Original Research Article

PREVALENCE OF HIV AND HEPATITIS B INFECTIONS AMONG CHILDREN IN BAYELSA STATE, NIGERIA

ABSTRACT

The prevalence of HBV infection amongst HIV-positive and HIV-negative children was assessed. A total of 322 study samples were collected from discarded residual blood spot samples following routine diagnosis of HIV in children. Statistical differences in the prevalence of HBV between the HIV-positive and HIV-negative samples were calculated using the Pearson chi-square test, and a *p*-value < 0.05 was considered statistically significant. The number of HBV-positive children was 33, giving a prevalence of 10.25%, while the number of HBV-negative children was 289, giving a prevalence of 89.75%. The prevalence of HIV serotype-I was significantly higher in the HBV-positive children (15.96 %) than the HBV-negative children (84.04 %). The prevalence of HIV serotype II was also significantly higher in the HBV-positive children (8.96 %) than the HBV-negative children (91.04 %). The prevalence of HIV and HBV co-infection was higher in the female (7.78 %) than the male (5.16 %). The highest prevalence of HIV and HBV co-infection withrespect to age was seen in children within the age range of 1 – 2 years (8.57 %), while the lowest prevalence was seen in children between the age range of 3 – 4 years (0 %). The finding of a 10.25 % HBV prevalence in this children cohort is clinically significant. The non-statistically significant difference in HBV prevalence between HIV-positive and HIV-negative children suggests that the high prevalence of HBV infection in children may be independent of HIV infection. Therefore, the transmissions of HBV and HIV in children are not closely linked.

Keywords: Paediatrics, transmission, HIV/AIDS, Hepatitis, HBsAg.

1.0.INTRODUCTION

"Hepatitis B infection is a serious public health issue confirmed to be widespread in Nigeria and other sub-Saharan African countries. The condition has been identified as a major health concern, with a high risk of death from cirrhosis and liver cancer"[1]. "It is estimated that 240 million individuals are chronically infected with hepatitis B, and approximately 686,000 people die each year as a result of infection complications"[2]. "According to reports in 2005, there were approximately 6.1 million HIV-positive individuals in Nigeria alone"[3]."Moreover, a small percentage of people with chronic hepatitis B virus infection also have HIV infection. Due to this co-infection, cirrhosis has advanced quickly, HB virus loads have increased, HBeAg prevalence has increased, and the mortality rate among those affected has even increased"[4, 5]."Thus, combating the hepatitis B endemic is now a top priority for health institutions in many developing nations, along with HIV and cancer"[6].

"The Hepatitis B vaccination was developed due to advances in medical science, making the infection avoidable. Moreover, notable achievements in mitigating chronic consequences in

regions with elevated prevalence have been shown"[7]."The first dose of the Hepatitis B vaccine for children should ideally be given during the first few days of life, per the standards set forth by the World Health Organisation"[8]."However, this initial dose is given at six weeks of age in most Sub-Saharan African nations. This is due to epidemiological research demonstrating that African women are primarily HBeAg negative and, as a result, have a low vertical risk of vertical transmission of the Hepatitis B virus"[9]."Studies confirming this low risk found little to no early hepatitis B virus infection in children but increased acquisition between the ages of one and five years, suggesting horizontal transmission among siblings and playmates" [10]. "Hepatitis B viral load may be high in patients with HIV and Hepatitis B virus co-infection. Delaying the initial vaccine by six weeks may fail to lower the risk of perinatal hepatitis B virus transmission to infants delivered to HIV/Hepatitis B virus co-infected women, in whom hepatitis B virus infection is frequently upregulated" [11].

"Many research findings have shown that HIV-positive people have a much greater prevalence of the hepatitis B virus, primarily due to shared risk factors" [12]. "There does not seem to be a clear government policy in Nigeria for screening or diagnosing cases of hepatitis B virus in high-risk persons or children, despite the well-acknowledged high incidence of both HIV and the virus. Moreover, there appears to be an underreporting in Nigeria about the overall frequency of the hepatitis B virus in children" [13].

Most hepatitis B virus infections in highly endemic (≥8% of the population is HBsAg positive) parts of Africa happen in the first five years of life [14]. Three million persons from sub-Saharan Africa are thought to be co-infected with HIV and hepatitis B, and many of them may be youngsters who are immunotolerant [15]. It would be expected that the prevalence of hepatitis B virus infection in HIV-positive children would be higher than that of the general paediatric population, given that both the hepatitis B virus and HIV can be transmitted perinatally and that children exposed to the hepatitis B virus are more likely to develop chronic hepatitis B virus infection [16]. Hence, this study seeks to add to the body of knowledge by providing useful data on HIV and HBV infections among children. The study was therefore aimed at determining the prevalence of HIV and Hepatitis B virus (HBV) infection among children (≤ 5 years old) in Bayelsa state of Nigeria.

