

PREVALENCE AND DETERMINANTS OF HEPATITIS B VIRUS ANTIGENEMIA AMONG PREGNANT WOMEN ATTENDING ANTENATAL CLINICS IN SOME HOSPITALS IN BAUCHI METROPOLIS

ABSTRACT

Background: Hepatitis B virus infection is a significant public health problem in the world and is more common among most vulnerable individuals such as pregnant women in developing countries.

Design and Duration: This is a cross-sectional study involving pregnant women attending antenatal clinics in some hospitals in the Bauchi metropolis, from January 2021 to February 2022.

Aim: The aim of this study is, therefore, to assess the seroprevalence and determinants of the hepatitis B virus among pregnant women attending some hospitals in Bauchi Metropolis, Nigeria.

Materials and Methods: A total of 394 blood specimens were collected from the fingertip of the randomly selected pregnant women. A structured questionnaire was administered and interviews were conducted for data collection. The participants were screened for HBsAg status by rapid diagnostic test.

Results: The overall prevalence of the disease was 11.7% (46 of 394). The infection was more common (39.1%) among the women in the 31 to 35 years age group, followed by 23.9% (26-30) years. The majority are married (67.4%), business owners (30.4%), then civil servants (26.1%) and had attended tertiary education (52.1%). The highest frequency (63.0%) was found among the antenatal women at primiparous and mainly (50%) started visiting in the 3rd trimester, with 2 children as the highest number of live births (45.7%). Risk factors analysis revealed that, most of the women positive (78.3%) have no history of previous surgery, or blood transfusion (61.20%), but 52.2% are co-infected with HIV/AIDS.

Conclusion: This study found a relatively low prevalence of HBV infection (11.7%) among pregnant women in this area, but it was very high, especially among the unvaccinated and those co-infected with HIV.

INTRODUCTION

Hepatitis B virus (HBV) is a DNA virus of the family *hepadnaviridae* and the etiologic agent of hepatitis B infection [1]. The virus is about a hundred times more contagious than HIV and highly infectious than the hepatitis C virus (HCV). Many infected carriers are usually asymptomatic and unaware of their infective conditions until they reach the advanced stage silently [2]. The virus infective dose to be transmitted through such practices as sharing a toothbrush, unsterilized blades, or needles is similar to that of HIV, as the duo shares a common route [3]. There are about 350 million people infected with Hepatitis B Virus globally [4], where Nigeria was considered among the endemic countries [5].

Hepatitis B virus infection is one of the most common diseases of the liver all over the world. The virus was first discovered in a hospitalized patient blood in Australia, thus called Australian antigen, but later re-named as hepatitis B surface antigen (HBsAg) [6]. This antigen was further identified after some as a marker for patients at high risk for transmission of the infection [7]. The virus is spread through body contact sexually and congenitally, where about 10% occurs in utero and mostly during delivery [7, 8]. Mothers who are positive for both Hepatitis B antigens

(HBsAg and HBeAg) have up to 90% chance of transmitting the virus to their newly born babies [8, 9]. This transmission mainly occurs at, or around the time of birth through the mixing of maternal blood and genital secretions. Approximately 25% of the carrier neonate will die from cirrhosis or hepatic carcinoma between late childhood and adulthood [9, 10].

Pregnancy does not alter the natural history of hepatitis B infection. Vertical transmission is the commonest mode of transmission worldwide [10,11]. Without immuno-prophylaxis, the transmission occurs 70 to 90% if the mothers are HBeAg positive [11,12]. This is reduced to 40% if the mother is HBeAg negative. Overall, vertical transmission is reduced to 5 to 10% with passive and active vaccination [11]. However, mothers with high viral load despite immuno-prophylaxis can have 8 to 32% of infants becoming infected and if treatment is given at the third trimester it may reduce the morbidity drastically [12]. Some pregnant women may likely develop fulminant hepatitis, resulting in massive hepatic necrosis. About 10% of pregnant women positive for Hepatitis B virus infection may be chronic carriers, that can develop liver cirrhosis and hepatocellular carcinoma [13,14].

