Received: 24th March, 2020

Accepted: 4th May, 2020

Seroprevalence and Risk Factors Associated with Hepatitis B Virus Infection among Pregnant Women Attending Antenatal Care in Azare, Bauchi State, Nigeria

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Abstract

Hepatitis B virus is known to thrive in peripheral mononuclear cells, tissues of pancreas, spleen, kidney, skin, fluids such as saliva, semen, sweat, breast milk, tears, urine as well as vaginal secretion. This study was carried out to determine the seroprevalence of Hepatitis B virus infection and associated risk factors among pregnant women attending antenatal care in General Hospital Azare, Bauchi State. In this study, 100 consenting pregnant women were recruited and their blood samples were screened for HBs Ag using Rapid Test Strip. A structured questionnaire was used to obtain information about the socio-demographic and risk factors of the study population. Data obtained were subjected to Chi-square test using statistical package for social science (SPSS) version 20 to determine the association between risk factors and Hepatitis B virus infection. The result showed that the overall seroprevalence of Hepatitis B virus infection among pregnant women attending General Hospital, Azare, was 6(6.0%). Highest seroprevalence of HBsAg (16.7%) was observed among pregnant women within the age group of 36-40 years so also unemployed pregnant women (6.8%) had the highest seroprevalence of HBs Ag. Previous history of blood transfusion, previous history surgery, use of contraceptives, sharing of sharp objects and sharing of tooth brush were found to be the risk factors associated with pregnant women in Azare. The differences observed in the seroprevalence of HBs Ag with different demographic and risk factors were not significant ($P > 0.005$), with the exception of age ($p = 0.03$). Pregnant women and the general public should be enlightened on the risk factors associated with hepatitis B virus infection.

Keyword, Seroprevalence, Hepatitis B virus, pregnant women, Rapid Test Strip

INTRODUCTION

Hepatitis is the inflammation of the liver. It may be caused by exposure to certain chemicals, autoimmune diseases, or by bacterial infections but is often caused by one of several viruses (Ahmedin *et al.*, 2004; Agarry *et al.*, 2010). The most common causes of viral hepatitis are the five unrelated hepatotropic viruses; Hepatitis A virus, Hepatitis B virus, Hepatitis C virus, Hepatitis D virus, and Hepatitis E virus. In addition to the nominal hepatitis viruses, other viruses that can also cause liver inflammation include Cytomegalovirus and Epstein-Barr virus (Jinli. and Hongyum 2015)

Hepatitis B virus (HBV) is a partially double stranded DNA virus of the family *Hepadnaviridae* and the causative agent of Hepatitis B infection (Pungpapong *et al.*, 2007). It is 50-100 times more infectious than HIV and 10 times more infectious than Hepatitis C virus (HCV) (Dessie *et al.*, 2014). Many carriers do not realize they are infected with the virus, thus it is referred to as a "silent killer"

(Oluboyo *et al.*, 2014). The minimum infectious dose is so low that such practices like sharing a tooth brush or a razor blade can transmit the infection (Chang, 2008).

The virus has been detected in peripheral mononuclear cells, tissues of pancreas, spleen, kidney and skin, and fluids like saliva, semen, sweat, breast milk, tears, urine and vaginal secretion (Chen, 2014). Approximately 350 million people are infected with HBV worldwide (Hablie *et al.*, 2013). Viral hepatitis during pregnancy is associated with high risk of maternal complications. But there is a high rate of vertical transmission causing fetal and neonatal hepatitis which can have serious effects. These include impaired mental and physical health later in life, maternal mortality, and it is also the most common cause of jaundice in pregnancy (Gerald *et al.*, 2009). Perinatal transmission of Hepatitis B occurs if a mother has had acute Hepatitis B infection during late pregnancy, in the first postpartum, or if she is a chronic HBsAg carrier (Esan *et al.*, 2014).

