International Blood Research & Reviews

13(2): 1-10, 2022; Article no.IBRR.84167
ISSN: 2321–7219

Occurrence Rate of Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) Co - infection among Expectant Mothers Attending Antenatal Clinic in Rivers State University Teaching Hospital

Beatrice Wobiarueri Moore-Igwe [a], Beauty Eruchi Echonwere –Uwikor [a*], Ransom Baribefii Jacob [a] and Emmanuel-Nath Ogochukwu [a]

[a] Department of Medical Laboratory Science, Rivers State University, Port-Harcourt, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IBRR/2022/v13i230170

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/84167

Original Research Article

Received 29 November 2021
Accepted 31 January 2022
Published 03 February 2022

ABSTRACT

The global burden of co-infection with human immunodeficiency virus (HIV), hepatitis B and C virus (HBV and HCV) has a negative impact in Sub-Saharan Africa.When HIV, HBV and HCV co-exist, they become life threatening and with high fatality rate particularly in gestation in which transmission occurs vertically, causing fetal and neonatal hepatitis. The study aimed at examining the occurrence rate of Human Immunodeficiency Virus (HIV), Hepatitis B virus (HBV) and Hepatitis C Virus (HCV) co - infection among expectant mothers attending antenatal clinic in Rivers State University Teaching Hospital (RSUTH). The study population comprised of one hundred and fifty (150) pregnant women. Venous blood was used in the study and screened for hepatitis B surface antigen (HBsAg), anti-HCV, and anti-HIV antibodies using commercially available immunoassay test kits. The prevalence of HCV, HIV and HBsAg among the pregnant subjects in relation to age group 21-30 and 31-40 in the study revealed a seropositive percentage of 0.7% and 1.3%. The other groups, however, showed no positive result among the three viruses. Furthermore, 0.7% of the pregnant women in their first, second and third trimester were co-infected with HCV and HBsAg while 1.3%

**Corresponding author: E-mail: beautyechonwere@gmail.com;*

out of 36.7% and 0.7% out of 61.3% of pregnant women within the age groups 21-30 and 31-40 respectively were seropositive for HIV. In relation to gestational age, it was seen from the study that 0.7% of the pregnant women in their first, second and third trimester were seropositive for HCV and HBsAg respectively, while 2% of the HIV seropositive pregnant women were in their first trimester. The overall seroprevalence of HCV, HIV and HBsAg as revealed in the study showed that infection was found to be 2% respectively among the pregnant women. The reduced prevalence of hepatitis B (HBsAg), hepatitis C (HCV) and human immunodeficiency virus (HIV) infection observed in the study among pregnant women attending antenatal care in the Rivers State University Teaching Hospital may be attributed to the increase in the awareness amongst the general populace in Port Harcourt especially couples about the consequences of sexually transmitted diseases such as HIV, Hepatitis B as well as Hepatitis C. In other words, there is reduction in seroprevalence of HBsAg, HCV and HIV which is premised on the efficacy of sensitization particularly on HBV vaccination and preventive protocols for HIV.

Keywords: Human immunodeficiency virus; hepatitis B and C Virus; co-infection; pregnant women; seroprevalence.

1. INTRODUCTION

It has globally been established that the commonly identifiable viruses are human immuno deficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus. They are significantly prominent among other disease-causing agents. The impressions they make, transcend humans and greatly affect Gross Domestic Product (GDP) of States with greater consequence on humanity [1]. HIV also has imbedded in it; similar features as are prevalent in HBV. These elements are vertical and horizontal transmission, injection drug use and sexual activities [2,3]. Having pointed out this problem, the management of patients co-infected with HIV and HBV, HCV have been reviewed and guidelines provided in recent times [3,4,5].

It has been established that there is a noticeable difference in the prevalence of HIV, HBV and HCV coinfection of infected people occasioned by geographical region and behaviour of infected people. [3]. HIV and HBV have similar pattern of spreading and risk factors. This is the reason so many climes that are affected by high HIV are also affected by HBV [6,7]. Globally, HIV accounts for about 40 million, HBV is responsible for about 370 million chronic infections and 130 million is apportioned to HCV [8].