Viral (serum) hepatitis is responsible for a significant number of liver diseases globally and infected individuals can remain asymptomatic for many years. However, more than 80% of these patients become chronic carriers which can increase the risk of liver cancer and subsequent failure in the next three decades [15]. Serum hepatitis has similar modes of transmission; thus coinfection is common especially in areas of high prevalence and among people at high risk of the infection acquired parenterally [16]. It is estimated that more than two billion people have been infected by HBV worldwide and 350 million people have a chronic infection [17, 18]. When a pregnant woman is infected with HBV, there is a chance of infecting her foetus. It has been reported that 10 - 20% of women seropositive for HBsAg transmit the virus to their neonates, but in women who are co-infected, vertical transmission is approximately 90% [18].

The global prevalence of HBV has considerable economic implications because some of its complications such as cirrhosis and cancer make great demand on the care system. However, from a true economic point of view, hepatitis B is more dreaded than acquired immune deficiency syndrome (AIDS) where patients die silently rather than developing the chronic disease [19] (WHO 1982). HBV is the leading global cause of this chronic liver disease and worldwide about 20-25% of people with chronic hepatitis infection develop progressive liver disease [20].

Chronic HBV infection has been defined as the carriage of HBsAg for at least six months and the highest risk (80 – 90%) of chronic infection has been found among infected neonates born to HBeAg-positive carrier mothers [21]. Nigeria is classified among the group of countries endemic to HBV infection. Currently, about 18 million Nigerians are infected [22,23]. Many of these people may not be aware of the infection and hence fail to seek appropriate medical attention, therefore, progressing to chronic cases and severe complications. Where there is pregnancy, it constitutes a serious health risk not only to the unborn child but to the entire community [24].

In some cases, the principal risk to human health is associated with the transmission of pathogens like Hepatitis B Virus from mother to foetus, which implies that knowledge of the prevalence of hepatitis in relation to pregnant women will help in reducing the risk. Hepatitis B is highly transmissible, with high incidence, and can lead to severe complications after infection [25, 26]. In Nigeria, a report on the serum carrier rate of the surface antigen of hepatitis B virus (HBsAg) showed that the infection is gradually increasing, especially among pregnant women [27, 28]. The need to screen their blood during the antenatal visit, therefore, becomes absolutely necessary in order to prevent the rate of infection and congenital transmission.

The prevalence of HBV infection is more common in some vulnerable individuals such as pregnant women [29]. In fact, there are few studies on this contagious disease in pregnant women in developing countries, such as Nigeria. Most of the previous studies usually focused on the entire population instead of a specific group like pregnant women. The aim of this study is, therefore, to assess the seroprevalence and determinants of hepatitis B virus among pregnant women attending some hospitals in Bauchi Metropolis, Nigeria.

MATERIALS AND METHODS

Study design

This is a cross-sectional study involving pregnant women attending antenatal clinics in Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH), Specialist Hospital Bauchi (SHB), Infectious Disease Hospital Bayara (IDHB) and some private hospitals, all in Bauchi metropolis, from January 2021 to February, 2022.

Sample and data collection

Whole capillary blood was collected from the fingertip of 394 pregnant women randomly enrolled from the selected hospitals in the Bauchi metropolis. Confidentiality was maintained by assigning a consent enrolment number to each participant. A structured questionnaire was administered and interviews were conducted with the help of a Midwife to collect relevant clinical information and demographic details of the pregnant women.

Hepatitis B Screening Test

All the participating pregnant women were screened for HBsAg status using an immunochromatographic rapid test, as described by Dutta [30]. A drop of whole blood specimen was placed on the sample application pad, and one drop of buffer (supply with the kit) was added. The test result was read after 15 minutes. A positive hepatitis B antibody test result was shown by a red line in the patient and control area. The presence of a red line in the control area only indicates a negative hepatitis B test.

Inclusion and Exclusion Criteria

All eligible consented pregnant woman with antenatal card (document showing the number of visit and service provided) on admission was recruited in the study until the designed sample size was reached. A woman without an antenatal card or that showed unwillingness at the time of visit was excluded from the study.