Hepatitis B is transmitted when blood, semen, or other body fluid infected with the Hepatitis B virus enters the body of a previously uninfected person. Infection can also occur during activities such as unhygienic deliver, sex with an infected partner, sharing of needles, syringes, or other drug-injection equipment. Others are sharing of items such as razors or toothbrushes with an infected person, direct contact with the blood or open sores of an infected person, as well as exposure to blood from needle sticks or other sharp instruments (Richard *et al.*, 2015).

The aim of the study was to determine the seroprevalence and associated risk factors of

Hepatitis B virus infection among pregnant women attending General Hospital Azare.

MATERIALS AND METHODS

Study Area

The study was conducted at General Hospital Azare, Bauchi State, among pregnant women attending antenatal care. Azare is situated in Katagum, Bauchi, Nigeria, its geographical coordinates are 11° 40' 42" North, 10° 11' 31" East (<http://www.maplandia.com/>). General Hospital Azare is located in Azare metropolis, Katagum Local Government Area of Bauchi State, Nigeria. The hospital is built as a secondary health facility, and has 150 beds and pediatric cots.

Map of Katagum L.G.A. showing General Hospital.

Source: Modified from the Administrative Map of Katagum L.G.A.

Study Design and Population

The study design was a descriptive cross-sectional study which combined the use of structured questionnaire and analysis of blood samples taken from consented individuals. The 100 pregnant women who gave informed consent were enrolled as the subjects for the study. The study population comprised pregnant women of all ages attending General Hospital, Azare, Bauchi State.

Research Tool

A well designed personal data information sheet (i.e. structured questionnaire) was used to gather information regarding socio-demographic and risk factors associated with

acquisition of the infection from 100 antenatal clients.

Inclusion Criteria

Consenting pregnant women attending the ANC within the period of study.

Exclusion Criteria

Non-consenting pregnant women at the clinic.

Sample Size

The sample size for this research was determined using the formula of (Pennap *et al.*, 2010) at 95% confidence level and a reported seroprevalence of 6% of HBV (Oluboyo *et al.*, 2014).

$$N = \frac{Z^2 (P) Q}{L^2}$$

Where, N= Sample size

Z= Statistics for a level of 95% confidence interval = 1.96

P= prevalence rate of HBV from previous studies =6% or 0.06

L = level of significance (allowable error) = 5% or 0.05

Q = 1-P

$$N = \frac{(1.96)^2 (0.06) (1-0.06)}{(0.05)^2}$$

$$N = 86.67$$

In order to minimize error and improve statistical precision, a total of 100 samples were collected.

Ethical Approval and Consent

Ethical approval was obtained from the Ethical Committee of Hospital Services Management Board, Bauchi State, and the objectives of the study were explained to the pregnant women for the purpose of obtaining their consent.

Blood Sample Collection and Processing

Blood sample was collected by venipuncture. The blood was centrifuged at 1500 rpm for 5 minutes, and the separated serum were poured into a plain sterile container and then stored at -20°C in a refrigerator until analyzed (Oluboyo *et al.*, 2014). Sample Processing Procedure for HBsAg detection Using One Step Rapid Strip by ACON Laboratories incorporated, USA, was used for screening the participants. The ACON HBsAg strip is a rapid chromatographic immunoassay for the qualitative detection of Hepatitis B surface antigen in serum/plasma (Agarry *et al.*, 2010). Assays were done at room temperature. The serum was removed from the refrigerator for it to equilibrate with room temperature before testing. With arrows pointing at the serum, the test strip was immersed vertically in the blood sample for at least 10 seconds. Taking into consideration, the maximum level of immersion indicated on the strip. Following immersion the strip was then placed on a non-absorbent surface. The timer was then set for 15 minutes, awaiting the red line to appear or not. Two distinct red lines, one on the control region (C)

while the other on the test (T) region. The intensity of the red color on the test line varies depending on the concentration of the HBsAg in the specimen. Therefore, any shade of red in the test (T) region was considered positive. One red line on the control (C) region and no shade of red colour on the test (T) region, meant it was negative (14).