Approximately 4–5 million have HCV co-infection while nearly 2–4 million individuals who suffer from HIV are also infected with chronic HBV co-infection [9]. The degree of occurrence varies tremendously from one clime over a period of time [10-15]. It is on that premise that observation studies are needed to monitor the level and method of occurrence of these viruses and to execute relevant preventive protocols. HIV, HBV and HCV infections are endemic in Africa, but their rates vary considerably within African countries. The occurrence rates of HBV and HCV measure between 3–20% and 1–26%, respectively. Going further, above 63% of those infected with HIV globally live in Africa, and in 2008, about 2.7 million fresh HIV infections were profiled in Sub-Saharan Africa alone [16]. The area most ravaged by HIV is Africa as compared to other areas in the world with 35 million individuals infected with HIV and 670,000 recent HIV infections in 2020 [17]. In 2009, the approximate population of people living with HIV virus in Nigeria is 3.6%. and the country recorded the greatest number of deaths worldwide (220,000) after South Africa [18].

Hepatitis B infection is relatively high in Africa as it varies tremendously around the globe. It is also noted that Africa has the second highest number of chronically HBV – infected individuals [19].

Globally, Hepatitis C virus infection (HCV) affects nearly 3.9 million persons [20]. Liver cirrhosis and liver cell carcinoma is largely caused by HCV and it proliferates in Africa [21,22,23]. The greatest prevalence rate of HCV (5.3%) occurs in Sub-Saharan Africa with a similar dominance in HIV [24].

In Nigeria and sub - Saharan Africa, hepatitis B virus (HBV) and hepatitis C virus (HCV) are endemic and put at above 35 million and 75 million respectively [25]. Prescribed combination of effective antiretroviral treatment is encouraged in the management of symptoms in this population. In fact, chronic hepatitis is considered when prescribing drugs to treat HIV and hepatitis

diseases [26]. Hence, it becomes imperative to know the epidemiology and occurrence of the three viruses, and their consequence on the immune system.

It is a fact that HIV infection has spread greatly in Africa, and information about the prevalence of HBV and HCV among HIV infected individuals are reduced. The problem of liver disease in Africa owing to serious HBV and/or HCV has become a thing of great concern especially in those infected with HIV [27]. HIV increases the success rate of serious liver diseases related to HBV and HCV. Some HIV patients manifest viral hepatitis. The implication of this is that liver diseases will seemingly show obvious causes of morbidity and mortality among HIV infected persons in Africa, similar to the happenings worldwide [28].

According to several reports, co-infection helps rapid production and reduces clearance of the viruses, as a result of weakened innate and adaptive immune responses [29,30]. Attention should be given to the HIV-positive sub-population because of its huge implication on public health which co-infection with HBV can have.

2. MATERIALS AND METHODS

2.1 Study Design

The study is cross-sectional retrospective in nature. Structured questionnaire was used to capture data on socio-demographic, obstetric, knowledge of HBV and HIV.

2.2 Study Area and Study Population

The study population comprised of one hundred and fifty (150) pregnant women attending the antenatal clinic of the Rivers State University Teaching Hospital, Port Harcourt.

2.3 Eligibility Criteria

2.3.1 Exclusion criteria

Non-pregnant women were not included in this study.

Pregnant women whose consent were not obtained to enrolment in this study were also not included.

2.3.2 Inclusion criteria

Pregnant women, no matter the age; gestational age or parity were enrolled in the study.

Only those who agreed and gave oral consent were included in the study.

2.4 Sample Collection /Analysis

4ml of whole blood was collected aseptically into a potassium ethylene diamine tetracetic acid (K_3EDTA) sample container. The sample was screened within 24 hours of collection using commercially available immunoassay test kits.

