

# Seroprevalence of Hepatitis B Surface Antigen and Liver Function Tests among Adolescents in Abakaliki, South Eastern Nigeria

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## Abstract

Of the 785 apparently healthy adolescents, 386 (49.2%) males and 399 (50.8%) females (mean age,  $15.6 \pm 2.3$  years) screened for hepatitis B surface antigen (HBsAg) using a third generation enzyme linked immunosorbent assay method, 32 (4.1%) were seropositive. Although, males and females did not differ significantly in HBsAg seropositivity (17 vs. 15; 95%CI: -0.025-0.065) more infections were found in patients from lower- than middle-/or and upper- socioeconomic classes ( $p < 0.05$ ). The major routes of HBV transmission in this population were unsafe injection (28.1%; 95%CI: 0.03-0.15), tribal marks/circumcision/scarification (12.5%; 95%CI: 0.00-0.08) and blood/blood products transfusions (6.3%; 95%CI: -0.04-0.28) while 53.1% (95%CI: 0.02-0.04) of HBV infections have no identifiable mode of transmission. While HBsAg seropositive patients showed significantly higher levels of liver enzymes and lower conjugated bilirubin than their seronegative counterparts, total protein, albumin and total bilirubin were comparable among the groups. Asymptomatic HBV infection among adolescents without proper identifiable risk factors or mode of acquisition calls for general surveillance, mass immunisation, and public health education to curtail the spread of the virus and its sequelae.

## INTRODUCTION

Hepatitis B virus (HBV) has been recognised as one of the public health challenges worldwide with approximately 2 billion people infected [1], an estimated 1-2 million annual deaths due to infection and about 400 million persons being chronic carriers of the bacterium globally [2,3]. The prevalence of HBV varies between 2% in developed countries where the prevalence is low to about 8% in developing countries where infection is endemic with sex, age and socio-economic status as important risk factors for infection [4-6]. Apart from aflatoxin contamination of foods, hepatotoxic medicinal herbs, and hepatitis C virus infection, HBV infection accounts for the high incidence of hepatocellular tumours in sub-Saharan Africa [7]. In Africa, hepatitis B virus infection is the most common cause of liver disease which is the third most common cause of death in medical wards with 15-60% seropositivity for HBsAg in normal population [8]. Nigeria is a holoendemic area for HBV with carrier rate of 15-37% [8] and an estimated 12% of the total population being chronic carriers of HBsAg [9]. According to a recent study [10] HBV prevalence of 67% was found among hepatocellular carcinoma patients in north eastern Nigeria. Hepatitis B virus is transmitted parenterally

and most common by transfusion of HBV infected blood or blood products, intravenous drug abuse, from mother to child, needle stick injury, ear piercing, tattooing and other tribal ceremonies (scarification), barbers razors e.t.c.[11-13]. Infection may also spread by fomites, sharing of tooth brush, abrasion, and sexual contact (hetero- or homosexual) with infected persons. Comprehensive strategies for the elimination of HBV transmission include (1). Universal vaccination of infants beginning at birth, (2). Prevention of perinatal HBV infection through routine screening of all pregnant women for HBV infection and by providing immunoprophylaxis to infants born to infected women or to women of unknown infection status, (3). Routine vaccination of previously unvaccinated children and adolescents, and (4). Vaccination of adults at increased risk for infection, including health-care workers, dialysis patients, household contacts and sex partners of persons with chronic HBV infection, recipients of certain blood products, persons with recent history of multiple sex partners or a sexually transmitted disease, and injection-drug users [14]. In Nigeria, the availability of most of these strategies is limited. Early childhood acquisition of HBV which remains typically asymptomatic with subsequent progression to

chronic infection underscores the importance for early detection through screening. This study therefore aims to determine the seroprevalence of hepatitis B surface antigen (HBsAg) among adolescents in Abakaliki, south eastern Nigeria.

## MATERIALS AND METHODS

This study was conducted among apparently healthy students of five randomly selected government secondary schools in Abakaliki metropolis. The approval for the study was obtained from the authority of the schools and the Parents' Teachers Association of the schools. The approval was on the agreement that patients anonymity must be maintained, good laboratory practice/quality control ensured, and that every finding would be treated with utmost confidentiality and for the purpose of this research only. All work was performed according to the International Guidelines for Human Experimentation in Clinical Research. The study was conducted between February 2007 and May 2009. Following informed consent, the participating students; apparently healthy without jaundice were interviewed to obtain information on their socio-demographic data such as age, sex, history of blood or blood products transfusion, jaundice, injection from unqualified medical personnel and parents' living accommodation, educational level, and occupation e.t.c. Students that were jaundiced, confirmed HBsAg positive and were on hepatitis medication or have any apparent ill health were excluded from the study. Students' socioeconomic class was assessed based on parents' living accommodation, educational level, and occupation. A total of seven hundred and eighty five (785) students aged 12-17 years were recruited into the study. Venous blood (3.0 ml) was obtained from participants aseptically into plain bottles and allowed to clot and retract after which serum was isolated by centrifugation at 2000g for five minutes. Serum hepatitis B surface antigen (HBsAg) was determined by using a third generation enzyme linked immunosorbent assay method. Participants that were seropositive for HBsAg (n = 32) were further evaluated by running their liver function tests together with that of matched seronegative controls (n = 32). Serum total protein was determined by colorimetric Biuret method [15] and albumin was estimated by the bromocresol green method [16] while liver enzymes and bilirubin were determined using reagent kits [Quimica Clinical Applicada (QCA, S.A)] in accordance with the manufacturer's instructions.

