

## Seroprevalence of Hepatitis B surface Antigenaemia in Children Attending the University of Maiduguri Teaching Hospital

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### Summary

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**Background:** Hepatitis B virus (HBV) is the organism responsible for one of the most prevalent chronic infectious diseases and is widespread throughout the world.

**Objectives:** The sero-prevalence of HBV infection among children presenting to the University of Maiduguri Teaching Hospital (UMTH), Nigeria was investigated with a view to assessing the scope of HBV infection among children in this part of the country and correlating serological findings to epidemiological data.

**Methods:** This was a hospital-based cross-sectional study of 276 children attending the paediatric clinics of UMTH from July 2007 to December 2007. The subjects were recruited consecutively from the population of patients aged four months to 15 years. A protocol detailing epidemiological data, history of HBV vaccination and physical examination was completed for each of the patients. All the study samples were tested for hepatitis B surface antigen (HBsAg) by the ELISA method, making use of Wellcozyme HBsAg commercial kits (*Wellcome Diagnostics, Dartford, England*).

**Results:** The overall prevalence of HBsAg among children tested was 9.4 percent. The highest frequency of HBsAg was observed in children two years and below (38 percent). HBs antigenaemia was higher among males than females, although the difference was not statistically significant ( $\chi^2 = 0.861$ ,  $df = 1$ ,  $p = 0.354$ ). No significant difference was observed between HBsAg status and socio-economic class (SEC) of the study population ( $\chi^2 = 6.930$ ,  $df = 4$ ,  $p = 0.140$ ). There was however, a significant association between lack of immunisation and HBs antigenaemia (Fisher's exact test  $p < 0.000$ ,  $RR = 0.463$ ;  $0.370-0.580$ ).

**Conclusion:** The prevalence of HBs antigenaemia among children in Maiduguri was high. HBV predominantly infects children in their infancy and early childhood without a significant gender disparity. Lack of HBV vaccination was significantly associated with HBsAg positivity.

**Key words:** Seroprevalence, HBsAntigenaemia

### Introduction

HEPATITIS B virus (HBV) is the cause of one of the most prevalent chronic infectious diseases and is widespread throughout the world. It is estimated that

globally, more than two billion people have serological evidence of HBV infection and over 350 million people are chronic carriers of the virus.<sup>1-3</sup> The global prevalence of HBV varies widely depending on the geographical region. In high endemicity regions, which include Asia, sub-Saharan Africa and the west Pacific, the prevalence is higher than eight percent while in areas of low endemicity which include Western Europe, North America and Australia, the prevalence ranges between 0-2 percent.<sup>4</sup> Nigeria is considered to be a region of high prevalence for HBV infection with a reported figure of 19.3-46 percent, using ELISA techniques.<sup>5</sup> This difference in the prevalence

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rates of HBsAg may probably reflect geographical, cultural, behavioural patterns as well as the type of population studied.<sup>5</sup> The most important epidemiological factor affecting the chronic carrier rate is the age at infection. The earlier in life an infection occurs, the higher the probability that this infection will result in chronic carriage; 90 percent of infants, 25-50 percent of children 1-5 years and less than five percent of adults who acquire the infection become chronic carriers.<sup>6,7</sup>

Neonatal and infantile HBV vaccination is the most effective measure for the prevention of HBV infection in countries of intermediate to high level of HBV endemicity.<sup>8</sup> Since the introduction of the HBV vaccination as part of the EPI of many countries, various studies have shown the vaccine to be both immunogenic and efficacious.<sup>8,9</sup> Fortunately, mass HBV vaccination has been incorporated into the national programme on immunisation (NPI) in Nigeria.

There is a relative scarcity of data on the prevalence of HBV among children in this part of the country. As a result of this dearth of information, guidelines and adequate information on the prevention and control measures are essentially lacking. In this study, the sero-prevalence of HBV infection among children presenting to the University of Maiduguri Teaching Hospital (UMTH), Nigeria was investigated with a view to assessing the hospital prevalence of HBV infection among children in this part of the country. In addition, the study was aimed at determining the relationship between demographic factors of age, sex and socio-economic class (SEC) and history of HBV immunisation and HBV infection.

#### Patients and Methods

The study was a hospital-based cross-sectional study of children attending the paediatric clinics of UMTH, Maiduguri, from July 2007 to December 2007. The hospital is a designated centre of excellence for infectious diseases and immunology, serving as a referral centre not only for the north-eastern region of Nigeria but also the neighbouring countries of Cameroon, Chad and Niger Republics. All aspects of the study protocol were reviewed and authorized by the Ethical Committee of UMTH before initiation. Parents'/caregivers' written consents were obtained after a pre-test counselling and they had unlimited liberty to deny consent for, or opt out of the study at any stage without any adverse consequences. Confidentiality was maintained.

