Anti-Hepatitis B Surface Antibody (Anti-HBsAb) in a Representative Population of Ozuoba in Rivers State, Nigeria

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Abstract: *Background*: Hepatitis B infection is a foremost worldwide health issue of public health significance and chief origin of chronic hepatitis, cirrhosis and hepatocellular carcinoma (HCC). There are vaccines available for hepatitis B infection which can be used for prevention before infection. In an effort to prevent and control HBV, the Nigeria Government in 2004 made HBV vaccine as part of national immunization programme. This definitely is an essential procedure to minimize the occurrence of HBV in many countries. Thus, our study was designed to investigate the seroprevalence of hepatitis B surface antibody (HBsAb) in a representative population of Ozuoba in Rivers State, Nigeria following the incorporation of HBV vaccine into NPI schedule.

Methods: Ninety (90) blood samples were obtained from a male and female population of Ozuoba community in Rivers State, Nigeria. Questionnaires were distributed to obtain demographic profile of participants. ELISA (DIA.PRO Diagnostic Bioprobes, Milano-Italy) was employed for the qualitative and quantitative evaluation of HBsAb in sera and plasma of representative population of Ozuoba in Rivers State, Nigeria. The serological evaluation and result interpretation were carried out as stipulated by the kit's manufacturers. We engaged Fisher's exact test and Chi-square test to estimate variances amid groups at $p \leq 0.05$ significance.

Results: Of the 90 participants evaluated, nine tested seropositive for HBsAb giving a general prevalence of 10.0% and a seronegativity of 90.0%. The sex-related prevalence was males (7.1%) and females (12.5%). Sex and age had no effect in hepatitis B surface antibody (p-value >0.05). The age-specific prevalence was 7.7% for age group 13-19 years, 10.2% for 20-35 years of age and 10.7% for 36 years and above.

Conclusion: This study revealed that the presence of HBsAb was low (10.0%). Our outcomes indicted that seropositivity and seronegativity of HBsAb have no significant relationship with age and sex. It further showed that 90.0% were HBsAb seronegative and hence, more susceptible to HBV infection. Vaccination programme must be strengthened further to grasp those continuing at highest risk.

Keywords: Anti-HBsAb, Antibody, ELISA, HBsAb, HBV, Prevalence, Nigeria.

1. INTRODUCTION

Infection caused by HBV is a foremost worldwide health issue of public health significance and chief origin of chronic hepatitis, cirrhosis and hepatocellular carcinoma (HCC) [1-4]. In Nigeria HBV is hyperendemic [5, 6]. Chronic HBV infection is mainly acquired in infantile through the horizontal mode of transmission since the majority of children cannot clear the virus from their body [5]. Approximately two billion persons were estimated to have had a serological indication of present or past HBV infection [1, 7]. Over 360 million persons are HBV chronic carriers [1, 7] and it is hyperendemic (i.e. >8% of the population infected) in Sub-Sahara Africa (SSA) [6]. As stated, 15-40% of HBV positive persons would progress to cirrhosis, liver failure or HCC [1, 8-9] and annually, about half a million to 1.2 million persons die owing to HBV [1, 10-11]. The worldwide disease burden of HBV is considerable owing to the elevated HBV-connected illness and death [1, 9], however, it varies depending on the geographic area [12].

Reports have shown that in countries such as United States, Canada and Western Europe are low prevalence areas of HBV which ranges from <2% to 2 to 7% in intermediate-prevalence areas (e.g., Mediterranean countries, Japan, Central Asia, Middle East, and parts of South America) to ≥8% in high-prevalence areas (e.g., Western Africa, South Sudan) [12-15]. In 90% perinatally acquired infection can progress from acute to complicated HBV infection [16]. 20 to 50% for infections between the age of one and five years there is 20 to 50% increase or progression HBV [17-18], and less than 5% for adult-acquired infection [17].

"WHO called on all nations to include HBV vaccine in the National Program on Immunisation (NPI) schedules since 1991." World Health Assembly accepted resolution 63.18 to identify viral hepatitis as a worldwide health issue in 2010 [5,6,19]. In answer to this, the WHO established a 4-point plan directed at mobilizing resources, increasing awareness, policy, stopping the spread, diagnosing and treatment [6,20].

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In 2011, 184 nations worldwide adopted HBV in their vaccination program and the global coverage rate reached eighty percent [6,20]. At the close of 2014, the infants HBV vaccine had been introduced in 184 nations worldwide [21] with a worldwide HBV vaccination coverage is projected at 82% while an increase of HBV (92%) was observed in Western Pacific it is as high as 92% [21]. Though 184 Nations integrated HBV vaccination in their immunization program with 82% coverage, differences persist amid developing and developed nations [6, 20- 21].

