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Original article

Seroprevalence of hepatitis B and C viruses among pregnant women in Ilorin, Kwara State, Nigeria

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Background: Infections due to hepatitis B (HBV) and C viruses (HCV) are significant around the world including Nigeria, and pregnant women infected with hepatitis B and C viruses represent a major reservoir of the viruses in the community. This research was conducted among 400 pregnant women in Ilorin Kwara State, Nigeria to determine the sero-prevalence of HBV and HCV. **Method:** Blood samples from consented pregnant women were collected and the blood samples were tested for hepatitis B surface antigen HBsAg and Anti-HCV one step rapid test strip adopting immunochromatographic methods and all seropositive samples were confirmed by detecting the presence of specific immunoglobulin G (IgG) for HBV and HCV respectively, using enzyme linked immunosorbent assay (ELISA) technique. **Results:** The result showed that 44 (11%) and 2 (0.5%) of the blood samples were positive for HBV and HCV respectively, 2 samples, however showed coinfection, being positive to both HBV and HCV. HBsAg was detected at a higher rate among pregnant women aged 30 and above than in any other age group, the difference was not statistically significant ($p \geq 0.05$). **Conclusion:** The data obtained from the structured questionnaires were also analyzed to demonstrate the reactivity levels of both HBV and HCV in relation to the sociodemographic characteristics of the participants included in this research.

Introduction

Hepatitis means inflammation of the liver. The liver is a vital organ that processes nutrients, filters blood and fights infection and when a liver is inflamed or damaged, its function can be affected [1]. Viral hepatitis is a life-threatening liver disease, caused by hepatitis B (HBV) and C virus (HCV), and is a major public health problem, particularly in developing countries [2]. Viral hepatitis is the inflammation of the liver caused by infection with the hepatitis viruses; it can also be due to toxins (notably alcohol, certain medications and plants), other infections and autoimmune diseases [3].

Liver disease due to HBV or HCV infection is the most common indication for liver transplant as chronic hepatitis infection leads to increased risk for hepatic insufficiency, cirrhosis, and hepatocellular carcinoma (HCC) [4]. Hepatitis B virus is a DNA virus of the family *hepadnaviridae* and the causative agent of hepatitis B infection [5].

Hepatitis B is an infectious illness caused by HBV; an enveloped virus with double-stranded circular DNA. The prevalence of chronic hepatitis B infection varies greatly around the world and is closely associated with the main routes of HIV transmission [6] .

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Both HBV and HIV share similar mode of transmission and risk factors, HIV-infected people are frequently co-infected with HBV [7]. Modes of transmission of hepatitis B varies since the virus is present in blood, saliva, semen, vaginal secretions, menstrual blood, and in smaller quantities in perspiration, breast milk, tears and urine of the infected individual [8]. Acute HBV infection occurs in 1 to 2 of every 1000 pregnancies with 1 to 5% of pregnant women being chronic carriers of HBV [9]. Onwuakor et al. reported the prevalence of HBV in Umuahia and its neighboring towns was 7.1%. Hepatitis C virus, a blood borne pathogen found worldwide, is the leading cause of chronic liver disease and the commonest indication for liver transplant [4].

Hepatitis C was first characterized in 1989 as an enveloped single-stranded RNA virus of the flaviviridae family and genus hepacivirus, with about 6 major genotypes and over 50 subtypes identified [10,11]. Infection caused by HBV is a serious public health problem causing about two billion infections worldwide [12].

Hepatitis B virus is usually transmitted parenterally through transfusion of blood and blood products, sharing of needles and razors, tattooing and acupuncture, renal dialysis, organ donation and sexual intercourse. Horizontal transmission is possible in children, families and 'close personal contact'. Vertically transmission occurs perinatally from a carrier mother to her baby, through the placenta and during delivery [13]. Nigeria is classified among the group of countries endemic for HBV infection. It is estimated that about 18 million Nigerians are infected [14].