The subjects were consecutively recruited from the population of patients aged four months to 15 years attending the paediatric out-patient department

(POPD) of UMTH and from apparently healthy school children from whom blood was taken for some routine investigations, e.g. as part of medical examination required by schools. Children who were known to be HIV positive, or to have sickle cell anaemia and those who were aged >15 years, were excluded. Other children excluded were those with other forms of liver diseases, haemophilias and those that declined consent.

On enrolment, a protocol detailing epidemiological data (age, sex and socioeconomic status), history of HBV vaccination and physical examination were completed for each of the patients. Socio-economic class (SEC) was assigned to each child using Oyediji's classification.<sup>10</sup> Physical examination was carried out with emphasis on the presence or absence of jaundice, hepatomegaly and splenomegaly.

Venous blood was drawn aseptically into plain bottles for serological test and the serum was stored at -20°C until the time of assay. All the study samples were tested for HBsAg by the ELISA method, making use of Wellcozyme HBsAg commercial kits (*Wellcome Diagnostics, Dartford, England*) according to the manufacturer's protocol.

Data were analysed using SPSS version 11.0. Values were expressed as mean  $\pm$  standard deviation. Chi-square ( $X^2$ ) or Fisher's exact test was used appropriately to determine associations for qualitative variables. A p value of <0.05 was considered significant. Tables and diagrams were used appropriately for illustration.

#### Results

Two hundred and seventy six children aged four months to 15 years with mean age ( $\pm$ SD) of 4.0 ( $\pm$ 3.0) years were screened for HBsAg. They included 146 (52.9 percent) males and 130 (47.1 percent) females (M: F 1.12:1). Children aged less than five years constituted more than 65 percent of the study population. Twenty six (9.4 percent) of the 276 children were HBsAg positive. Segregation by sex showed that 16 (11 percent) of the 146 males were HBsAg positive while 10 (7.7 percent) of the 130 females were also HBsAg positive. Although HBs antigenaemia was higher among males, the difference was not significant ( $x^2 = 0.861$ ,  $df = 1$ ,  $p = 0.354$ ). The frequency of HBsAg positivity among the children by age is shown in Fig. 1. The highest frequency of HBsAg was observed in children aged 2 years and below. With increase in age, the frequency of children infected with HBV appeared to be falling; this finding was statistically significant ( $P < 0.05$ ). The relationship between SEC and HBs antigenaemia is shown in Table I. No significant difference was observed between HBsAg status and SEC of the study population ( $X^2 = 6.930$ ,  $df = 4$

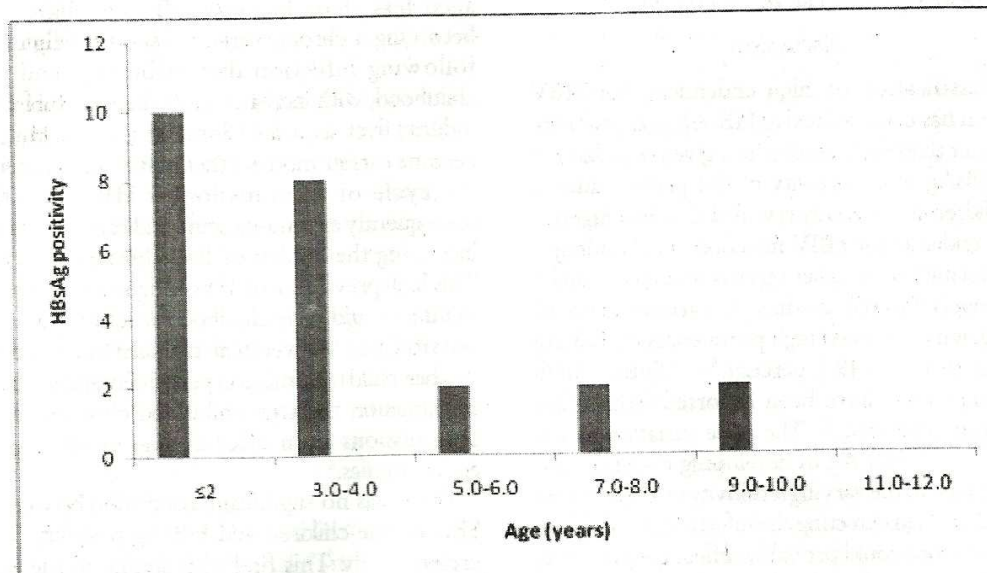


Fig. 1: Age distribution of children with positive HBsAg

Table I

Relationship between Socio-economic Class (ssec) and HBs Antigenaemia among the Study Population

SEC Class	HBsAg Positive (%)	HBsAg Negative (%)	Total
1	0 (0)	12 (4.8)	12
2	6 (23)	30 (12)	36
3	2 (7.7)	38 (15.2)	40
4	10 (38.5)	62 (24.8)	72
5	8 (30.8)	108 (43.2)	116
Total	26 (100)	250 (100)	276

P value = 0.140. Not significant

$p=0.140$ ). When the relationship between immunisation status and HBs antigenaemia was analysed, there was a significant association between a lack of immunisation and HBs antigenaemia (Fisher's exact test  $p < 0.000$ , RR = 0.463; 0.370-0.580).