Ethical Consideration

Ethical clearance was sought from the hospital management and informed consent of the **women** was obtained before commencement of sampling/screening and data collection.

RESULTS

In this study, an analysis of hepatitis B infection according to the demographic profile of the pregnant women (table 1), indicated that the disease is more prevalent (39.1%) among the 31 to 35 years age group, followed by 23.9% (26-30) years. The majority of them are married (67.4%) and are said to be small to medium-scale business owners (30.4%), then civil servants (26.1%). The results also revealed that most of the women positive (52.1%) attended tertiary education and hail from urban locations (Bauchi metropolis). The overall prevalence of the disease in our study is 11.7% (46 of 394).

Table 1: Distribution of hepatitis B virus infection based on the women's socio-demographic characteristics

Variable	Number of specimens collected (n=394)	Number of HBV positive (n=46)	Percentage of positive (%)
Age (Years)			
15-20	56	06	12.5
21-25	109	09	19.6
26-30	98	11	23.9
31-35	76	18	39.1
36-40	47	02	4.3
41-45	08	00	0.0
46-50	00	00	0.0
Marital status			
Single	09	05	10.9
Married	146	31	67.4
Divorced	23	07	15.2
Separated	16	03	6.5
Education status			
Primary	28	05	10.9
Secondary	79	13	28.3
Tertiary	57	24	52.1
Qur'anic	26	03	6.5
Informal	04	01	2.2
Occupation			
Housewife	36	06	13.0
C/Servant	38	12	26.1
Handcraft	17	03	6.5
Business	47	14	30.4
Tailoring	32	07	15.2
Others	24	02	4.3
Location			
Urban	143	36	78.3
Rural	51	10	21.7

The present study revealed that the highest frequency (63.0%) of hepatitis B was found among the women attending the facility pregnancy at their first pregnancy (primiparous) and mainly (50%) started visiting in the 3rd trimester. Two children were the highest number of live births (45.7%) observed among most of the participants in this study.

Table 2: Distribution of Hepatitis B virus Infection according to clinical profile

Clinical profile	Number of Women Screened (n=394)	Number of HBV positive (n=46)	Percentage Positive (%)
Parity			
Primiparous	221	29	63.0
Multiparous	173	17	37.0

Gestational age			
1 st trimester	182	09	19.6
2 nd trimester	88	14	30.4
3 rd trimester	124	23	50.0
No. of live Birth			
One	81	04	8.7
Two	99	21	45.7
Three	103	12	26.1
Above	91	09	19.6

The results on the prevalence of hepatitis B virus based on risk factors (table 3) shows that most of the women positive (78.3%) have no history of previous surgery, or blood transfusion (61.20%). HBV vaccination (73.90%), Cupping/Hijama (73.9%), without infected sex partner (95.7%), and no history of abortion. However, more than half of the women (52.2%) are co-infected with HIV/AIDS

Table 3: Distribution of HBV infection according to the risk factors

Risk factors	Number of Sample collected (n=194)	Number of HBV positive (n=46)	Percentage Positive (%)
Previous surgery			
Yes	136	10	21.7
No	258	36	78.3
History of blood transfusion			
Yes	142	17	36.9
No	252	29	63.0
Vaccinated			
Yes	185	12	26.1
No	209	34	73.9
HIV Status			
Positive	49	24	52.2
Negative	345	22	47.8
History of cupping (Hijama)			
Yes	22	00	0.0
No	372	46	100
Infected sex partner			
Yes	15	02	4.3
No	379	44	95.7
History of abortion			
Yes	31	05	10.9
No	363	41	89.1

The distribution of Hepatitis B virus Infection in the various hospitals where the women were enrolled indicated that the highest positive cases (60.9%) were recorded in Abubakar Tafawa Balewa University (ATBUTH), Bauchi, this is followed by (19.6%) in Infectious Disease Hospital Bayara (IDHB), Specialist Hospital Bauchi, with private hospitals (PH) as the least (4.3%).