While an inexpensive and extremely effective recombinant DNA vaccine for HBV has existed since 1982, it was introduced in Nigeria in 1995 [6]. In 2004, The Nigeria Government added HBV vaccine into the NPI in a bid to control HBV [4]. Though childhood vaccination against HBV began in Nigeria a few years back, and the coverage was 41% [5]. Inappropriately, immunization agendas in Nigeria lack sufficient funding or attention by the government [6]. Furthermore, misconceptions by the community have delayed cumulative coverage rates [6, 22-23].

According to the WHO and UNICEF, HBV vaccine coverage was reported zero percent in 2000-2005, eighteen percent in 2006, and steady at forty-one percent in 2013 i.e. only 41% of Nigerian populace were vaccinated against HBV in 2013 [6, 24]. Odusanya [5] also noted a 58% HBV vaccine coverage and 80% HBV vaccine efficacy in a privately financed community centred vaccination scheme. Though most lately stated coverage rate is not significant by the global average, the influence can be seen with a quick drop in the prevalence of HBV [6].

HBV vaccines have an exceptional record of protection and efficiency [4, 25-26]. The integration of HBV vaccination in NPI in many countries is definitely a significant move to decrease the occurrence of HBV infection [2, 27-28]. The authors [2, 27-28] showed that HBsAg prevalence fell from 10.5% to 1.7% and the HBV prevalence decreased significantly from 25% to 4.3% ten years after the implementation of national HBV inoculation plan in schools. Additionally, the occurrence of HCC/100000 children dropped from 0.54 - 0.20 in children delivered prior HBV inoculation and after [2, 27-28].

HBsAg remained the main structural polypeptide envelope of HBV and is contained primarily of the type-specific determinant “a” and the type-specific determinants “d” and “y”, found solely on the specific serotypes. A robust immunological reaction grows upon infection initially, against the type-specific determinants and subsequently, against the “a” determinant. Anti “a” antibodies are nevertheless documented to be utmost active in the neutralization of HBV, shielding the infected person from other opportunistic infections and causing it to convalescence. HBsAb detection has to turn out to be significant for the follow-up of HBV-infected persons and the recipients monitoring upon inoculation with synthetic and natural HBsAg.

Thus, this study was designed to ascertain anti-HBsAb seroprevalence in a representative population of Ozuoba in Rivers State, Nigeria following the incorporation of HBV vaccine into NPI schedule.

2. METHODS

2.1. Study Area and Population

This study was done using a representative sample of Ozuoba Community. The sample size was determined according to Macfarlane [29] and Naing *et al*. [30] equations. Therefore, the assessed sample size was 84 with extra 10% samples to cater for data inconsistencies [29-31], providing a total sample size of approximately 90 samples. *Methods were in agreement with the Declaration of Helsinki (October 2008 revision) and the research ethics standards of the Nigerian National Code for Health Research Ethics.*

2.2. Sample Collection and Preparations

A total of ninety (90) samples was collected from a male and female population of Ozuoba community in Rivers State, Nigeria. Their demographic profile (age, and sex) was obtained using a questionnaire. A 3 mL blood samples were collected from these participants into plain containers with no anticoagulant. Samples were conveyed in an ice-box to the Medical Microbiology Laboratory, Department of Microbiology, University of Port Harcourt, Nigeria. Samples were centrifuged and sera were extracted into Eppendorf tubes and stored at -20^{O}C.

2.3. Serological Analysis

The serological analysis of the representative population of Ozuoba in Rivers State, Nigeria for anti-HBsAb antibodies was done using ELISA (DIA.PRO Diagnostic Bioprobes, Milano-Italy). The serological evaluation and result interpretation were carried out as stipulated by the kit’s manufacturers.

2.4. Data Analysis

Results were presented in proportions. We engaged Chi-square test and Fisher's exact test to ascertain variances amid groups at $p \leq 0.05$ significance.

3. RESULTS

Nine of the 90 participants evaluated were anti-HBsAb positive giving a 10.0% general prevalence and a seronegativity of 90.0%. Figure **1** shows the sex-related prevalence of HBsAb in Ozuoba, Rivers State, Nigeria. The sex-related prevalence was males (7.1%) and females (12.5%). Sex was not a predictor of hepatitis B surface antibody (p-value >0.05).

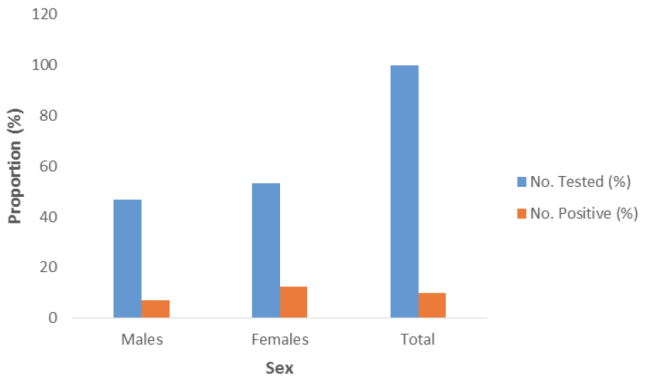

Figure 1: Sex-related prevalence of HBsAb in Ozuoba, Rivers State, Nigeria.