In Nigeria, several reports have established the endemic nature of HBV by the presence of HBsAg in different population groups from different parts of the country. In Nigeria, the prevalence rate of HBV and HCV in pregnant women differs from one locality to another. A prevalence of 7.9 and 7.6% respectively was reported in Kano, Nigeria [16]. While a prevalence rate of 8 (2.2%) and 3 (0.8%) of HBV and HCV infections among pregnant women was reported in Benin City, Nigeria [17]. Furthermore a prevalence of 11.5% was reported in Ibadan Oyo state [18] and a prevalent rate of 4.3% in pregnant women in Port Harcourt, Nigeria [19].

In a study conducted in Bauchi state, north-east Nigeria, the prevalence of HBV and HCV was 14.6 and 2.0%, respectively [20]. The prevalence of HBV from Ilorin in mothers and their preschool children was 5.7%, [15] 11.6% from Maiduguri, [21] and 8.3% from Zaria [22]. A sero-prevalence of 23.3% was reported among patients attending all clinics at the Aminu Kano Teaching Hospital (AKTH) [23]. Hepatitis C virus is five times as widespread and ten times as infectious as HIV and recent estimates of HCV disease burden show that about 185million people worldwide are chronically infected [24], over 80% of whom are asymptomatic and 55-85% progress to chronic liver disease in a slow and insidious manner [24]. According to the World Health Organization (WHO), HBV infection affects approximately two billion people globally and more than 240 million have chronic infections [25]. Between 500,000 and 780,000 patients die annually from HBV-related liver disease and most of these deaths occur in developing countries [24]. Similarly, WHO estimates that around 3% of the world's population has chronic HCV Infection, with more than one million new cases annually, the majority of which are occurring in Africa [26]. The objective of the present study is to determine the seroprevalence of HBVs and HCVs among pregnant women in Kwara State, Nigeria as well as to determine the effect of the sociodemographic characteristics of the participants in relation to the occurrence of hepatitis B and C viruses.

Methods

This research is a cross sectional study that focused on the seroprevalence of hepatitis B and C viruses among pregnant women attending ante natal clinics in Ilorin, kwara state. About 4mls of venous blood was collected aseptically by venipuncture from the cubital fossa, forearm or the hand of the 400 pregnant women recruited during their antenatal clinic, following standard operating procedures for phlebotomy. The aspirated samples were then dispensed into appropriately labeled EDTA sterile bottles and transported to the laboratory immediately for analysis. At the molecular laboratory in Kwara State university, the blood samples were registered, sorted and centrifuged at room temperature at 3000 rpm for 5minutes, to obtain clear plasma layer which was then separated from the packed cells and transferred into well labelled plain screw capped sterile bottles for storage in the freezer at -20^0C until processing. Ethical clearance was obtained and all the

participants fully consented to be included in the study. Semi structured questionnaires were also designed as a method to generate data from the participants in order to study their socio demographic characteristics.

HbsAg and anti HCV screening

HbsAg and Anti-HCV screening were conducted on all the blood samples using immunochromatographic methods following international best practices [27] .Thereafter, the seropositive samples for both HbsAg and anti HCV were analyzed using enzyme linked immunosorbent assay (ELISA) as described by the manufacturer (BIO-INTECO, UK) to detect the presence of immunoglobulin G (IgG) for HBV and HCV respectively.

Results

A total of 400 blood samples were collected from pregnant women attending ante natal clinics in Ilorin, Kwara state. Out of the total number of participants, a total number of 44 and 2 were positive for HBV and HCV respectively and this was further confirmed by ELISA technique. The mean age of the subjects used in this research is 30.7. Data generated from the study was entered into SPSS version 20.0, the data is summarized in frequency tables and Chi-square test was used to test the significance of the association between variables at 5% level of significance.

Table 1 shows the frequency distribution of the socio-demographic characteristics of the subjects used in the study. A total number of 400 subjects were involved in the serology screening for HBsAg and HCV. Majority of the subjects were above 30 years (46%), 36% were between 26-30 and 18% were between 20-25. Those who are married and living in urban area dominated the study with 98% and 89% respectively. 84% have higher education, 10.5% have secondary education and 5.5% have primary education. Most of the subjects are civil servant/professional worker (34.5%), followed by, trader (31%), artisan (16.5%), student (10.5%) and unemployed (7.5%). Majority of the subjects were in their third trimester of pregnancy (42%), 41.5% were in second trimester and 16.5% were in first trimester.