Table 4: Distribution of Hepatitis B virus Infection according to Hospitals

Hospitals	Number of Women Screened (n=194)	Number of HBV positive (n=46)	Percentage Positive (%)
ATBUTH	182	28	60.9
SHB	93	07	15.2
IDH	65	09	19.6
PH	54	02	4.3

KEY:

ATBUTH = Abubakar Tafawa Balewa University SHB = Specialist Hospital Bauchi
IDH = Infectious Disease Hospital Bayara PH = Private Hospitals

DISCUSSION

The prevalence of hepatitis B Virus infections varies in different parts of the world from country to country, from one region to another region, and from one population group to another in a country [23, 31], and since pregnant women have depressed immunity; infections of HBV are of clinical importance.

The higher prevalence (39.1%) of HBV infection among the pregnant women in this study was found within the middle age group, 31 to 35 years. These are sexually active women that are exposed to sexual activity and other associated risk factors. Although the majority of the participants are married, highly occupied with means of livelihood, educated, and live in the urban centers; the disease remained common in the area. This implied that the occurrence and distribution of STDs like HBV infection can be associated with the socioeconomic status of the individual. This result is in line with the findings of Bittaye *et al.* [23] in Gambian City where 58% of the pregnant women screened were in the age category 27 to 43 years and 91.3% (389 of 424) were married. The overall prevalence in our study is 42.2% (46 of 194) which was very high, compared to 39 (9.2%) screened positive for hepatitis B in their study, and 7.4% (241 of 3238) found in Jos, Nigeria by Magaji *et al.* [28].

In Ethiopia, Kinfu *et al.* [32] reported that the overall prevalence of hepatitis B virus infection among their study participants was 9.2%. The majority (46.7%) of the participants infected by hepatitis B were in the age group 25-34 years. The study found that married study participants were more likely to be infected by hepatitis B when compared to unmarried study participants.

In the study, single women exhibited a significant prevalence of HBV infection [33]. This indicated that acquisition of HBV infection may be related to sexual lifestyle, influenced by

education and other risk factors pass across all categories of participants irrespective of social status as reported by Yakasai *et al.* [34]. The findings also emphasized that there is a low probability of acquiring the disease depending on the marital status of the women. However, Adegbesan-omilabu *et al.* [35] reported a high prevalence of HBsAg among married, pregnant women compared to their single counterparts, as found in this study. In this area and in many places, an occupation involving outdoor interaction with different men exposes and tempts some women into promiscuity, which is a risk factor for STDs like HBV infection. This can be the reason for the higher rate of infection among the civil servants and Business women in our study. Urbanization mainly determined the level of social activities and antisocial vices, which make venereal diseases easily spread in the community. In our study, the prevalence of HBV is more common in those women from the urban center than those from rural settings.

Viral hepatitis causes acute and chronic diseases with a significant public health concern. More than two billion people are estimated to have hepatitis B virus (HBV) infection worldwide (Mac *et al.* [29, 36]. Pregnancy is an immuno-suppressive condition that is complicated by Hepatitis B virus infection leading to high maternal and infant mortality [36]. The present study revealed that the highest frequency (63.0%) of hepatitis B was found among the women attending the facility at their first pregnancy (primiparous) and mainly (50%) started visiting ~~at~~ **in** the 3rd trimester. Two children were the highest number of live births (45.7%) observed among most of the participants in this study. The small number of children in some ~~the~~ women can be attributed to the increased awareness of family planning/child-spacing programs which go a long way with the socio-economic status of some individuals.

Multigravida, late registration on antenatal visits usually before 140 days of gestational age, and lack of Hepatitis B virus disease vaccination are among the predictors of HBV infection as also reported by Magaji *et al.* [28]. Vaccines for the prevention of HBV infection are either inadequate or had received lower coverage in Nigeria. This disease was severally reported to be the commonest cause of liver disorders that can be congenitally transmitted. However, an effective and inexpensive recombinant DNA vaccine for HBV has been available in Nigeria for more than 3 decades. But ineffective public awareness and misconceptions have drastically reduced the efforts to meet the target objective [37]. The risk of being infected by the hepatitis B virus in Nigeria is obvious, not only due to low vaccination rates but also for the fact that about 75% of the population can be exposed to the virus [37, 38].