Figure **2** shows the age-related prevalence of HBsAb in Ozuoba, Rivers State, Nigeria. The age-specific prevalence was 7.7% for age group below 20 years, 10.2% for 20-35 years of age and 10.7% for 36 years and above. Age was not a predictor of hepatitis B surface antibody (p-value >0.05).

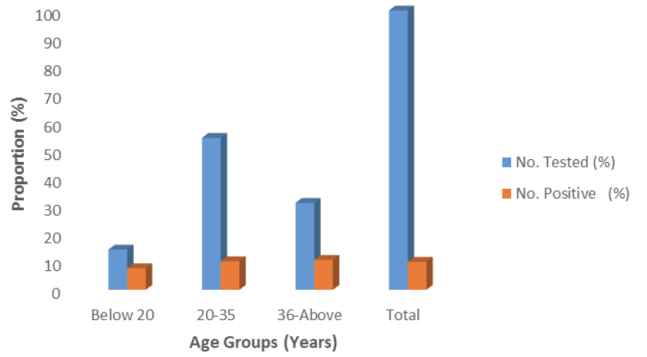

Figure 2: Age-related prevalence of HBsAb in Ozuoba, Rivers State, Nigeria.

4. DISCUSSION

Chronic HBV prevalence differs significantly in different parts of the World. Clearance of HBV is characteristically by anti-HBsAb occurrence homologous to HBsAg, which comprises a number of vital antigenic epitopes, in specific the “a” determinant that extends 124-147 amino-acids inside its main hydrophilic area [32-34]. Therefore, anti-HBsAb and HBsAg are characteristically not identified concurrently in infected persons’ sera with current infection in routine clinical practice [34]. But, long-lasting HBV infection and replication is capable occurring notwithstanding the existence of usually termed “protective” anti-HBsAb in sera of seropositive persons [34]. The concomitant finding of anti-HBsAb and HBsAg may be connected to the appearance of HBsAg HBV mutants in infected persons [34-36]. Persons with persisted positivity to HBsAg for at minimum 6 months are considered to be HBV carriers [37].

Detection of antibody to the surface antigen (HBsAb) is generally assumed to depict immunity to HBV infection or HBV vaccination [38]. Anti-HBs could be formed in reaction to inoculation or salvage from HBV acute infection [38]. Chernesky *et al*. [39] revealed in their study that a significant association of HBsAb prevalence among anaesthetists with a history of previous HBV infection. It has been reported that regions where HBV is endemic shows high positivity for anti-HBs [39]. According to Chernesky *et al*. [39], country of origin might have stood as a defining factor to HBsAb prevalence as highest prevalence has been described in participants from Africa, Asia and Eastern Europe. Nevertheless, in other related studies amongst the general population, pregnant women and blood donors point to about 18-20% prevalence of anti-HBsAb [40-41].

This study was designed to ascertain the prevalence of anti-HBsAb in a representative population of Ozuoba, Rivers State, Nigeria and such 9(10.0%) of the 90 participants screened had anti-HBsAb. This study in line with other studies considered positivity to anti-HBs only as immunity marker owing to HBV infection or HBV vaccination. In an earlier study, Lewis *et al*. [42] reported HBV antibody to be double as recurrent among healthcare workers (HCWs), signifying increased contact to HBV in addition that it is connected with the previous infection among HCWs, thus, signifying that obvious HBV infection is increased amongst HCWs.

The 10.0% HBsAb prevalence in this study compared favourably to the 8.5% HBsAb prevalence stated by Bolarinwa *et al*. [38] in Ile-Ife, Osun State, Nigeria and the 11.7% prevalence for anti-HBs

reported by Janzen *et al*. [43]. However, the anti-HBsAb prevalence in this representative population of Ozuoba is higher than 3.7% and 5.6% by Chernesky *et al*. [39] among volunteer blood donors and patients respectively. This is higher than the 6.9% anti-HBs prevalence indicated by Salpini *et al*. [44] in immunosuppressed patients. A study conducted by Singal *et al*. [45] presented a comparable prevalence of anti-HBsAb amid the unvaccinated and vaccinated groups.