Table 2 presents the distribution of the serology screening result conducted. Out of the 400 samples analyzed, 44 (11%) were positive for HBsAg while 2 (0.5%) were positive for HCV with co-infection in 2 samples.

Table 3 presents the age distribution of subjects and HBsAg status among pregnant women in Ilorin. The prevalence of HBsAg was higher among age group of 30years and above (4.5%), then age group 26-30years (4.0%), with the least (2.5%) found among age group 20-25years.

Table 4 presents location of subjects and HBsAg status in Ilorin. 40 of 358 (10%) of subjects living in urban area were positive, 4 of 42 (1%) subjects living in rural area were positive.

Table 5 presents subject marital status and HBsAg status. 4 of 8 (1%) subjects that are single were positive while 40 of 392 (10%) subjects that are married were positive.

Table 6 presents subjects educational status and HBsAg status. It was higher among subjects with tertiary education as 32 of 336 (8.0%) tested positive, then subjects with secondary education 8 of 42 (2.0%) and least among subjects with primary education 4 of 22 (1.0%).

Table 7 present subjects' occupation and HBsAg status. It was higher among Civil servants/professional workers and Traders as 14 (3.5%) were positive in each group, then subjects who are Artisans 8(2%) and least in both Unemployed and Students as 4(1%) tested positive in each group.

Table 8 presents trimester and HBsAg status for the subjects. It was higher in second trimester 20(5%) then third trimester 14 (3.5%) and least in first trimester 10 (2.5%).

Table 1. Socio-demographic characteristics of pregnant women in Ilorin.

Characteristics	**Frequency**	**Percentage**
Age		
20-25	72	18.0%
26-30	144	36.0%
Above 30	184	46.0%
Location		
Urban	358	89.0%
Rural	42	10.5%
Marital Status		
Single	8	2.0%
Married	392	98.0%
Educational status		
Primary	22	5.5%
Secondary	42	10.5%
Tertiary	336	84.0%
Occupation		
Unemployed	30	7.5%
Student	42	10.5%
Artisan	66	16.5%
Trader	124	31.0%
Civil servant/Professional	138	34.5%
Period		
First trimester	66	16.5%
Second trimester	166	41.5%
Third trimester	168	42.0%

Table 2. Prevalence of HBsAg and HCV among pregnant women in Ilorin.

	Positive	**Negative**	**Total**
HBsAg	44 (11%)	356 (89%)	400 (100%)
HCV	2 (0.5%)	398 (99.5%)	400 (100%)

Co-infection = 2

Table 3. Age distribution and hepatitis B status among pregnant women in Ilorin.

Age group	Negative	Positive	Total
20-25	62 (15.5%)	10 (2.5%)	72 (18.0%)
26-30	128 (32.0%)	16 (4.0%)	144 (4.0%)
Above 30	166 (41.5%)	18 (4.5%)	184 (4.5%)
Total	**356 (89.0%)**	**44 (11.0%)**	**400 (100%)**

Table 4. Association between location and hepatitis B Status among pregnant women in Ilorin.

Location	Negative	Positive	Total
Urban	318 (79.5%)	40 (10.0%)	358 (89.5%)
Rural	38 (9.5%)	4 (1.0%)	42 (10.5%)
Total	**356 (89.0%)**	**44 (11.0%)**	**400 (100%)**

Table 5. Association between marital status and hepatitis B status among pregnant women in Ilorin.

Marital Status	Negative	Positive	Total
Single	4 (1.0%)	4 (1.0%)	8 (2.0%)
Married	352 (88.0%)	40 (10.0%)	392 (98.0%)
Total	**356 (89.0%)**	**44 (11.0%)**	**400 (100%)**

Table 6. Association between educational status and hepatitis B status among pregnant women in Ilorin.

Educational attainment	Negative	Positive	Total
Primary	18 (4.5%)	4 (1.0%)	22 (5.5%)
Secondary	34 (8.5%)	8 (2.0%)	42 (10.5%)
Tertiary	304 (76.0%)	32 (8.0%)	336 (84.0%)
Total	**356 (89.0%)**	**44 (11.0%)**	**400 (100%)**

Table 7. Association between occupation and hepatitis status among pregnant women in Ilorin.