2.5 Statistical Analysis

The percentage frequency of HIV, Hepatitis B virus and Hepatitis C virus amongst the studied subjects was obtained using MS Excel statistical package and information represented in tables.

3. RESULTS

3.1 Demographic Features of the Study Population

150 pregnant women attending antenatal clinic at the Rivers State University Teaching Hospital (RSUTH) were used for this study. The demographic information of the participants is shown in Table 1. Only one of the women was below 20 years representing 0.7% of the total population. The ones between the ages of 21-30, 31-40 and 41-50 were 55(36.7), 92(61.3) and 2(1.3) in the same order. Three (2%) of the women were unmarried parents, while 147(93.3%) were married. Educated women made up a larger percentage of the pregnant women with about 85.3% comparative to the 14.7% for those with secondary school education and below. 85(56.7%), 39(26%) and 26(17.3%) of the women were in their first, second and third gestational age in the same order. Estimated 34% (51/150) of the women were nulliparous while 48% (72/150) had 1-3 children and 18% (27/150) had 4 children and above. A greater number of the women were in monogamous(women married to Men with one wife) family setting (147/150) and the remaining 2% (3/150) were in polygamous(women married to men with more than one wife) family settings.

Table 1. Demographic details of participants

Subjects		Frequency (%)
Age group	< 20	1 (0.7)
	21-30	55 (36.7)
	31-40	92 (61.3)
	41-50	2 (1.3)
	> 51	0
	Total	**150 (100)**
Marital Status	Unmarried	3 (2)
	Married	147 (98)
	Total	**150 (100)**
Education	Nil	0
	Primary	0
	Secondary	22 (14.7)
	Tertiary	128 (85.3)
	Total	**150 (100)**
Gestational Age	1st Trimester	85 (56.7)
	2nd Trimester	39 (26)
	3rd Trimester	26 (17.3)
	Total	**150 (100)**
Number of Children	None	51 (34)
	1-3	72 (48)
	> 4	27 (18)
	Total	**150 (100)**
Type of Family	Monogamous	147 (98)
	Polygamous	3 (2)
	Total	**150 (100)**

3.2 The Percentage Distribution of Hepatitis C, Human Immunodeficiency Virus and Hepatitis B Virus Status amongst the Pregnant Subjects with Respect to Age Group and Gestational Age

The prevalence of HCV, HIV and HBsAg amongst the pregnant subjects in relation to age group of 21-30 and 31-40 in the study revealed a seropositive percentage of 0.7% and 1.3% and a seronegative percentage of 36% and 60% (HCV and HIV) and 1.3% and 0.7% for HBsAg in the same order. The other groups, however, showed no positive result among the three viruses.

In relation to gestational age, it was seen from the study that 0.7% of the pregnant women in their first, second and third trimester were seropositive for HCV and HBsAg respectively, while 2% of the HIV seropositive pregnant women were in their first trimester. Detailed information is shown in Table 2.

3.3 Percentage Distribution of Hepatitis C (HCV), Human Immunodeficiency Virus (HIV) and Hepatitis B Virus (HBsAg) Status Amongst the Pregnant Subjects According to Marital Status and Education

In examining the prevalence of HIV, HBsAg and HCV, with respect to marital status, amongst the pregnant subjects in the study exposed a seropositive percentage of 2%. unmarried pregnant women were all seronegative. Seroprevalence of HIV, HBsAg and HCV among pregnant women with first degree was 0.7%, 2% and 1.3% respectively while pregnant women with senior secondary certificate had a seroprevalence of 1.3% and 0.7% for HIV and HBsAg infection respectively. This information can be deduced from Table 3.