Reference values of liver function tests

**Figure 1**

Parameters	Reference values
Total protein (g/L)	60-80
Albumin (g/L)	33-45
AST (U/L)	< 35
ALT (U/L)	< 45
ALP (U/L)	54-128
Total bilirubin (μmol/L)	0.0-34
Conjugated bilirubin (μmol/L)	0.0-3.4

Legend: AST- Aspartate transaminase; ALT- Alanine transaminase, ALP- Alkaline phosphatase

## STATISTICAL ANALYSIS

Data were analysed for mean and standard deviation, 95% confidence interval and differences between means were compared by one-way ANOVA at 0.05 level of significance using SPSS computer software.

## RESULTS

The age of the students ranged 12-17 years (mean =  $15 \pm 2.3$  years). Table 1 shows the prevalence of HBsAg according to sex and socio-economic status of the students. Hepatitis B surface antigen was detected in 32 (4.1%) students, comprising 17 (4.4%) males and 15 (3.8%) females.

**Figure 2**

Table 1: Seroprevalence of HBsAg according to socio-economic class and sex (percentage in parenthesis)

Socio-economic class	Male		Female		Total		95%CI
	Number examined	HBsAg <sup>+</sup> (%)	Number examined	HBsAg <sup>+</sup> (%)	Number examined	HBsAg <sup>+</sup> (%)	
Upper Class	34	1 (2.9)	36	1 (2.8)	70	2 (2.8)	-0.077-0.079
Middle Class	179	6 (3.4)	181	7 (3.9)	360	13 (3.5)	-0.044-0.034
Lower Class	173	10 (5.8)	182	7 (3.8)	355	17 (4.8)	0.04-0.16
Total	386	17 (4.4)	399	15 (3.8)	785	32 (4.1)	-0.025-0.065

Although there was no statistically significant difference in HBV infection between males and females (17 vs. 15; 95% CI; -0.025-0.065), more infections were found in students from lower socio-economic class than the middle/or and upper class (p < 0.05).

**Figure 3**

Table 2: Seroprevalence of HBsAg according to reported risk factors

Reported risk factors	Number Examined (%)	HBsAg <sup>+</sup> (%)	95% CI
Previous transfusion with blood/blood products	17 (2.2)	2 (6.3)	-0.04-0.28
Unsafe injection	102 (13.0)	9 (28.1)	0.03-0.15
Scarification(tribal marks/circumcision)	91 (11.5)	4 (12.5)	0.00-0.08
Previous surgery	19 (2.5)	0 (0)	-
None	556 (70.8)	17 (53.1)	0.02-0.04
Total	785 (100)	32 (100)	0.03-0.05

The major route of HBV transmission in this population were unsafe injection (28.1%; 95%CI: 0.03-0.15), tribal marks/scarification/circumcision (12.5; 95%CI: -0.00-0.08), and blood transfusion (6.3%; 95%CI: -0.04-0.28) while 53.1% (95%CI 0.02-0.04) of HBV infection have no identifiable risk factors (table 2).

Although the liver function tests were within the reference ranges, there were significantly higher levels of liver enzymes in HBsAg seropositive patients than in their seronegative counterparts. However, while total protein, albumin and total bilirubin were comparable among the groups, conjugated bilirubin was significantly lower in HBsAg seropositive individuals than their seronegative counterparts (table 3).

**Figure 4**

Table 3: Liver function test of HBsAg seropositive and seronegative patients

	HBsAg <sup>-</sup> (n = 32)	HBsAg <sup>+</sup> (n = 32)	p-values
Total protein (g/L)	55.0 ± 3.8	54.6 ± 5.0	0.721
Albumin (g/L)	40.51 ± 1.7	39.3 ± 4.5	0.178
AST (IU/L)	19.18 ± 3.33	26.06 ± 5.15	0.000*
ALT (IU/L)	14.79 ± 2.56	21.28 ± 4.40	0.000*
ALP (IU/L)	80.19 ± 12.35	96.28 ± 18.05	0.000*
Total bilirubin (μmol/l)	13.26 ± 4.37	13.47 ± 2.64	0.816
Conj. Bilirubin (μmol/l)	3.00 ± 2.05	1.49 ± 0.53	0.000*

Legend: AST- Aspartate transaminase; ALT- Alanine transaminase, ALP- Alkaline phosphatase  
\* p < 0.05 is significant