Analysis of Data and Presentation of Results

Data obtained from questionnaires and the results obtained from laboratory analysis were reduced to percentages by descriptive statistics and chi square was used to compare variables, while the results obtained were presented in tables and figures.

RESULTS

General Parameters of the Participants

Among the pregnant women that took part in the research, majority 59 (59.0%) were unemployed while 4(4.0%) were civil servants. However, 36 (36.0%) of the participants had primary level of education while just 12(12.0%) had tertiary level of education. Most of the participants 62(62.0%) were in their second trimester of pregnancy while 15 (15.0%) were in their third trimester of pregnancy. All the women that took part in the research were married. Majority (88 i.e. 88.0%) of the participants were from urban areas while 12 (12.0%) were from rural areas. Out of the 100 pregnant women tested only 15 (15.0%) were aware of their HBV status while 85 (85.0%) were not aware of it (Table 1).

Table 2 shows the overall seroprevalence of HBsAg among pregnant women attending Azare General Hospital, Azare. Out of the 100 samples analyzed, 6 were positive giving an overall seroprevalence of 6.0% while 94.0% were negative.

Analysis of the results according to age group of the participants is shown in Table 3 below. The highest seroprevalence of HBsAg was seen among the age group 36-40 years with 1(16.7%), while the lowest seroprevalence of HBsAg was seen among the women in age group 21-25 years with 0(0.0%).

Table1: General Parameters of the participants involved in the study

Parameters	Frequency	Percentages (%)
Age Groups (years)		
16-20	18	18.0
21-25	37	37.0
26-30	32	32.0
31-35	07	7.0
36-40	06	6.0
Occupation		4.0
Civil servants	4	37.0
Self-employed	37	39.0
Unemployed	39	20.0
Housewife	20	
Educational status		
Primary	36	36.0
Secondary	35	35.0
Tertiary	12	12.0
others	17	17.0
Marital status		
Married	100	100
Trimester of pregnancy		
First	23	23.0
Second	62	62.0
Third	15	15.0
Residency		
Rural	12	12.0
Urban	88	88.0
Awareness		
Yes	15	15.0
No	85	85.0

Table 2: Overall seroprevalence of HBV among pregnant women in Azare General Hospital, Azare

Hepatitis serology	Number examined	Number positive (%)	Number negative (%)
HBs Ag	100	6(6.0)	94(94.0)

Table 3: Seroprevalence of HBs Ag according to the age group of the participant

Age group (years)	Number tested	Positive (%)	Negative (%)	x ²	p-value
15-20	18	1(5.6)	17(94.4)	25.4150.003	
21-25	37	0 (0.0)	37(100)		
26-30	32	3(9.4)	29(90.6)		
31-35	7	1(14.3)	6(85.7)		
36-40	6	1(16.7)	5(83.3)		
Total	100	6(6.0)	94(94.0)		

Analysis of results according to sociodemographic factors is shown in Table 4. Of the 100 sera analyzed the highest seroprevalence of HBsAg was seen among the unemployed participants 4(6.8%) while lowest seroprevalence was seen among the self-employed 2 (5.4%). There was no statistically significant association between occupation and hepatitis infection ($\chi^2 = 4.701$, $df = 2$, $p = 0.099$). Based on educational status the highest seroprevalence of HBsAg was seen among those with other types of education 2(11.8%), while

the lowest seroprevalence was seen among participants with secondary level of education 1(2.9%). Similarly, there was no statistically significant association between educational level and hepatitisB infection ($\chi^2 = 4.807$, $df = 3$, $p = 0.806$). Moreover all the participants were married hence the results showed 6% seroprevalence of HBsAg. There was no statistically significant association between hepatitis infection and marital status ($\chi^2 = 3.601$, $df = 0$, $p = 0.098$).