Table 2. Percentage distribution of hepatitis C, human immunodeficiency virus and hepatitis B virus status amongst the pregnant subjects with respect to age group and gestational age

		HCV		HIV		HBsAg	
Subjects		**Seropositive n (%)**	**Seronegative n (%)**	**Seropositive n (%)**	**Seronegative n (%)**	**Seropositive n (%)**	**Seronegative n (%)**
Age group	< 20	0	1 (0.7)	0	1 (0.7)	0	1 (0.7)
	21-30	1 (0.7)	54 (36)	2 (1.3)	53 (35.3)	1 (0.7)	54 (36)
	31-40	2 (1.3)	90 (60)	1 (0.7)	91 (60.7)	2 (1.3)	90 (60)
	41-50	0	2 (1.3)	0	2 (1.3)	0	2 (1.3)
	> 51	0	0	0	0	0	0
	Total	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**
Gestational Age	1st Trimester	1 (0.7)	84 (56)	3 (2)	82 (54.7)	1 (0.7)	84 (56)
	2nd Trimester	1 (0.7)	38 (25.3)	0	39 (26)	1 (0.7)	38 (25.3)
	3rd Trimester	1 (0.7)	25 (16.7)	0	26 (17.3)	1 (0.7)	25 (16.7)
	Total	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**

Table 3. Percentage distribution of hepatitis C (HCV), human immunodeficiency virus (hiv) and hepatitis B Virus (HBsAg) Status amongst the pregnant subjects according to marital status and education

		HCV		HIV		HBsAg	
Subjects		**Seropositive n (%)**	**Seronegative n (%)**	**Seropositive n (%)**	**Seronegative n (%)**	**Seropositive n (%)**	**Seronegative n (%)**
Marital Status	unmarried	0	3 (2)	0	3 (2)	0	3 (2)
	Married	3 (2)	144 (96)	3 (2)	144 (96)	3 (2)	144 (96)
	Total	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**
Education	Nil	0	0	0	0	0	0
	Primary	0	0	0	0	0	0
	Secondary	0	22 (14.7)	2 (1.3)	20 (13.3)	1 (0.7)	21 (14)
	Tertiary	3 (2)	125 (83.3)	1 (0.7)	127 (84.7)	2 (1.3)	126 (84)
	Total	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**

Table 4. Percentage distribution of hepatitis C virus (HCV), human immunodeficiency virus (HIV) and hepatitis B virus (HBsAg) status amongst the pregnant subjects according to family type and number of children

		HCV		HIV		HBsAg	
Subjects		**Seropositive n (%)**	**Seronegative n (%)**	**Seropositive n (%)**	**Seronegative n (%)**	**Seropositive n (%)**	**Seronegative n (%)**
Number of Children	None	0	51 (34)	1 (0.7)	50 (33.3)	0	51 (34)
	1-3	3 (2)	69 (46)	2 (1.3)	70 (46.7)	3 (2)	69 (46)
	> 4	0	27 (18)	0	27 (18)	0	27 (18)
	Total	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**
Type of Family	Monogamous	3 (2)	144 (96)	3 (2)	144 (96)	3 (2)	144 (96)
	Polygamous	0	3 (2)	0	3 (2)	0	3 (2)
	Total	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**	**3 (2)**	**147 (98)**

3.4 Percentage Distribution of Hepatitis C Virus (HCV), Human Immunodeficiency Virus (HIV) and Hepatitis B Virus (HBsAg) Status Amongst the Pregnant Subjects According to Family Type and Number of Children

Occurrence of HIV, HBsAg and HCV amongst the pregnant subjects according to family type in the study revealed that women with 1-3 children had the highest seropositive cases for HIV, HCV and HBsAg of (1.3%, 2%, 2%) each respectively. Except for 1 seropositive case for HIV out of 51 women in the group with no previous pregnancy, other groups had no seropositive cases. Pregnant women only, in monogamous(women married to Men with one wife) families, were seropositive for HIV, HCV and HBsAg with 2% seroprevalence respectively. This can be deduced from Table 4.