2.0. MATERIALS AND METHODS

2.1 Study Area

This study was carried out in Bayelsa, the southernmost state in Nigeria. It is situated in the core Niger Delta region, between Delta State and Rivers State, with coordinates (latitude and longitude) of 4.7719° N and 6.0699° E. Its capital is Yenagoa. The main language spoken is Ijaw, and dialects includeKolukuma, Mein, Bomu, Nembe, Epie-Atisa, and Ogbia. Like the rest of Nigeria, English is the official language. The state was formed in 1996 from part of Rivers State and is thus one of the newest states of the Nigerian federation.

2.2 Advocacy Mobilization and Pre-survey Contacts

A formal letter of introduction and the project proposal were submitted to the Federal Medical Centre, Yenagoa ethics committee. Following that, ethical approval was obtained from the hospital. In addition, questionnaires and informed consent were obtained from the

participantsthrough their parents. Also, demographic data were obtained, and a day was fixed to collect blood samples.

2.3 Study Participants

The sample size was calculated following the guidelines described by Pirillo et al. (2007). Three hundred and twenty-two (322) participants aged 0 – 5 years were recruited for this study. One hundred and sixty-one (161) participants were HIV positive, and the remaining one hundred and sixty-one (161) participants were HIV negative. These participants have their samples subjected to HIV confirmatory test, as well as further screened for Hepatitis B viral infection.

2.3Collection and preparation of blood samples

Venous blood samples were collected by venipuncture from the study participants and stored in EDTA anticoagulant tubes beforethe HIV confirmatory test and the Hepatitis B test.

2.4 Screening for Hepatitis B Infection

"The Hepatitis B infection screening was done using the HBsAg Rapid Test Strip (Plasma) (ACCU-TELL® manufacturers, China) method as described by Xu *et al.*[17].The HBsAg Rapid Test Strip is a lateral flow chromatographic immunoassay based on the principle of the double antibody–sandwich technique"[18]. "The membrane is pre-coated with anti-HBsAg antibodies on the test line region of the test. During testing, the Hepatitis B Surface Antigen in the serum or plasma specimen reacts with the particle coated with anti-HBsAg antibody. The mixture migrates upward on the membrane chromatographically by capillary action to react with anti-HBsAg antibodies on the membrane and generate a coloured line. The presence of this coloured line in the test region indicates a positive result, while its absence indicates a negative result. To serve as a procedural control, a coloured line will always appear in the control line region, indicating that the proper specimen volume has been added and membrane wicking has occurred" [1, 6]. Within 2 hours of collecting the blood sample, a portion of 2.0 mL of the sample was introduced into a centrifuge test tube. The erythrocytes were separated from plasma by centrifugation at 1200×g for10 min. Two drops of the plasma were placed on the absorbent pad on the strip. The results were read and recorded after 15 minutes.

2.5. Screening for HIV

The test for HIV was carried out using the HIV Rapid Test Strip (Plasma) method described by Xu *et al*. [17]. The HIV Rapid Test Strip is a lateral flow chromatographic immunoassay based on the double antibody–sandwich technique principle. In the process, a coloured line is generated in the test (patient) region to indicate a positive result; the absence of this line in the test region indicates a negative result. The continuous appearance of coloured lines in the control region in the cases of both Positive and Negative results indicates that the accurate volume of the specimen was added and that the correct procedural technique was used [18, 19, 20]. Two hours after blood sample collection, 2.0 mL of the blood sample was introduced into a centrifuge test tube. The erythrocytes were separated from plasma by centrifugation at 1200×g for 10 minutes.Two drops of the plasma were introduced on the absorbent pad on the strip. After 15 minutes, the results were read.

3.0.RESULTS

3.1.Overall prevalence of HBV infection amongst children in Bayelsa State, Nigeria

Table 1 below shows the overall prevalence of HBV infection amongst children in Bayelsa state, Nigeria. Out of the 322 children screened, 33 were HBV-positive, giving a prevalence of 10.25%, while 289 (89.75) were HBV-negative.

Table 1: Overall prevalence of HBV infection amongst children in Bayelsa State, Nigeria

Number Examined	Number Positive (%)	Number Negative (%)
322	33 (10.25)	289 (89.75)

3.2.Prevalence of HBV infection among children based on sex in Bayelsa state Nigeria.

Table 2 below shows the prevalence of HBV infection among children in Bayelsa State based on sex. The prevalence of HBV-positive infection was higher in female children (11.38%) than in males (90.03%). However, this observed difference was not statistically significant (*P* = 0.33).