Table 4: Seroprevalence of HBs Ag according to socio-demographic factors of the participants

Parameters	Number Tested	Positive (%)	Negative (%)	x ² =	p-value
Occupation					
Civil servants	4	0 (0.0)	4(100)	4.701	0.099
Self-employed	37	2(5.4)	35(94.6)		
Unemployed	59	4(6.8)	55(93.2)		
Educational status					
Primary	36	2(5.6)	34(94.4)	4.807	0.806
Secondary	35	1(2.9)	34(97.1)		
Tertiary	12	1(8.3)	11(91.7)		
Others	17	2(11.8)	15(88.2)		
Marital status					
Married	100	6(6.0)	96(96.0)	3.601	0.098
Divorced	0	0(0.0)	0(0.0)		
Widowed	0	0(0.0)	0(0.0)		

Analysis of data and results according to possible risk factors that might predispose to the hepatitis infection is shown in Table5. HBsAg positive individuals with the history of blood transfusion were 3 (15.8%) and those with no history of blood transfusion were 3(3.7%). Hence the highest seroprevalence was seen among the participants with history of blood transfusion while those without the history had lowerseroprevalence. Pregnant women with history of blood transfusion were at higher risk of acquiring hepatitis B infection (OR (95% CI) = 4.9(0.9-26.4) $p = 0.0659$).

The seroprevalence of individuals positive for HBs Ag with a history of surgery was 18.75%, while those without surgery was 3.6%. The result showed that participants with history of surgery had the higherseroprevalence while those without the history had lowerseroprevalence. Pregnant women with history of surgery were at higher risk of acquiring hepatitis B infection (OR (95% CI) = 6.2(1.1-34.2) $p = 0.0354$). The seroprevalence of the participants that used contraceptives and were HBs Ag positive was (9.1%) while the percentage of those that did not use contraceptives was 3.6%. There was no significant association between history of

surgery and hepatitis infection (OR (95% CI) = 2.7(0.5-15.5) $p = 0.2648$).

None of the participants with history of hepatitis were positive of HBs Ag. There was no statistically significant association between history of hepatitis and hepatitis infection. However, those with no history of hepatitis infection were more likely to be infected than those without history of Hepatitis (OR (95% CI) = 4.7(0.2-129.7) $p = 0.3515$).

Individuals that were positive with HBsAg and who had the habit of sharing sharp objects had a seroprevalence of 11.4% while those that did not share sharp objects were 3.1% of the total number of participants. The seroprevalence of HBs Ag was higher among participants who shared sharp objects but lower among those that did not (OR (95% CI) = 4.1(0.7-23.4) $p = 0.1165$).

Moreover, there was 23.1%seroprevalenceof positive HBs Ag participants who had the habit of sharing tooth brushes, while 3.4% was the rate of seroprevalence of positive HBsAg participants who did not share tooth brushes. There was no statistically significant association between hepatitis B infection and habit of sharing tooth brushes (OR (95% CI) = 8.4(1.5-47.4) $p = 0.0159$).

Table 5: Seroprevalence of HBsAg in relation to possible risk factors

Risk factor	Number tested	Positive (%)	Negative (%)	OR (95% CI)	p-value
History of Blood transfusion					
Yes					
No	19	3(15.8)	16(84.2)	4.9(0.9-26.4)	0.0659
	81	3(3.7)	78(96.3)		
History of surgery					
Yes					
No	16	3(18.75)	13(81.25)	6.2(1.1-34.2)	0.0354
	84	3(3.6)	81(96.4)		
History of Hepatitis					
Yes					
No	1	0	1(100)	4.8(0.2-129.7)	0.3515
	99	6(6.1)	93(93.9)		
Sharing of sharp objects					
Yes					
No	35	4(11.4)	31(88.6)	4.1(0.7-23.4)	0.1165
	65	2(3.1)	63(96.9)		
Sharing of tooth brush					
Yes					
No	13	3(23.1)	10(76.9)	8.4(1.5-47.4)	0.0159
	87	3(3.4)	84(96.6)		
Use of contraceptive					
Yes					
No	44	4(9.1)	40(90.9)	2.7(0.5-15.5)	0.2648
	56	2(3.6)	54(96.4)		