4. DISCUSSION

The overall seroprevalence of HBsAg, HIV and HCV infection was found to be 2% in the same order among the pregnant women attending the River State University Teaching Hospital. According to WHO [31], endemic rates are classified according to states. States with low rates are < 2%, intermediate endemic rates (2-8%) and high endemic rates (> 8%) positive for HBV. Our observation in this study shows intermediate endemicity of HBV infection as 2.0% in the occurrence of HBsAg among pregnant women attending antenatal. A report made in Southeast Nigeria by Munoz et al. [32] showed 2.2% occurrence rate of HBV which is in close agreement with our study. In South-South Nigeria, Similarly, Obi et al. [33] revealed the occurrence rate of 2.9% among pregnant women in Port Harcourt. The total occurrence rate of HIV for pregnant women seen in this study was 2.0%, this is lower than the 7.2% occurrence of HIV noted in a study conducted among pregnant women in Benin Nigeria by Oladeinde et al. [34] and 10.2% reported by Oladeinde et al. [35] among pregnant women attending antenatal clinic in Okada village, Edo State, Nigeria. The Federal Ministry of Health Nigeria has reported downward trend of HIV infection among pregnant women as seen in its studies which shows HIV occurrence rate of 5.8%, 5.0% and 4.6% for 2001, 2003 and 2008 in the same order [36,37,38]. This may be the reason for the low occurrence rate among pregnant women in this study.

It is shown worldwide statistically that 15% of HIV positive females fall within the group of 15 – 24 years. Okonko et al. [39] showed that the greatest occurrence was found among persons of 25-31years.

Furthermore, some studies showed the dominance of females within the age bracket of 20 – 29 years [40,41].

Co-infection with Hepatitis C Virus (HCV) is hardly seen in persons living with human immunodeficiency virus (HIV) however, where it occurs, it leads to treatment complications. Most patients with HIV do not know that they may also be infected with HCV [6], but epidemiological studies have revealed that HIV and HCV co-infection is gaining global recognition because the mode of transmission is the same [24]. Ejeta and Dabsu [42], revealed that occurrence rate of HCV/HIV co-infection was 0.23% while Desalegn et al. [43] noted a 0.93% occurrence rate for HBV/HIV co-infection. This finding differed from study in South -Eastern Nigeria where women aged between 25-29 years and 20-30 years respectively were found to be at a significant risk of HIV/HBV co- infection [44,45]. The Nigerian researchers attributed this to the higher prevalence of HIV as well as the likelihood of high sexual activity in these age groups.

It has been observed in Nigeria that the seroprevalence of HCV reported as 2% in this study is greater than the 0.5% stated in Gwagwalada by Agarry et al. [46], 0.5% verified by Buseri et al. [47] and 0.4% in Calabar by Mboto et al. [48]. The results of this study were in tandem with the 2.1% quoted for Nigeria in the hepatitis C prevalence data worldwide, published by Lavanchy [49] and also the 1.86% found among pregnant women in University of Benin Teaching Hospital by Onakewhor et al. [50]. In another development, research by Duru et al. [51] performed in Benin City revealed an occurrence rate of 5% which is greater than the rate seen in the present study. The occurrence rate of 1.8% seen among pregnant women in Cameroon obtained by Richard et al. [10] and the 2% and 2.1% noted in Burkina Faso and Gabon respectively by Ndong-Atome et al. [11] though studies conducted in other African countries, are in consonant with findings from our study. The peculiarities in the mode of transmission of HCV which may be dictated by socio-cultural and environmental factors are related to the variation which occurred. From this study, it was noticed that the HCV infection was greater among

pregnant women who were within the age bracket of 31-40 years (1.3%) when compared to the 0.7% recorded for women of 21-30 years. This agrees with a studies by Mac et al. [12] and Chinenye et al. [13]. which showed a systematic pattern.

On the contrary, a study by Olokoba et al. [14] in Yola, Nigeria showed progressive increase in the occurrence of HBsAg when the pregnant women were grouped according to age groups, with a rise in the 25−29 years (2.2%) age group and a downward fall in 40−44 years age group (0.9%).