The 10.0% prevalence of anti-HBs reported in this study differs from what was previously reported by other authors in various places. In a study by Papaevangelou *et al*. [46], the prevalence of HBsAb was 56.7% among prostitutes. Payne *et al*. [47] reported the incidence of HBsAb in patients to be 0.271% and 0.103% in donors. Leers [48] in a study among hospital staff population in Canada reported the prevalence of Anti-HBs to be 8.1% among North American staff members, 42.3% among Asians, 6.1% among low-risk administrative staff, 29.6% among low-risk dietary staff and hospital assistants (30.6%). Lauer *et al*. [49] stated the anti-HBsAb seropositivity to be 68.4% among HCWs in Turkey. Werner and Grady [50] reported 36.6% anti-HBsAb positivity rate among HCWs in South Africa. Chernesky *et al*. [39] reported 16.9% prevalence in a group of anaesthetists. Romieu *et al.* [51] in their study found HBsAb seropositivity to be 79.2% among hospital staff . Zarina *et al*. [52] reported 46.6% for anti-HBsAb in in Dental Clinics in Rawalpindi/Islamabad. Zarina *et al*. [52] also reported anti-HBsAb in 26.6% lacking previous vaccination history against HBV in in Dental Clinics in Rawalpindi/Islamabad which indicated HBV sub-clinical infection and confirmed protection against HBV re-infection.

The seroprevalence rates of anti-HBs in Ozuoba, Rivers State, Nigeria were not similar to the prevalence rates in different studies conducted in recent time. Biswas *et al*. [41] in their study found anti-HBs seropositivity to be 48.0% in India. Zhang *et al*. [53] reported the prevalence of anti-HBsAb to be 35.66% in an adult populace in Ji Lin, China. Liang *et al*. [54] reported a weighted anti-HBsAb incidence for Chinese populace ages 1–59 years to be 50.1%. Aghakhani *et al*. [55] stated the anti-HBsAb seroprotection rate to be 60.0%. It is also lower than 30.1% incidence of anti-HBs reported by Biswas *et al*. [3] in a tertiary care hospital in Bangladesh. The wide range in the prevalence of patients with chronic HBV in different parts of the world is largely related to differences in the age at infection, which is inversely related to the risk of chronicity [12]. This difference is most likely attributable to the increase in immunization coverage ratios after 1982 when HBV vaccine was introduced in the NPI [6].

The sex-related prevalence was males (7.1%) and females (12.5%). Sex was not a predictor of hepatitis B surface antibody (p-value >0.05). This deviates from Janzen *et al*. [43] who reported sex to be significantly associated with higher rate of HBV infection than a control group with less exposure to infectious materials. Biswas *et al*. [41] also reported that women of reproductive age had a 46.7% HBsAb protective rate, hitherto indication of interaction with HBV was considerably higher with 88.3% HBcAb seropositivity. Zhang *et al*. [53] indicated male gender as an independent predictor of immunity to by HBV exposure. Our finding also corroborates that of Aghakhani *et al*. [55] who reported insignificant sex variance in anti-HBsAb positivity. The slight difference between male and females in this study may be due to random errors during the selection of samples [56]. This slight sex-related difference may have existed owing to the fact that females receive vaccination readily than males. Genetics, the better health-seeking behaviour may also be one of the predisposing factors.

The age-specific prevalence was 7.7% for age group below 20 years, 10.2% for 20-35 years of age and 10.7% for 36 years and above. Age was not a predictor of anti-hepatitis B surface antibody (p-value >0.05). This also deviates from Janzen *et al*. [43] who reported significant age-associated HBV prevalence. The prevalence of HBAb was clearly age-dependent in the study by Papaevangelou *et al*. [46] contrary to the present findings. Zhang *et al*. [53] indicated older age as an independent predictor of immunity to by HBV exposure and younger age as an independent predictor of immunity to HBV by vaccination. The slight difference in age-specific prevalence between our study and other studies may be related to the time HBV vaccine was implemented in these countries. In 2015, Nigeria, where the vaccination programs have not received adequate attention or funding by the government until now, Musa *et al*. [6] reported that the prevalence of HBsAg in that country was 11.5% in children.

Furthermore, most of the subjects used in this study may have been born before the introduction of HBV vaccine into the NPI in 2004 [6]. While most recently reported coverage level is low by the worldwide average, the impact can be magnified with a rapid

reduction in HBV prevalence [6]. Therefore, incremental efforts and even small-scale efforts aimed at HBV prevention and control are likely to have a great benefit [6].

This study has shown that the prevalence of HBsAb was low (10.0%). Our findings indicated that prevalence of anti-HBsAb has an insignificant association with age and sex. It further showed that 90.0% were anti-HBsAb seronegative and hence, more susceptible to HBV infection [3]. Vaccination programme should be further reinforced to grasp those still at highest risk [54]. Thus, it should be envisaged that proper implementation of interventions such as early immunization and screening of high-risk groups could further reduce HBV burden as well as improve Nigeria's socioeconomic indices.

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CONFLICT OF INTEREST

No conflict of interest to declare.

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