Table 2: Prevalence of HBV infection among children based on sex in Bayelsa state, Nigeria

Sex	Number Examined	HBV-positive (%)	HBV-negative (%)	*P*-value
Male	155	14 (9.03)	141 (90.97)	0.33
Female	167	19 (11.38)	148 (88.62)	
Total	**322**	**33 (10.25)**	**289 (89.75)**	

Key: *P*-value is significant when p<0.05.

3.3.Prevalence of HBV infection amongst children based on age in Bayelsa State, Nigeria

The prevalence of HBV infection amongst children based on age in Bayelsa state, Nigeria, is shown in Table 3. Analysis by age categories showed that out of the 33 persons that were positive for the HBV infection, the highest prevalence (11 children) was recorded among those between 1-2years. This was followed by nine positive cases in people of 0-1 year, and then five positive cases were recorded among children of 2-3 years. Furthermore, 3 positive cases were recorded in children between 4-5 years, while children between 3-4 years had no positive case. The chi-squared test showed no differences in HBV infection across all age categories (*P* = 0.73).

Table 3: Prevalence of HBV infection amongst children based on age in Bayelsa state, Nigeria.

Age Range	Number Examined	HBV-positive (%)	HBV-negative (%)	*P* –value
0 – 1 year	86	9 (10.5)	77 (89.5)	0.73
1-2 years	140	16 (11.4)	124 (88.6)	
2 – 3 years	47	5 (10.6)	42 (89.4)	
3 – 4 years	10	0 (0.00)	10 (100)	
4 – 5 years	39	3 (7.69)	36 (92.31)	
Total		**33 (10.25)**	**289 (89.75)**	

Key: *P*-value is significant when p<0.05.

3.4. Prevalence of HBV and HIV amongst HIV-positive and HIV-negative children in Bayelsa State, Nigeria

The prevalence of HBV infection amongst HIV-positive and HIV-negative children in Bayelsa state, Nigeria, is shown in Table 4. The incidence of HBV in HIV-negative children (86.96%) was higher than that of HIV-positive children (13.04%). However, the difference is not statistically significant (p = 0.098).

Table 4: Prevalence of HBV infection amongst HIV-positive and HIV-negative children in Bayelsa state, Nigeria.

HIV Status	Number Examined	HBV-positive (%)	HBV-negative (%)	*P* –value
Positive	161	21(13.04)	12(7.45)	0.098
Negative	161	140(86.96)	149(92.55)	
Total	**322**	**161 (50)**	**161 (50)**	

Key: *P*-value is significant when p<0.05.

3.5.The prevalence of HIV serotypes in HBV-positive and HBV-negative children in Bayelsa state, Nigeria

The prevalence of HIV serotypes in HBV-positive and HBV-negative children in Bayelsa state, Nigeria, is shown in Table 5. The prevalence of HIV serotypeI was significantly higher in HBV-negative children (84.04 %) than in HBV-positive children (15.96 %).Furthermore, the prevalence of HIV serotype II was also significantly higher in HBV-negative children (91.04 %) than in HBV-positive children (8.96 %).

Table 5: Prevalence of HIV serotypes in HBV-positive and HBV-negative children in Bayelsa state, Nigeria

HIV Serotype	Number Examined	HBV-positive (%)	HBV-negative (%)	*P* –value
I	94	15(15.96)	79 (84.04)	0.024
II	67	6 (8.96)	61 (91.04)	
Total	**161**	**21 (13.04)**	**140 (86.96)**	

Key: *P*-value is significant when p<0.05.

3.6.The prevalence of HIV and HBV co-infection in relation to sex in children in Bayelsa State, Nigeria

The prevalence of HIV and HBV co-infection in relation to sex in children in Bayelsa State, Nigeria, is shown in Table 6. The prevalence rate of HIV and HBV co-infection was higher in females (7.78 %) than in males (5.16 %).

Table 6: Prevalence of HIV and HBV co-infection in relation to sex in children in Bayelsa State, Nigeria

Sex	Number Examined	Number Co-infected (%)	*P* –value
Male	155	8(5.16)	0.38
Female	167	13(7.78)	
Total	**322**	**21 (6.52)**	

Key: *P*-value is significant when p<0.05.