5. CONCLUSION

The study depicted a low rate of occurrence of human immunodeficiency virus (HIV), hepatitis B (HBsAg), and hepatitis C (HCV) which points to the increase in the awareness created in different media in Port Harcourt with particular interest in married people about the effects of sexually transmitted diseases such as HIV, Hepatitis B and Hepatitis C as well as preventing HBV through vaccination and preventive measures for HIV by health care professionals in the antenatal clinic of Rivers State University Teaching Hospital.

INFORMED CONSENT AND ETHICAL CLEARANCE

Permission was given by the Department of Medical Laboratory Science, Rivers State University, Port Harcourt to carry out this study. Written informed consent was obtained from the respective subjects before enrolment. Information was obtained using questionnaires to obtain the socio-demographic characteristics and presence of risk factors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Daw M, Dau A. Hepatitis C in Arab world: A state of concern. Scientific World Journal. 2012;321(7253):78–82.
2. WHO. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: Recommendations for a Public Health Approach; 2013.
3. Nelson P, Mathers B, Cowie B. The epidemiology of viral hepatitis among people who inject drugs: results of global systematic reviews. The Lancet, 2013;378(9791):571–83.
4. Highleyman L. HIV/HBV and HIV/HCV coinfected people with impaired liver function and inflammation have higher risk of non-AIDS death, in Proceedings of the 17th Conference on Retroviruses and Opportunistic Infections (CROI '10), San Fransisco, Calif, USA; 2010.
5. Rosenthal E, Poirée M, Pradier C. Mortality due to hepatitis C-related liver disease in HIV-infected patients in France (Mortavic 2001 study). AIDS. 2003;17(12):1803–09.
6. Zenebe Y, Wondemagegn M, Mulat Y, Bayeh A. 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. 2014;14:118.
7. Daw MA. Transmission of hepatitis C virus. In: Oumaima Stambouli (eds.). Hepatitis C Virus: Molecular Pathways and Treatments. OMICS Group, Nevada, USA; 2014 .
8. Alter MJ. Epidemiology of viral hepatitis and HIV co-infection. Journal of Hepatology. 2006;44:6-9.
9. Singal AK, Anand BS. Management of hepatitis C virus infection in HIV/HCV co-infected patients; clinical review. World Journal of Gastroenterology. 2009; 15:3713–24.
10. Richard N, Christophe P, Ahidjo A, Mathurin CT, Aurelia V, Jermie M. Low risk of mother-to-child transmission of Hepatitis C virus in Yaoundé, Cameroon. American Journal of Tropical Medicine and Hygiene. 2005;73(2):460-66.
11. Ndong-Atome G, Makuwa M, Njouom R, Branger M, Brun-Vézinet F, Mahé A. Hepatitis C virus prevalence and genetic diversity among pregnant women in Gabon, central Africa. BioMed Central Infectious Diseases. 2008;8(1):82.
12. Mac PA, Suleiman AC, Airiohuodion PE. High prevalence of hepatitis B virus infection among pregnant women attending antenatal care in Central Nigeria. Journal of Infectious Diseases and Epidemiology. 2019;5(1):68.