Occupation	Negative	Positive	Total
Unemployed	26 (6.5%)	4 (1.0%)	30 (7.5%)
Student	38 (9.5%)	4 (1.0%)	42 (10.5%)
Artisan	58 (14.5%)	8 (2.0%)	66 (16.5%)
Trader	110(27.5%)	14 (3.5%)	124 (31.0%)
Civil servant/Professional worker	124 (31.0%)	14 (3.5%)	138 (34.5%)
Total	**356 (89.0%)**	**44 (11.0%)**	**400 (100%)**

Table 8. Prevalence of hepatitis B in different trimesters among pregnant women in Ilorin.

Period	**Negative**	**Positive**	**Total**
1st Trimester	56 (14.0%)	10 (2.5%)	66 (16.5%)
2nd Trimester	146(36.5%)	20 (5.0%)	166 (41.5%)
3rd Trimester	154 (38.5%)	14 (3.5%)	168 (42.0%)
Total	**356 (89.0%)**	**44 (11.0%)**	**400 (100.0%)**

Discussion

The WHO classification of high endemicity for HBV infection has been defined as HBsAg greater than 7% in an adult population [28]. The HBsAg sero-positivity of 11% among pregnant women in this study shows that the North central region like other parts of Nigeria is highly endemic for HBV infection. This result is in conformity with a finding carried out at General hospital Minna, Niger state in which a prevalence rate of 12.3% was reported [29] but in contrary with an earlier finding carried out in Federal medical centre Keffi, Nasarawa state [30] and the one carried out in Anyigba, Kogi state [31] with HBV prevalent rate of 6.67% and 1.0% respectively. The HBV result is higher than 6% reported by **Oluboyo et al. 2014** but the HCV is lower than 1% reported in the same research carried out in Nnewi, Anambra state. The HCV result is higher than 0.36% reported at Bowen University Teaching Hospital, Ogbomoso, South-west Nigeria [32]. The HBsAg result is higher than 4.6% as reported in 2018 in Yenagoa [33]. The HBsAg sero-prevalence rate is different from the 8.3% prevalence each, found among pregnant women in Nnewi [34] and in Yola [35] in South East, and North East Nigeria respectively. It is also dissimilar to the 7.9% reported in Aminu Kano Teaching Hospita [16]. The dissimilarity in the socio-demographic characteristics such as the age of the women, their level of education, and marital status, may account for the different results. The sero-prevalence rate found in this study is higher than the 2.9% found in pregnant women in Port Harcourt, South-South Nigeria [36] likewise higher than the 2.2% reported in Benin city [37], 4.6% obtained in Enugu [36], 4.7% in Akure [38], 6.7% found among pregnant women in Keffi [30], 9.5% in Gwagwalada North Central Nigeria [39], 11.0% found in Makurd [40] all in Nigeria. The lower rates found in these areas may be as a result of the differences in the assay method employed. In these studies, rapid test kits were used and third generation ELISA which has higher specificity and sensitivity was used to confirm it. Results from some other parts of Nigeria showed higher prevalence of HBsAg such as11.5% found among pregnant women in Oluyoro Ibadan [18] ,12% in Warri, Delta State [38],12.3% found in Minna [29], and 15.8% at the University of Maiduguri Teaching Hospital [34]. The prevalence rate depicts a trend that follows a low prevalence from the southern parts of the country increasing to its highest of 15.8% in the northern parts. Socio-demographic factors, most importantly the level of health education on prevention, may play a role in the southern parts of the country. Other reasons include higher economic status, higher educational level, early seeking of health-care assistance, and better effective utilization of these health-care facilities. Also, early marriage and hence early age at sexual debut, polygamy, multiple sexual partners, and inconsistent use of condom may account for this.