The seroprevalence of HBsAg based on history of vaccination was highlighted in Table 6. The seroprevalence of those positive of HBsAg that had history of vaccination was 0.0% while those that did not have history of vaccination was 6.1%. There was no statistically significant association between history of vaccination and hepatitis infection ($\chi^2 = 1.892$, $df = 1$, $p = 0.169$). Serorevalence of HBsAg in relation to the trimester of pregnancy of the participants is shown in Figure 1. The higher seroprevalence of HBsAg of (8.7%) was seen among those in the first trimester of pregnancy while lower seroprevalence was seen among those in the second trimester (6.5%). In contrast with the

aforesaid, there were no positive participants in the third trimester of pregnancy. There was no statistically significant association between stage of the pregnancy and hepatitis infection ($\chi^2 = 0.267$, $df = 2$, $p = 0.875$).

Figure 2 reveals the seroprevalence of HBsAg in relation to residency, the highest seroprevalence of HBsAg (16.7%) was seen among the participants that are from the rural areas and a low seroprevalence (4.5%) of the HBsAg positive was seen among participant from the urban areas. There was no statistically significant association between residency and hepatitis infection ($\chi^2 = 0.289$, $df = 1$, $p = 0.591$).

Table 6: Seroprevalence of HBsAg in Relation to history of vaccination

History of Vaccination	Number Tested	Positive %	Negative (%)
Yes	1	0.0	1 (100.0)
No	99	6(6.1)	93(93.9)

Figure 1: Seroprevalence of HBsAg in relation to trimester of pregnancy of the Participants
 $\chi^2 = 0.267$, $df = 2$, $p = 0.875$

Figure 2: Seroprevalence of HBsAg in relation to residency of the participants
 $\chi^2 = 0.289$, $df = 1$, $p = 0.591$

DISCUSSION

This study reveals a low seroprevalence of 6.0% of HBsAg, this seroprevalence is moderate according to the WHO (2010) classification. This seroprevalence of HBsAg is similar to the seroprevalence of HBsAg (6.7%) among antenatal clinic attendees in Gamawa, Bauchi State reported by Mustapha *et al.* (2020). Similar low seroprevalence value were reported by Oluboyo *et al.* (2014) in Nnewi, Anambra State and Ugbebor *et al.* (2011) in Benin, Edo State. The similarity observed is likely due to similar in study population since all the study It is however lower when compared with the study of Alberstein *et al.* (2012) which reported

involved pregnant women. However, the result of this study was in contrast with the result reported by Bankole *et al.* (2013) in Ghana where HBV seroprevalence of 9.5% was reported. It is equally in contrast with the seroprevalence recorded in a study of hepatitis B viral infections among pregnant women in Benin, Nigeria by Alberstein *et al.* (2012). In this study, HBsAg seroprevalence of 6.8% was seen among unemployed individuals. This seroprevalence is similar to that reported Pennap *et al.* (2010) in which a similar seroprevalence of 5% was reported. 21.2% seroprevalence. It is also inconsonance with the result of Agarry *et al.* (2010) which

reported that the highest seroprevalence of HBV was among the civil servants.

Based on educational status, individuals with other educational attainments had the highest HBsAg seroprevalence of 11.8%. The level of education may determine knowledge and practice of preventive measures against Hepatitis B virus infections. Educational level may also determine the level of economic power and access to good quality health care. Individuals with low level of education are more likely to undergo scarifications and injections with unsterilized instruments than those with higher level of education (Jibrin *et al.*, 2016).

In the current study, all the pregnant women tested were married or chose to hide their marital status. The low seroprevalence of 6.0% for HBsAg recorded might be due to their conservative sexual behaviour.