13. Chinenye GA, Adeola F, Chukwuma O, Rasheed B. Prevalence, sociodemographic features and risk factors of Hepatitis B virus infection among pregnant women in Southwestern Nigeria. 2015;20(406):6-8.
14. Olokoba AB, Salawu FK, Danburam A, Olokoba LB, Midala JK, Badung LH. Hepatitis B virus infection amongst pregnant women in North-Eastern Nigeria- A call for action. Nigerian Journal of Clinical Practice. 2011;14(1):10-13.
15. Ya'aba Y, Isu NR, Mohammed SB, Oladepo DK, Ibrahim K, Oladusu P, Onoja AJ. Prevalence of Hepatitis C virus (HCV) and human immunodeficiency virus (HIV) co-infection among pregnant women attending antenatal clinics in Abuja, Nigeria. Journal of Phytomedicine and Therapeutics. 2009;14(2):15-18.
16. Rusine J, Ondoa P, Asiimwe-Kateera B, Boer KR, Uwimana JM. High Seroprevalence of HBV and HCV Infection in HIV-Infected Adults in Kigali, Rwanda. PloS one. 2013;8(5):63303.
17. UNAIDS. AIDSinfo.unaids.org; 2021.
18. Central Intelligence Agency. Author. The World Factbook. [database on the Internet] Washington, DC: Central Intelligence Agency; 2009. [Cited 2011 Jul 23]. Available:https://www.cia.gov/library/publications/the-world-factbook/
19. Mbaawuaga EM, Enenebeaka MNO, Okopi JA, Damen JG. Hepatitis B virus infection (HBV) among pregnant women in Makurdi, Nigeria. African Journal of Biological Sciences. 2008;11:155 – 59.
20. Shittu OK, Lawal B, Oluyomi OI. Effects of methanol extract of musca domestica larvae on antioxidants enzymes in t. brucei infected rats. Nigerian Journal of Biochemistry and Molecular Biology. 2014;29(2):1-10.
21. Olokoba AB, Salawu FK, Danburam A, Desalu OO, Olokoba LB, Wahah KW, Badung LH, Tidi SK, Midula J, Aderibigbe S, Abdulrahman, MB, Babalola OM, Abdukkarim A.Viral hepatitis in voluntary blood donors in Yola, Nigeria. European Journal of Scientific Research. 2009;31(3):329 – 334.
22. Elsheikh RM. Hepatitis B virus and Hepatitis C virus in pregnant Sudanese women. Journal of Virology. 2007;4(1):104.
23. Kleinman SH. Frequency of HBV DNA detection in US blood donors testing positive for the presence of anti-Hbc: Implications for transfusion transmission and donor screening, Transfusion. 2003;43:696–04.
24. Madhava V, Burgess C, Drucker E. Epidemiology of chronic hepatitis C virus infection in sub-Saharan Africa. The Lancet Infectious Diseases. 2002;2(5):293-02.
25. Modi AA, Feld JJ.Viral hepatitis and HIV in Africa. AIDS Reviews. 2007;9(1):25-39.
26. Kumar R, Singla V, Kacharya SK. Impact and management of hepatitis B and hepatitis C virus co-infection in HIV patients. Tropical Gastroenterology. 2008;29(3):136-47.
27. Hoffmann CJ, Thio CL. Clinical implications of HIV and hepatitis B co-infection in Asia and Africa. The Lancet Infectious Diseases. 2007b;7:402–09.
28. Hatzakis A, Damme P, Alcorn K, Gore C, Benazzouz M. The state of hepatitis B and C in the Mediterranean and Balkan countries: report from a summit conference. Journal of Viral Hepatitis. 2013;20:1–20.
29. Hoffmann CJ, Charalambous S, Thio CL. Hepatotoxicity in an African antiretroviral therapy cohort: The effect of tuberculosis and hepatitis B. AIDS. 2007a;21(10):1301–08.
30. Sulkowski MS, Thomas DL, Chaisson RE, Moore RD. Hepatotoxicity associated with antiretroviral therapy in adults infected with human immunodeficiency virus and the role of hepatitis C or B virus infection. The Journal of the American Medical Association. 2000;283(1):74–80.
31. WHO/EPI. Protocol for assessing prevalence of hepatitis B infection in antenatal patients. WHO/EPI/GEN/90.6 1990. Available:http://whqlibdoc.who.int/publications/2010/9789241599764_eng.pdf,accessed 23 August 2011).
32. Munoz PS, Rober S, Sheffiedld J.6.3% Prevalence of hepatitis B and C in pregnant women who are infected with HIV. American Journal of Obstetrics and Gynecology. 2005;193(3):1270-3.
33. Obi RK, Iroagba II, Ojiako OA. Prevalence of human immunodeficiency virus (HIV) infection among pregnant women in an antenatal clinic in Port-Harcourt, Nigeria.