In similar studies done in Africa, lower rates of 6.5% each in Congo and Zambia and 6.2% in Sierra Leone [39], and 6.3% in Tanzania [29], had been reported while higher prevalence rate of 25.3% and 22% were reported in Cameroon and Egypt respectively [41]. In other parts of the world, 10% prevalence rate each was found in Hong Kong and India, 11% in Papau New Guinea [42] Lower prevalence rate of 1.53% was reported in Afghanistan [43], 1.7% was reported in Brazil among pregnant women [32] 0.29% in France, while in United States a report of 0.14%- 0.97% in different races and 5.6% among Asian American [42]. This agrees with WHO epidemiological survey

report that Global prevalence of HBV infection varies highest in Africa, Asia and Western Pacific (>8%) and lowest in Western Europe, North America and Australia [29]. Interestingly the prevalence of 11% found in the study is also lower than the 17% and 36% found among commercial sex workers in Jos and Ilorin respectively, 6-12% among blood donors in north central Nigeria [35], 21.3% and 24% also among blood donors in Jos and Ibadan [28]. It is also lower than the 30.6% found among people living with HIV and AIDS, as reported in Ogun [38] but it was higher than the 10.1% reported among voluntary blood donor reported in Bida North-central Nigeria [44]. In this study, the prevalence of HCV infection was found to be 0.5% which is not consistent with the 2.1% quoted for Nigeria in the hepatitis C global prevalence data, published in 2010 [4]. It is lower to the 1.86% found among pregnant women in University of Benin Teaching Hospital [37]. It is however similar to the 0.5% found in Gwagwalada [39] and higher than 0.4% reported in Calabar [45]. The lower rates here could be as a result of lower risk factors of HCV in Ilorin and its environment also it can be due to the sample size (400) employed in this research.

When compared to findings from other African countries, it was lower to the prevalence rate of 1.8% found among pregnant women in Cameroon, 8 and 2% in Burkina Faso [46]. It was lower than 17-26% rate in Egypt [39], 2.1% found in Gabon [46] and 2.6% in Côte d'Ivoire [39]. In other parts of the world, it is higher than the 0.31% reported in Afghanistan [43] but lower than the 5% in Pakistan. It is also lower than the 2.9-8.1% found among voluntary blood donors in Cross Rivers [32], and 7.6% reported among HCV co-infection in human immunodeficiency virus positive population in Bida, North-central Nigeria [44], the 225 obtained in Egypt [6], and 2.1% reported in Indonesia among blood donors [32]. The wide variations in the sero-prevalence of HBV and HCV in pregnant women may be due to differences in geographical location with African and Asian countries having a higher prevalence rate than Australia, North America, and Europe [4,29]. Patterns also differ between rural and urban setting and the variation could also be due to socio-economic status and ethnical variation, likewise the differences in socio-cultural practices such as sexual behavior and marriage practices.

Differences in the population group studied bring about variations; commercial sex workers, voluntary blood donors have consistently had higher prevalence rate than the pregnant women in the same location. This is not surprising as the former groups are characterized by more risky sexual behaviors such as multiple sexual partners, inconsistent condom use, and intravenous drug use. These are further enforced by enabling socio-demographic characteristics such as low socio-economic status. HIV enforces the transmission of HBV and HCV infection hence the higher prevalence rates found among those living with HIV and AIDS.

As expected, this study finds HBV and HCV co-infection in one of the women. This is not in agreement with findings in a similar study carried out in Gwagwalada [39]. Prevalence of HCV infection among pregnant women is low and could account for the finding in this study, however studies done in Yaounde (Cameroon) [41] revealed co-infection rate of 7.9% while in different populations like blood donors, commercial sex workers, intravenous drug users, heamo-dialysis patients, high co-infection rates have been reported [35] .

Hepatitis B virus infections in developing countries are mainly acquired following vertical transmission or through sexual contact [15].

