are more sensitive than the single immunochromatography test used for this study.

The prevalence from this study is lower than the 11% reported in the obstetric population of Makurdi, Nigeria [3], 6.67% [25] and 12.3% [24] reported in pregnant women in Keffi, Nigeria and Minna, Nigeria respectively, in North-Central Nigeria. This prevalence is also lower than 8.2% [22] and 11.6% [23] reported in obstetric populations in Yola and Maiduguri respectively, in North-Eastern Nigeria. When compared with reports from South-West Nigeria, the prevalence of 1.7% in this study is lower than 4.0% [24] and 6.08% [28] reported in pregnant women in Abeokuta and Lagos respectively in South-West Nigeria. This is consistent with the finding that HBV is known to vary in its epidemiology between regions of the same country [23].

However, apart from the heterogeneity of the socio-demographic characteristics, socio-cultural and sexual practices among these regions, differences in sampling and testing methods may also account for the differences observed in these studies. Though within the same continent, the result of this study is also lower than the 6.5% [23], 18.2% [26] and 4.0% [30] for pregnant women in Zambia, Ghana and Egypt respectively.

Although the seroprevalence of HBV in the present study is in the low endemicity range comparable to that in USA and Europe, sexual transmission is unlikely to be the major route of transmission in Umuahia, Nigeria. Rather, the relatively low prevalence seen in this study conducted in an HBV endemic area may be attributable to the low-risk nature of the study population. It can be seen, that most of the HBsAg positive women did not report previous history suggestive of sexually transmitted infection and all those who had parenteral drugs did so in a medical facility.

Previous history of contact with somebody with jaundice was the only statistically significant predisposing factor to HBsAg infection established from this study. This finding is consistent with the finding of Sali *et al* [31] and Toukan *et al* [32]. This finding is pertinent because the risk of transmission of HBV is known to be high in people who are in contact with chronically infected subjects [4, 31]. Close body contact with patients with active infection or carriers especially those with skin lesions like impetigo, scabies and cuts enable transfer of blood and body fluids [33]. However, such infection in the adult results in only 10% carrier risk [4]. Without prejudice to the plausibility of horizontal transmission of HBV in the study population, this study was limited by its inability to establish HBV infection in these contacts and exclude other causes of jaundice in them.

Indeed, in most countries across the world, the epidemiology of HBV infection has changed after the integration of HBV vaccination in infants and high-risk groups. Consequently after several years it seems that the primary vertical route, mothers-to-child, has shifted to horizontal routes of HBV transmission [34]. It is also posited that most infections in Nigeria occur through horizontal transmission [31]. Indeed, a previous history of sexually transmitted infections, previous blood transfusion, previous surgeries/dental manipulations and tribal marks/tattoos were not significantly associated with HBV infection from this study. This corroborates with findings in some studies [30] but not in others [21].

None of the HBsAg+ women in the present study tested positive to HBeAg, unlike in Makurdi [5] where the seroprevalence rates of HBeAg were 3.3%. This is not surprising, as comparatively few black Africans who are carriers of HBV still have replicative infection by the time they reach adulthood [35]. However because patients with precore mutation do not synthesize HBeAg, HBV-DNA will still be required to establish with certainty, infectious women likely to transmit the infection to their baby [7]. The HBeAg seroprevalence in the study population has important connotations, especially regarding maternal treatment and neonatal immunization.

The HBeAg seroprevalence of 0% implies that Lamuvidine treatment for maternal disease only in the HBsAg- women may be futile as HBsAg- chronic hepatitis B has poorer prognosis and treatment response than does $HBeAg^+$ chronic hepatitis B [39]. On the other hand, though HBV infection is highly preventable through vaccination, 5-10% of infants are not protected by vaccination [37]. Therefore, Lamuvidine treatment of highly viraemic HBsAg+ women during the final months of pregnancy may effectively reduce the risk of perinatal transmission of HBV, even in the setting of HBV vaccination plus HBIG [37]. However, Lamuvidine treatment for this reason will not be required in the HBsAg positive women in the study as there is no evidence of high maternal viraemia.