African Journal of Biotechnology. 2007;6(3):17-21.
34. Oladeinde BH, Omoregie R, Oladeinde OB.Prevalence of HIV, HBV, and HCV infections among pregnant women receiving antenatal care in a traditional birth home in Benin City, Nigeria. Prevalence. 2013;2(2):113-17.
35. Oladeinde BH, Omoregie R, Olley M, Anunibe JA. Prevalence of HIV and anemia among pregnant women. North American Journal of Medical Sciences. 2011;3(12):548-51.
36. Federal Ministry of Health, Nigeria . Technical report on the 2001 National HIV/syphilis sentinel survey among pregnant women attending antenatal clinics in Nigeria. Abuja Federal Ministry of Health, Nigeria; 2001.
37. Federal Ministry of Health, Nigeria. National AIDS/STD Control Programme: National HIV sero-prevalence Sentinel Survey. Abuja, Nigeria; 2003.
38. Federal Ministry of Health, Nigeria. Technical report on the 2008 National HIV seroprevalence sentinel survey among pregnant women attending antenatal clinics in Nigeria. Department of Public Health, National AIDS/STI Control Programme, Abuja, Nigeria; 2008.
39. Okonko IO, Osadebe AU, Onianwa O Okereke S. Prevalence of HIV in a cohort of pregnant women attending a Tertiary Hospital in Ibadan, Nigeria. Immunology and Infectious Diseases. 2019;7(1): 7-12.
40. Anyaka C, Tinuade O, Jonah M, Isichei M, Anyaka I, Isichei C. HIV prevalence amongst pregnant women clients attending antenatal clinic at the Faith Alive Foundation and PMTCT Centre, Jos Plateau State. World Journal of AIDS. 2016;6:59–64.
41. Okerentugba PO, Uchendu SC, Okonko IO. Prevalence of HIV among pregnant women in Rumubiakani, Port Harcourt, Nigeria. Public Health Research. 2015;5(2):58-65.
42. Ejeta E, Dabsu R. Prevalence of hepatitis C virus and HIV infection among pregnant women attending antenatal care clinic in Western Ethiopia. Frontiers in Medicine. 2019;5:366.
43. Desalegn Z, Wassie L, Beyene HB, Mihret A, Ebstie YA. Hepatitis B and human immunodeficiency 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. 2016;21(1):1-7.
44. Landes M, Newell ML, Barlow P, Fiore S, Malyuta R, Martinelli P. Hepatitis B or hepatitis C co-infection in HIV-infected pregnant women in Europe. HIV Medicine. 2008;9(7):526-34.
45. Nwobu G, Igwe CU, Agba MI, Okpala HO, Ikaraoha CI. The Seroprevalence of Hepatitis B Surface Antigen and Human Immunodeficiency Virus Among Pregnant Women in Anambra State Nigeria. Shiraz E-Medical Journal, Issue. 2004;5(5): 1-8.
46. Agarry OO, Lekwot GZ). Prevalence of hepatitis B virus and hepatitis C virus in ante-natal patients in Gwagwalada- Abuja, Nigeria. Report and Opinion. 2010;2(7):48-50.
47. Buseri FI, Seiyaboh E, Jeremiah ZA. . Journal of Global Infectious Disease. 2010;2(3):203–11.
48. Mboto CI, Ebenge Andy I, Ogban IE, Jewell AP. Prevalence, Socio demographic characteristics and risk factors for Hepatitis C infection among pregnant women in Calabar municipality, Nigeria. Hepatitis Monthly. 2010;10(2):116-20.
49. Lavanchy D. Evolving epidemiology of hepatitis C virus. Clinical Microbiology and Infection. 2011;17:107–15.
50. Onakewhor JU, Okonofua FE. Seroprevalence of Hepatitis C viral antibodies in pregnancy in a tertiary health facility in Nigeria. Nigerian Journal of Clinical Practice. 2009;12(1):65–73.
51. Duru MU, Aluyi HSA, Anukam KC. Rapid screening for co-infection of HIV and HCV in pregnant women in Benin City, Edo State, Nigeria. African Health Sciences, 2009;9(3):137-42.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/84167