3.7.The prevalence of HIV and HBV co-infection in relation to age among children in Bayelsa State, Nigeria

The prevalence of HIV and HBV co-infection in relation to age among children in Bayelsa state, Nigeria, is shown in Table 7. The highest prevalence was seen in children within the age range of 1 – 2 years (8.57 %), while the lowest prevalence was seen in children between the ages of 3 – 4years (0 %). However, the differences between the age groups are not statistically significant (*P*=0.083)

Table 7: Prevalence of HIV and HBV co-infection in relation to age among children in Bayelsa State, Nigeria

Age Range	Number Examined	Number Co- infected with HIV/HBV (%)	*P* –value
0 – 1 year	86	5 (5.81)	0.083
1-2 years	140	12 (8.57)	
2 – 3 years	47	3 (6.38)	
3 – 4 years	10	0 (0.00)	
4 – 5 years	39	1 (2.56)	

Key: *P*-value is significant when $p<0.05$.

4.0. DISCUSSION

This study aimed to determine the prevalence of HIV and Hepatitis B virus (HBV) infection among children in Bayelsa State of Nigeria. The HBV screening result showed a prevalence of 10% in the study population. Comparison of this with the reports from a systematic review of the global epidemiology of HBV over 27 years (1980–2007), in which HBV prevalence in Nigeria was around 7% in 1990 and 4% in 2005 [21], suggests that there is an increase in the incidence of HBV. The high prevalence rate recorded in this study could be because of the high rising level of sexual immorality among married couples and single mothers, which might have predisposed them to the HBV infection and probably led to the transmission of the infection to their children. However, further research is needed to establish this proposition.

Sub-Saharan Africa, a region in which Nigeria is located, has been previously categorized as being highly endemic with HBV and with a prevalence of more than 8% [22]. Furthermore, a retrospective database analysis conducted for nine years (2002 to 2010) in a reference laboratory in Nigeria estimated the overall seroprevalence of hepatitis B surface antigen in all age groups to be 12.05% [23]. Also, Dike-Ndudim et al. [24] reported an HBV prevalence rate of 9.61% in Imo State of Nigeria. Therefore, the 10% prevalence recorded in this study involving children corroborates the previous reports of HBV endemicity in Nigeria. Most HBV infections in endemic areas, including in Nigeria, are thought to be due to transmissions in the perinatal period and early childhood [25]. The high prevalence of HBV infection amongst children in this study lends credence to that assertion. Moreover, studies on the natural progression of HBV infection have shown that perinatally acquired infections progress to chronic hepatitis B, which is a cause for worry during vaccination programmes[11].

This study's main objective was to determine how common HBV is in HIV-positive children. It does, however, differ from earlier research by Wang et al. [26],in which co-infection with HIV was not given significant consideration. Furthermore, due to common modes of transmission, a higher prevalence of HBV among individuals living with HIV has been documented. However, increased HBV infection rates may be recorded in children without

HIV co-infection, as evidenced by the reports of this study. Here, the observed prevalence of HBV in HIV-positive children was not statistically significant when compared to HIV-negative children. Studies conducted on pregnant women in Kano, Nigeria, reported similar findings [27].

In this study, it was observed that the prevalence of HBV infection was higher in females than in male children. This corroborates the report by Eke *et al*. [11] and Luo *et al*. [28], in which a similar pattern was observed. It is also in agreement with the higher prevalence rate reported in females as compared to male subjects by Dike-Ndudim et al. [24]. The reason for this higher prevalence in female children has not been established. It is, therefore, imperative that further research is carried out to determine if some genetic or anatomic factors make females more prone to HBV infection.

Data analysis following age stratification showed unequal distribution of HBV infection, with almost 10% of infections observed among children aged one year and below. This suggests the possibility of congenital infection in this sub-group. Therefore, routine screening of pregnant women for HBV infection is highly recommended. Although this is done in some clinics/hospitals, there seems not to be a policy in the Bayelsa State and the Nigerian public health care sector that enforces and ensures that every pregnant woman is screened for HBV.More awareness of this should be created through sensitization/health education programmes organized for men and women of childbearing age.Furthermore, healthcare should be accessible to all, as finance tends to be a major constraint for some persons. Furthermore, children exposed to HBV *in utero*should have the HBV vaccine and HBV-specific immunoglobulin administered to them at birth [29]. According tothe WHO's recommendation, this HBV vaccination should be done within 24 hours of birth [30].Since this intervention is considered safe for the prevention of HBV infection in children, it should also be highly encouraged.

Conclusion

This study found a clinically significant prevalence of HBV infection (10%) among a population of HIV-positive and HIV-negative children (0 – 5 years) in Bayelsa state, Nigeria. It was observed that there was no statistically significant difference in HBV prevalence between the two groups of children. This suggests that HBV infection amongst children in this region might be independent of HIV transmission. In conclusion, the birth dose of HBV vaccination, which has been shown to reduce early perinatal transmission, should be considered part of the expanded programme on immunization in Bayelsa state and Nigeria at large.

Ethical Approval:

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

Consent

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of manuscripts.

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