The clinical implication of this study that attempted to explore the infectivity status was revealed in a very recent prospective cohort study in China that assessed the effects of caesarean section (CS) on the prevention of mother-to-child transmission of hepatitis B virus (HBV) among hepatitis B surface antigen (HBsAg) positive pregnant women [38]. The study explored the relationships between mode of delivery and the presence of HBV MTCT. They concluded that CS had a protective effect on early MTCT of HBV. The authors reported that CS for HBeAg-positive mothers with high viral load could lessen the risk of MTCT and may become a new preventive measure of HBV MTCT through research on its risk-benefit assessment [38].

Maternal HBV-DNA positivity is associated with high risk of intrauterine transmission of HBV and perinatal transmission increases as viral load increases [37]. Therefore, using HBeAg as a surrogate marker of HBV-DNA, the HBeAg negativity in the study implies that the risk of vertical transmission of HBV in HBsAg+ women should be sufficiently low that active and passive immunoprophylaxis of the infant will suffice. Even in the absence of the HBIG due to prohibitive cost, highly immunogenic recombinant HBV vaccines have been shown to be 90-95% effective in preventing HBV transmission, provided the three-dose schedule is strictly followed [2,3].

HBsAg+ women in this study were all married in a monogamous setting. This is expected since the respondents were predominantly Christians, a religion of which adherents expectedly strongly propagate monogamy as well as prohibit premarital and extramarital sex in both gender. Nevertheless, this finding corroborates that of Sali *et al* [31] and Pennap *et al* [25] where marital union was found to be a risk factor for HBsAg positivity. Furthermore, although the population studied clustered in the middle social class, HBsAg positivity preponderated in the upper class but in the low endemicity range. This is not surprising as decrease in HBV carrier rate accompanies urbanization [39]. However, the finding in the study is contrary to that by Ugwuaja and Ugwu [38], where HBV infection was found more in the lower class. That study recruited adolescents predominantly in the middle and lower socio-economic class which may explain the observed difference from findings in this study.

Most of the women studied (62.7%) were in the first and second trimester. This group had the highest number of HBsAg+ women in this study but no meaningful generalization can be made as this was not statistically significant (Fisher exact; p=0.287). Similarly, the observed concentration of HBsAg positive women in the booked group may just be because of the comparatively fewer number of unbooked women in the study.

The HIV/HBV co-infection rate from this study of 0.7% is less than a co-infection rate of 4.2% [4] and 51.9% [40] respectively in Nnewi and Lagos, Nigeria. HIV/HBV co-infection was similarly very low 0.20% [8] in a study in Benin- city, Nigeria, where it was concluded that obstetric co-infection with HIV and HBV was rare in their parturients. Since HBV and HIV have similar routes of spread, the low HBV/HIV co-infection rate in

this study can be explained by the low risk nature of the population as previously explained. Indeed, a study in Malawi showed that there was no statistical evidence to suggest that HIV positivity was associated with an increased prevalence of HBV [41]. The significance of HBV/HIV co-infection is seen in the study in Lagos [40] where HBV/HIV co-infection was found to result in significant reduction in T-lymphocyte count and deteriorates liver function.

CONCLUSION AND RECOMMENDATIONS

The result of this study show low seroprevalence of hepatitis B among pregnant women. It also shows negligible infectivity rate in the HBsAg+ pregnant women. Of the socio-demographic variable studied, only contact with one with jaundice was statistically significant. This low prevalence of chronic HBV carrier state, negligible infectivity and significant history of contact with one with jaundice as the only risk factor identified in the study implies horizontal rather than vertical transmission of HBV. Therefore, control of HBV infection is likely to be dependent more on a national control strategy in the general population rather than a local control policy only. To this end, strengthening universal vaccination of all infants as presently practised with emphasis on a birth dose programme and achieving 90% coverage is recommended. With decrease in the carrier pool, a national HBV immunization programme should prevent HBV infection in children and subsequently, adults as well. Proper health education and catch up immunization of the population at risk should be planned as an adjunct to this control strategy.

Competing interests:

There is no conflict of interest.

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