In relation to age of the participants, the highest seroprevalence of HBsAg (16.7%) was seen among the age groups of 36-40 years, followed by 31-35 years (14.3%) and 26-30 years (9.4%). This is likely due to the fact that HBV infections are mainly acquired following vertical transmission or through sexual contact, and this age groups are the most active age group sexually. This is similar to the report of Mustapha *et al.* (2020) where pregnant women aged ≥ 35 years had the highest prevalence. However, this result is in contrast to the report of Isa *et al.* (2015), where age group 40 years and above had the highest seroprevalence. The lowest seroprevalence of HBsAg (5.6%) observed among the age group 15-20 years is in agreement with the report of Mustapha *et al.*

(2020) but in contrast to the report of Isa *et al.* (2015) where age group 36-40 years had the least seroprevalence.

Pregnant women in the first trimester had the highest prevalence of HBsAg (8.7%), followed by second trimester (6.5%). This result is alarming as this stages of pregnancy are the critical stages. This result is in contrast with that of Yakasai, *et al.* (2012) in Kano. In relation to vaccination, higher seroprevalence of 6.1% HBsAg was seen among participants that had no history of vaccination for hepatitis.

In this study, the risk factors associated with hepatitis B virus infection among pregnant were history of blood transfusion, surgery use of contraceptive, sharing of sharp objects and sharing of tooth brush. This shows that the mode of transmission of hepatitis to these participants might be via the aforesaid risk factors. This result is similar to the report of Sabria *et al.* (2014) where history of blood transfusion, surgery and contraceptive use were reported to be risk factors associated with hepatitis B virus infection.

CONCLUSION

In conclusion, the overall seroprevalence of HBsAg among pregnant women in Azare was 6.0%. Highest HBsAg seroprevalence was found among those with lower (other) educational attainment (11.8%), age group 36-40 years (16.7%) and those in first trimester (8.7%). The risk factors were history of blood transfusion, surgery use of contraceptive, sharing of sharp objects and sharing of tooth brush.

REFERENCE

- Agarry, O.O. and Lekwot, G.Z. (2010). Prevalence of hepatitis B virus and hepatitis C virus in ante-natal patients in Gwagwalada- Abuja, Nigeria, *Science pub*, 2(7):48-50. <http://www.sciencepub.net/report>
- Ahmedin, J., Taylor, M., Ram, C.T., Asma, G., Alicia, S., Elizabeth, W.; Eric J.F., Michael, J.T. (2004). A New Section in Cancer Offering Timely and Targeted information, *A Cancer Journal for Clinicians*. 54 (8):48-50.
- Alberstein, M., Zornitzki, T., Zick, Y. and Knobler, H. (2012). Hepatitis C care protein in pairs insulin down stream signaling and regulatory role of IGF1P. *Journal of viral Hepatitis*, 19:65-71.
- Bankole, H.O., Richard, O. and Oladapo, B.O. (2013). Prevalence of HIV, HBV, And HCV infections among pregnant women receiving antenatal care in a traditional birth home in Benin City, Nigeria. *Saudi Journal for Health Sciences*, 2(20): 113-117.
- Chang, M.H. (2008). Hepatitis B virus infection. *Foetal, Neonatal Medicine*, 12:160-1672
- Chen, C.T. (2014). A brief history of hepatitis milestones. *Liver International*. 34(1):20-37.
- Dessie, T., Kassu, D., Belete, T. and Tesfaye, 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. *Biomedical Research Notes*, 7: 239.
- Elinav, E., Ben-Dov, I.Z., Shapira, Y., Daudi, N., Adler, R., Shouval, D. and Ackerman Z. (2006). Acute hepatitis A infection in pregnancy is associated with high rates of gestational complications and preterm labor. *Gastroenterology*, 130: 1129-1134.