Blood donated for transfusion is generally screened routinely for Hepatitis B Virus infection and other venereal/communicable diseases in Nigerian hospitals. This good clinical practice had saved millions of lives. In this study, the majority of the pregnant women, although tested negative had no history of blood transfusion and previous surgery especially due to poor pregnancy outcomes. This implies that there is proper prenatal care, associated with a balanced diet in this area, which prevents the pregnant women from being anaemic and has no condition that necessitates delivery by cesarean section. Olokoba *et al.* [27] reported that among the 595 recruited voluntary blood donors screened in Yola, Nigeria, only 14 male donors (2.4%) were positive for HBsAg, which means that the seroprevalence of hepatitis B virus infection is low among voluntary blood donors in the area.

HIV/AIDS is a serious ill-health condition characterized by progressive impairment of the human immune system, exposing the body to many opportunistic infections and ~~another~~ **other** venereal diseases like Hepatitis B virus infection. In this study, 52.2% of the pregnant HBV-positive women are co-infected with HIV/AIDS. Atalay *et al.* [14] reported that among the pregnant women who participated in their study, 215 (91.1%) were screened for HIV on their

antenatal visit, where 4.5% were positive and 1.86% for HBsAg. As in our findings, their study also found a significant relationship between the factors influencing the rate of transmission of HBV infection and HIV infection. Bittaye *et al.* [23] reported that only 3 (0.7%) of the women participants were positive for HIV infection, while one woman is co-infected with retroviral and HBV infection. The high prevalence of HBV and HIV co-infection among pregnant women in our study could be associated with the same mode of transmission shared by the two diseases.

Tertiary health care facilities like teaching hospitals serve as referral centres from other hospitals in Nigeria. The hospitals usually received a large influx of heterogeneous patients, from different social classes, mostly urban dwellers. In this study, the highest frequency of HBV infection (60.9%) was found in the teaching hospital, which always has the largest patient turn-out in the heart of the city.

This study generally found that there is a significant relationship between social status such as educational background, marital status, urbanization, and the occurrence of sexually transmitted diseases like HBV infection in the study area.

CONCLUSION

This study generally found a moderately low prevalence of HBV infection (11.7%) among pregnant women in this area, but it was very high, especially among the women without prior vaccination for HBV, those with HIV co-infection, married, middle-aged group, educated class and those from urban centers.

REFERENCE

1. Manyahi J, Msigwa Y, Mhimbira F, Majigo M. High seroprevalence of hepatitis B virus and human immunodeficiency virus infections among pregnant women attending antenatal clinic at Temeke municipal health facilities, Dar es Salaam, Tanzania: a cross-sectional study. *BMC Pregnancy and Childbirth*. 2011;17(1):109.
2. Cheung KW, Seto MTY, Wong SF. Towards complete eradication of hepatitis B infection from perinatal transmission: a review of the mechanisms of in utero infection and the use of antiviral treatment during pregnancy. *Eur. J. Obst. Gyn. Reprod. Biol.*, 2013; 169 (1), 17–23.
3. Dyson JK, Waller J, Turley A, Michael E, Moses S, Valappil M, Hudson M, Bassendine M, McPherson S. Hepatitis B in pregnancy. *Frontline Gastroenterol*. 2014;5(2):111–117.
4. Black P, Nouanthong P, Nanthavong N. Hepatitis B virus in Lao People's Democratic Republic: a cross-sectional serosurvey in different cohorts, *BMC Infect. Dis*. 2014; 14 (4570), 1-9.
5. Adesina O, Oladokun A, Akinyemi O, Adedokun B, Awolude O, Odaibo G, et al. Human immuno-deficiency virus and hepatitis B virus coinfection in pregnancy at the University College Hospital, Ibadan. *Afr J Med Med Sci* 2010; 39:305–10.
6. Ahizechukwu CE, Uzoamaka AE, Charles IO, Ifeanyichukwu UE, Chukwuanugo O. Prevalence, correlates and pattern of hepatitis B surface antigen in a low resource setting. *Virology*. 2011; 8:12.
7. Balogun TM, Durojaiye IO, Sagoe A, Emmanuel S. Sero-epidemiology of Hepatitis B surface antigenemia in HIV positive patients. *West Afr J Med* 2010; 29:169–73
8. Bello AC. Prevalence of Hepatitis B virus markers in surgeons in Lagos, Nigeria. *East Afr Med J*. 2000; 77: 283-285.