Out of the 26 children with HBs antigenaemia, 12 (46.2 percent) had hepatomegaly and eight (30.8

percent) had splenomegaly. Hepatomegaly and splenomegaly were not found to be significantly associated with HBs antigenaemia ( $p=0.569$  and  $0.957$ , respectively). History of jaundice was positive in 18 (69.2 percent) of the children who had HBs antigenaemia. There was significant association

between the presence of jaundice and HBs antigenaemia ( $X^2 = 5.111$ ,  $df 1$   $p=0.029$ ).

### Discussion

The classification of high endemicity for HBV infection has been defined as HBsAg sero-positivity of greater than eight percent in a given population.<sup>4</sup> The HBsAg sero-positivity of 9.4 percent among the children in this study revealed that Maiduguri is highly endemic for HBV infection. Our finding is in conformity with earlier reports from community and hospital-based studies in various parts of Nigeria, which showed high prevalences of HBsAg ranging from 7.4-49.5 percent.<sup>5,11,12</sup> Similar high prevalence rates have been reported from other developing countries.<sup>6,8</sup> The wide variation in the prevalence of HBsAg in developing countries can be attributed to the varying sensitivity of the different methods used in detecting the infection. In addition, such variations could probably reflect geographical, cultural, and behavioural patterns of the populations studied.<sup>5</sup> The high prevalence rate observed in this study and many other parts of developing countries may partly be accounted for, by the absence of universal vaccination programmes targeting children. In addition, poor living conditions in many African countries may facilitate horizontal transmission of HBV infection. High risk socio-cultural and behavioural practices such as ear piercing, circumcision, scarification and traditional surgery using unsterilized instruments which are widely practised in our environment, may also contribute to the observed high prevalence. This finding is however contrary to the lower prevalence reported from more developed countries where universal vaccination against HBV infection is practised.<sup>13,14</sup>

The observed high prevalence of HBsAg among males compared to females in this study is similar to the findings of Mustapha and Jibrin<sup>15</sup> and Uneke *et al*<sup>16</sup> from Nigeria and Boubacar *et al*<sup>17</sup> from Burkina Faso but contrasts with those of Baba *et al*,<sup>18</sup> who noted that majority of their HBsAg positive patients were females. This difference has been explained on the basis of males being less likely to clear HBsAg and have a higher risk of progression to chronic carrier state and cirrhosis.<sup>15</sup>

The highest frequency of HBsAg of 38 percent in the present study was observed in children aged two years and below, with subsequent progressive fall with advancing age. This pattern is similar to what was reported by Fakunle *et al*<sup>19</sup> from Zaria, Nigeria and Ali<sup>6</sup> from Iraq who observed that the highest prevalence of HBsAg occurred in the 1-2 years of age and declined progressively thereafter with advancing age. The result obtained in this study supports the pattern of HBV infection in an endemic

area where most of the infection occur in children aged less than five years. The probability of becoming a chronic carrier is substantially greater following infection during infancy and early childhood, with increases in the incidence of HBV-induced liver sequelae.<sup>6</sup> Some of these patients will become carrier mothers themselves and perpetuate the cycle of transmission of HBV infection, subsequently expanding acute and carrier states and increasing the burden of liver disease in the area.<sup>6</sup> This high prevalence of HBs antigenaemia observed in infancy and early childhood would suggest both possibilities of vertical transmission through mother-child transmission perinatally and horizontal transmission through childhood close contact or transmissions from older siblings as suggested by earlier studies.<sup>6</sup>

There was no significant association between the SEC of the children and HBsAg positivity in the present study. This finding is similar to the earlier observation by Mayans *et al*<sup>20</sup> in the study of risk factors for transmission of HBV in Gambian children. Analysis of immunisation status-related seroprevalence of HBsAg showed that lack of vaccination is significantly associated with HBsAg positivity. This finding further underscores the usefulness of immunisation as the most effective measure of prevention of HBV infection.<sup>8,9,21</sup>

In conclusion, the prevalence of HBs antigenaemia among children in this study was high, with consequent adverse implications for the children, future generations and the sub-region. HBV predominantly affected children in their infancy and early childhood with progressive fall with advancing age without a significant gender disparity. Therefore, efforts should be made to reduce childhood HBV infection; the only logical approach to prevent early childhood transmission of HBV is by mass immunization of newborns and infants. Other markers of HBV infection (anti-HBcAg, anti-HBsAg, HBeAg and anti-HBeAg) need to be determined for more accurate assessment of the true prevalence of HBV infection and the state of infectivity in the area.

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