- Esan, A.J, Omisakin, C.T., Ojo-Bola, T., Owoseni, M.F., Fasakin, K.A. and Ogunleye, A. (2014). Sero-Prevalence of Hepatitis B and Hepatitis C Virus Co-Infection among Pregnant Women in Nigeria. *American Journal of Biomedical Research*, 2(1): 1-15.
- Ge, D., Fellay, J., Thompson, A.J., Simon, J.S., Shianna, K.V., Urban, T.J., Heinzen, E.L., Qiu, P., Bertelsen, A.H., Muir, A.J., Sulkowski, M., McHutchison, J.G. and Goldstein, D.B. (2009). Genetic variation in IL28B predicts hepatitis C treatment-induced viral clearance. *Nature*, 461(7262):399-401
- Habtie, T., Belete, B., Fasika, G., Kifle, T., Gizachew, Y. and Dagnachew, M. (2013). Seroprevalence of hepatitis B and C virus infection among patients attending serology laboratory of Gondar University Hospital. *Biomedical Research Notes*, 6: 164.
- Isa, I., Amonu, M. Abdullahi, S.A., Sani, M.A. and Eson, M.D. (2015). Seroprevalence of Hepatitis B Virus in a Tertiary Institution in North Western Nigeria. *African Journal of Microbiology Research*, 9(3):171-179.
- Jibrin, Y.B., Kolo, P.M., Mohammed, A., Sanya, E.O. and Aliyu, L.D. (2016). Burden of hepatitis B and C infections among pregnant women in Bauchi, Northeastern Nigeria. *Sub-Saharan African Journal of Medicine*, 3:188-93.
- Jinli, D. and Hongjun, L. (2015). Literature analysis of radiological studies on viral hepatitis. *Radiology of Infectious Diseases*, 2(2):57-60
- Mustapha, G.U., Ibrahim, A., Balogun, M.S., Umeokonkwo, C.D. and Mamman, A.I. (2020). Seroprevalence of hepatitis B virus among antenatal clinic attendees in Gamawa Local Government Area, Bauchi State, Nigeria. *BMC Infectious Diseases*, 20(194):1-6.
- Oluboyo, B.O., Ugochukwu, V.I., Oluboyo, A.O., Ihim, A.C., Chukwuma, G.O., Ogenyi, S.I., and Onyemelukwe, A. (2014). Prevalence of Hepatitis B and C Viral Infections In Pregnant Women Attending Antenatal Clinic In Nnewi Nigeria. *European Scientific Journal*, 10(3):1857 -7881.
- Pennap, G.R., Yakubu, A., Oyige, O., Forbi, J. (2010). Prevalence of hepatitis B and C virus infection among people of a local community in Keffi, Nigeria. *African Journal of Microbiology Research*. 4(4):274-278.
- Pungpapong, S., Kim, W.R. and Poterucha J.J. (2007). Natural History of Hepatitis B Virus Infection: An Update for Clinicians. *Mayo Clinical Procedures*, 82: 967- 975.
- Richard, E., Isaac, A., Samuel, A.S., Joyce, A. and Hope A. (2015). Seroprevalence and risk factors of Hepatitis B and Hepatitis C infection among pregnant women in the Asante North Municipality of the Ashanti region Ghana; a cross sectional study. *African health sciences*, 15(3): 709-713.
- Sabria, R., Charles, K. and Said, A. (2014). Seroprevalence of hepatitis B virus infection among antenatal clinic attendees at a tertiary hospital in Dares Salaam, Tanzania. *Tanzania Journal of Health Research*, 16(1): 1-8
- Ugbebor, O., Aigbirior, M., Osazuwa, F., Enabudoso, and Zabayo, O. (2011). The prevalence of hepatitis B and C viral infections among pregnant women. *North American Journal of Medical Sciences*, 3(5):238-241.
- World Health Organization (2010). Prevalence of hepatitis B virus in the world by country.
- Yakasai, I.A., Ayyuba, R., Abubakar, I.S. and Ibrahim, S.A. (2012). Sero-prevalence of Hepatitis B Virus Infection and its Risk factors among Pregnant Women Attending Antenatal Clinic at Aminu Kano Teaching Hospital, Kano, Nigeria. *Journal of Basic and Clinical Reproductive Sciences*, 1(1-2):49-55