9. Basse EB, Moses AE, Udo SM, Umo AN Parallel and overlapping human immunodeficiency virus, hepatitis B and C virus infections among pregnant women in the Federal Capital Territory, Abuja, Nigeria. *Online J Health Allied Sci* 2009; 8:4.
10. Buseri FI, Seiyaboh E, Jeremiah ZA. Surveying infections among pregnant women in the Niger Delta, Nigeria. *J Glob Infect Dis* 2010; 2:203–11.
11. Chen, DS. Hepatitis B vaccination: the key towards elimination and eradication of hepatitis B,” *J Hepatol*, 2009; 5(4), 805–816.
12. Franco E, Bagnato B, Marino MG, Meleleo C, Serino L, Zaratti L. Hepatitis B: epidemiology and prevention in developing countries. *World J Hepatol*, 2012; 4(3), 74–80.
13. Ott JJ, Stevens GA, Wiersma ST, “The risk of perinatal hepatitis B virus transmission: hepatitis B e antigen (HBeAg) prevalence estimates for all world regions,” *BMC Infect. Dis*, 2012; 12, article 131.
14. Atalay AA, Abebe RK, Dadhi AE, Bededa WK. Seroprevalence of hepatitis B virus among pregnant women attending Antenatal care in Dilla University Referral Hospital Gedio Zone, Ethiopia; health facility-based cross-sectional study. *PLoS ONE*, 2021;16(3): e0249216.
15. Lin HH, Kao JH, Chang TC, Hsu HY, Chen DS. Secular trend of age-specific prevalence of Hepatitis B surface and e antigenemia in pregnant women in Taiwan. *J Med Virol*. 2003; 69: 466-470.
16. Makuwa M, Mintsá-Ndong A, Souqui`ere S, Nkogh`e D, Leroy EM, Kazanji M, Prevalence and molecular diversity of hepatitis B virus and hepatitis delta virus in urban and rural populations of hepatitis B virus and hepatitis delta virus in urban and rural populations in northern Gabon in Central Africa. *J. Clin. Microbiol.* 2009; 47(7), 2265–2268.
17. Obi RK, Umeh SC, Okurede OH, Iroagba II. Prevalence of Hepatitis B virus infection among pregnant women in an antenatal clinic in Port Harcourt, Nigeria. *Afr J Clin Exper. Microbiol.* 2006; 7: 78-82.
18. Hou J, Liu Z, Gu F. Epidemiology and prevention of Hepatitis B virus infection. *Int J Med Sci.* 2005; 2: 50-57.
19. World Health Organization. Hepatitis B vaccines. WHO Position Paper Weekly Epidemiological Record. 2009;84(40):405–20.
20. Nguyen T, McLaws ML, Dore GJ. Highly endemic hepatitis B infection in rural Vietnam, *J Gastroenterol. and Hepatol*, 2007; 22 (12), 2093–2100.
21. Zhang Y, Fang W, Fan L. Hepatitis B surface antigen prevalence among rural women of childbearing age in Hainan Province, China: a cross-sectional study. *Virol. J.* 2013; 10, article 25.
22. Kramvis A. Molecular characteristics and clinical relevance of African genotypes and subgenotypes of hepatitis B virus. *S Afr. Med J.* 2018;108(8b):17–21.
23. Bittaye M, Idoko P, Ekele BA, Obed SA, Nyan O. Hepatitis B virus seroprevalence amongst pregnant women in the Gambia. *BMC Infect. Dis.* 2019; 19:259.
24. Mokaya J, McNaughton AL, Hadley MJ, Beloukas A, Geretti AM, Goedhals D, Matthews PC. A systematic review of hepatitis B virus (HBV) drug and vaccine escape mutations in Africa: a call for urgent action. *PLoS Negl Trop Dis.* 2018;12(8):e0006629.