## DISCUSSION

From this study, the prevalence of hepatitis B virus (HBV) infection among adolescents in Abakaliki, south eastern Nigeria is 4.1%. This value is lower than 7.6% prevalent rate reported in primary school children in Nnewi, Nigeria [17], 7% among Taiwanese adolescents [18], and 6.7% in Saudi Arabian children [19]. HBV prevalence of 4.1% is also lower than 12.4% reported by Alikor and Erhabor [5] in

children attending tertiary health institution in Niger Delta of Nigeria. The differences in prevalence in these studies could be attributed to differences in patient selection. Unlike our subjects who were apparently healthy adolescents (aged 12-17 years; mean = 15.6 ± 2.3 years) without any symptoms suggestive of liver pathology, theirs were children in the age range 4-12 years and among patients presenting at a tertiary health facility. Thus the higher prevalence recorded in these earlier studies were not unexpected as it has been shown that HBV is contracted in early childhood. Also the age of acquiring infection is the major determinant of the incidence and prevalence rates [20]. Again serological evidence of previous HBV infections varies depending on age and socioeconomic class. Additionally, higher prevalence of HBV infection has been reported in patients with liver disease than in normal population [5]. The lack of statistically significant difference in HBsAg seroprevalence between males and females in the present study suggests that they were equally exposed to HBV in corroboration with earlier findings [11,19] but however contradicts the findings of other authors elsewhere [4-6]. Our finding of a statistically significant difference in HBV prevalence between adolescents from different socioeconomic status is in agreement with the finding of Toukan et. al. [21] but contrasts that of Al-Faleh et. al. [19], where socioeconomic factors and family size did not significantly influence HBV prevalence among children. Considering the risk factors associated with HBV infection, unsafe injection (28.1%), tribal marks/circumcision/scarification (12.5%), and transfusion of blood/blood products (6.3%) were the major routes of HBV transmission in this population. This finding is in agreement with several epidemiological studies [11, 12, 22] which have consistently demonstrated that unsafe injection from unqualified medical personnel using HBV contaminated needle and syringe, transfusion of blood and blood products and socio-cultural practices such as tribal marks, circumcision and scarification were important routes of HBV transmission. In our environment, patronage of chemist/medicine shops manned by unqualified medical personnel is common and re-use of HBV contaminated needles and syringes may have accounted for the higher transmission rate through this route. Although there seems to be a decline in the practice of female genital cutting, as a result of the nationwide public enlightenment, there exist some socio-cultural practices such as tattooing, scarification and male circumcision which can expose individuals to HBV infection. Transfusion of blood/blood products is a very significant route of HBV transmission in the present study

and calls for the strengthening of the national policy on blood transfusion with the view of curtailing transmission through this route. This study also highlights that significant proportion (53.1%) of these adolescents has no identifiable mode of acquiring HBV. This suggests that they may have contracted the virus from their mother, family members or peer groups. It has been shown that children can acquire HBV during delivery or post-partum through breast feeding or from chronic carrier mothers [11] and through contact among siblings or children of poorer and larger families [21]. Also, a history of contact with jaundiced person has been identified as independent risk factor for HBsAg seropositive status. Inability to identify risk factors for viral acquisition among higher proportion of HBsAg seropositive patients in the present study population may be partly attributable to lack of accurate reporting by the participants as majority may not have given accurate information of past contacts. The implication of high prevalence of asymptomatic HBV infection among these adolescents is that they may become chronic carriers of the virus, thus acting as reservoirs for subsequent transmission. Additionally, there is compelling evidence from the present study that this population may be at increased risk for hepatocellular carcinoma in the nearest future as the risk of hepatocellular carcinoma has been found to increase by a factor 10 among men that were positive for HBsAg [23]. Also, high prevalence of HBsAg has been reported among hepatocellular carcinoma patients in north eastern Nigeria [10]. The significantly higher (though still within the reference ranges) levels of liver enzymes in HBsAg seropositive than in seronegative subjects may not be unconnected with the effect of HBV on the hepatocytes, although these enzymes (AST, ALT and ALP) were not specific for liver pathology except for ALT which higher levels in the bloodstream can be a sign of liver trouble. Furthermore, the significantly lower conjugated bilirubin in HBsAg seropositive adolescents compared with seronegative individuals recorded in this study despite comparable serum total protein and albumin suggests an effect on the excretory functions of the liver which may be progressing [24]. Taking together, we conclude that Nigerian adolescents in Abakaliki, south eastern Nigeria harbour asymptomatic HBV with majority of those infected having no identifiable risk factor for viral acquisition and in those which risk factors were identified, unsafe injection from unqualified medical personnel, scarification and transfusion of blood/blood products were the major route of acquiring the infection. General surveillance through mass screening (to

identify those with infection and instituting appropriate treatment), mass immunisation against the virus and public health education (to enlighten the public of the possible risk factors for and routes of infection) are advocated.

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