A high frequency of HBV infection was found in the age group of 30 years and above. HBsAg is higher (4.5%) among pregnant women with age 30years and above in this study, this is not surprising as the age group is very active both in terms of reproduction and sexual activities and the cumulative years of sexual exposure and risky behaviour is higher in this group. This finding is consistent with a similar study in Oluyoro in Ibadan [18]; where majority of those that were sero-positive for HBsAg were in the age range of 30-39 years [18] also with research conducted in North central Nigeria where higher prevalence was recorded among pregnant women aged 46years and above [47]. However, this did not tally with a previous study in Nnewi [34], and Minna [29]where majority of the HBV positive women were within the 21–25-year age group. This may be as a result of the difference in the mean age of the pregnant women; which is (30.7 years) in the index study, Nnewi (24.3 years) and Minna (25 years) [29,34] surprisingly, women above 40 years dominated the HBsAg sero-positive age group in a study done in Port-Harcourt [36] and in Ethiopia [42] this could be due to socio-cultural and sexual practices where women have

pre-marital sexual partners before marrying at an older age [47].

The mean age of 29.3(±5.51) was found among the anti-HCV antibody sero-positive women, all of whom were below 35 years of age. Age is a known risk factor for hepatitis C infection; sero-positivity has been reported to increase until the age 40 and then declines over time [46] .

On the same vein, this study shows higher prevalence of HBV among pregnant women living in developed part of Ilorin (10%), this may be due to the risk factors of HBV being practiced among people from this axis and also the number of subjects from urban part employed in this study which is much higher that rural part, the result is in conformity with the research carried out in Minna, Niger state [29], also this is not statistically significant .

Also, higher prevalence was reported among married pregnant women (10%) than single pregnant women (1.0%) women due to polygamous life lead by a reasonable number of married men in Ilorin Kwara State. However, this is in contrast to findings reported in Jos that carriage rates for HBV in the general population were higher among the single group who were believed to be free to indulge in more sexual activities with different partners as opposed to married women [26]. HBV and HCV can be sexually transmitted, the duration of sexual activity, number of sexual partners, and history of sexually transmitted infections determine the prevalence of HBV infections. The *p*-value= 0.012 at 5% confidence level shows that marital status is statistically significant and there is association between marital status and HBV infection.

Majority (8.0%) of the pregnant women tested positive to HBsAg had tertiary education. This may be because this study was tertiary hospital-based and in an urban centre. This finding was in agreement with that found Port-Harcourt [36], in Minna [29] and in Kano [19] but it's contrary to recent research conducted in North Central Nigeria [47] and the research conducted in Ibadan [48] where higher prevalence were recorded in pregnant women with low Educational status. There is no significant association between educational status and HBsAg in this study as (*p*-value= 0.310) is greater than 0.05, this may be explained by the fact that a higher educational status is associated with greater awareness of the infection, its route of transmission and prevention, indicating the positive influence of education and public enlightenment/awareness of the career rate of HBV infection. The presence of cosmetic alterations in the form of body piercing or tattooing, cultural practices that allow female circumcision and scarification marks as well as unsafe injection practices should be taken into consideration whenever assessing the risk of an individual having HBV or HCV infection.

Finally, this study shows prevalence of HBV is higher in second trimester (5%) of pregnancy than third trimester (3.5%) and first trimester (2.5%). this is in agreement with research conducted in Northern Nigeria where 13.6% were in their second trimester also recorded 12.8% but this study is in contrary to recent research conducted in Federal medical centre Keffi Central Nigeria where higher rate (39.2%) was recorded in third trimester [47]. This study shows that trimester (*p* value= 0.526) is not statistically significant at 5% confidence level

Conclusion

The result of this study brings to light the high prevalence of hepatitis B (11%) infection among pregnant women in Ilorin, of the women found to be sero-positive for HBsAg, five (2.5%) were within the age group of 20-25, eight (4.0%) were within the age group of 26-30 and nine (4.5%) were within the age group of 30 above. The study shows the decreasing prevalence of HCV infection as antibody to hepatitis C virus was detected in 2(0.5%) of the pregnant women. There was one HBV and HCV co-infection among the participants in this study. Socio-demographic characteristics like age group, educational status, Occupation, trimester and location are not statistically significant in this study as their *p*-value is higher than 0.05 but this study shows there is association between marital status and hepatitis B infection.

The high prevalence of HBV in this study, underscores the importance of emulating global standard practices towards restraining the spread of the infection. If pregnant women are left undiagnosed and unmanaged, the future burden of the disease for healthcare resources and society will be fundamental.

Conflict of interest : None.

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