25. Ye F, Liu Y, Jin Y, Shi J, Yang X, Liu X, Zhang X, Lin S, Kong Y, Zhang L. The effect of hepatitis B virus-infected embryos on pregnancy outcome. *Eur J Obstet Gynecol Reprod Biol.* 2014; 172:10–4.
26. Janahi EM. Prevalence and risk factors of hepatitis B virus infection in Bahrain, 2000 through 2010. *PLoS One.* 2014;9(2): e87599.
27. Olokoba AB, Salawu FK, Danburam A, Olokoba LB, Midala JK, et al. Hepatitis B virus infection amongst pregnant women in North-eastern Nigeria- a call for action. *Niger J Clin Pract.* 2011; 14: 10-13.
28. Magaji FA, Okolo MO, Hassan Z, Shambe IH, Pam VC, Ocheke AN, et al. Prevalence of hepatitis B virus infection among pregnant women in Jos, Nigeria. *Ann Afr Med.* 2020; 19 (3): 176-181.
29. Mac PA, Suleiman AC, Airiohuodion PE. High Prevalence of Hepatitis B Virus Infection among Pregnant Women Attending Antenatal Care in Central Nigeria. *J Infect Dis Epidemiol.* 2019; 5:068.
30. Dutta DC. Hepatitis B viral infection in pregnancy. Mita S (Ed).5th edition. Textbook of obstetrics; 2009. New central book agency (P) ltd. Pg 289–291.
31. Belopolskaya M, Avrutin V, Kalinina O, Dmitriev A, Gusev D. Chronic hepatitis B in pregnant women: Current trends and approaches. *World J Gastroenterol.* 2021; 27(23): 3279–3289.
32. Kinfe, H. Sendo EG, Gegremedhin KB Prevalence of Hepatitis B Virus Infection and Factors Associated with Hepatitis B Virus Infection Among Pregnant Women Presented to Antenatal Care Clinics at Adigrat General Hospital in Northern Ethiopia. *Int. J Women Health,* 2021; 13,119-127.
33. Magaji FA, Okolo MO, Yiltok ES, Golit W, Anzaku SA, Ogwuche J, et al. Prevalence of hepatitis B virus infection in pregnant women with and without HIV in Jos, Nigeria. *BMC Infect Dis.* 2021; 104:276-281.
34. Yakasai IA, Ayyuba R, Abubakar IS, Ibrahim SA. Sero-prevalence of Hepatitis B virus infection and its risk factors among pregnant women attending antenatal clinic at Aminu Kano Teaching Hospital, Kano, Nigeria. *J Basic Clin Reprod Sci,* 2012; 1: 49-55.
35. Adegbesan-Omilabu M, Okunade KS, Gbadegesin A, Olowoselu OF, Oluwole AA, et al. Seroprevalence of Hepatitis B virus infection among pregnant women at the antenatal booking clinic of a Tertiary Hospital in Lagos Nigeria. *Niger J Clin Pract* 2015; 18: 819-823.
36. Musa BM, Bussell S, Borodo MM, Samaila AA, Femi OL. Prevalence of hepatitis B virus infection in Nigeria, 2000-2013: a systematic review and meta-analysis. *Niger J Clin Pract.* 2015;18(2):163-72.
37. Onakewhor JU, Offor E, Okonofua FE. Maternal and neonatal seroprevalence of Hepatitis B surface antigen (HBsAg) in Benin City, Nigeria. *J Obstet Gynaecol.* 2001; 21: 583-586.
38. Baawuaga EM, Enenebeaku MNO, Okopi JA, Damen JG. Hepatitis B virus (HBV) infection among pregnant women in Makurdi, *Nigeria.* *J Biomed Res.* 2008; 11:155–159.