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Original Article

Assessment of Hepatitis B Virus Infection and Immunity Status Amid Inhabitants of Wukari in Taraba State, North-East Nigeria: A Community-Based Study

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Abstract

Hepatitis B viral infection is one of the major global public health problems which are a hushed killers in the world. This virus infection is transmitted through body fluid with an infected individual. This study focuses on the prevalence of Hepatitis B virus (HBV) infection, specifically examining the presence of Hepatitis B surface antigen (HBsAg) and antibodies (HBsAb) among individuals in Wukari, Taraba State, Nigeria. The research which was conducted in Wukari metropolis, sampled 100 persons of which male were 35 and female were 75 with age range from 15 to 45 years, using standard serological procedures, specifically Combo Rapid test immunochromatographic test strips. This study showed an 18% prevalence of HBsAg and a 15% prevalence of HBsAb, revealing a relatively low overall occurrence of active HBV infections. The results also show Sero-positive of HBsAg was more in male (20%) compared to females (16.9%). In contrast, the HBsAb Sero- positive was more in female (14.7%) than in male (11.4%). In terms of age group 21-25 years has the highest age based HBsAg prevalence of 40%. Also, gender disparities and age-based trends suggest higher susceptibility among certain demographics which is notably among males demonstrating a higher prevalence of HBsAg which is possibly influenced by behavioral factors and healthcare-seeking behaviors. However, females exhibited a higher prevalence of HBsAb, indicating potential immunity from past infection or vaccination. In conclusion, the findings of this study underscore the importance of encouraging individuals to undergo screening and ascertain their hepatitis B virus (HBV) status. This proactive approach is essential for effective management, thereby reducing the risk of developing cirrhosis and liver cancer, as well as preventing transmission to others. Therefore, for individuals who test positive for HBV, early diagnosis, appropriate treatment, and vaccination are crucial preventive measures. It is imperative to emphasize the necessity of enhancing vaccination rates and healthcare assessments in Wukari to mitigate the risks associated

with HBV infection effectively.

Keywords: Hepatitis B, Infection, Persons, Seroprevalence, Surface antigen, Wukari.

Introduction

Viral hepatitis, particularly Hepatitis B virus (HBV) infection, poses a significant global health burden, resulting in both acute and chronic liver diseases with potentially severe complications. With more than 2 billion people worldwide estimated to have experienced HBV infection and about 410 million people being lingering carriers of the virus, the impact on public health is substantial [1]. Annually, HBV is responsible for around 1 million deaths globally, underscoring its severity and significance as a cause of severe and chronic liver ailments [1]. The prevalence of HBV infection varies across regions, with tropical areas experiencing higher rates [2]. Notably, in sub-Saharan Africa, where an over 10% of adults are habitually infected with HBV, the burden of disease is particularly pronounced [2]. The consequences of HBV infection can be dire, with a notable risk of mortality from cirrhosis and hepatocellular carcinoma (HCC), particularly in adulthood [2].

In addition, a small but significant percentage of individuals with severe HBV infection may suffer from complications such as liver failure, further emphasizing the disease severity [2]. HBV transmission occurs through various routes, including exposure to contaminated body fluids and blood through, blood transfusion, unprotected sexual intercourse, and the use of contaminated needles and syringes [1]. Vertical transmission from mother to child also poses a risk, highlighting the potential for intrauterine infection [1,4]. This mode of transmission, occurring during pregnancy, childbirth, or breastfeeding, can lead to the transfer of HBV from an infected mother to her offspring. Such transmission not only poses immediate risks to the newborn, but also establishes a potential reservoir of chronic infection, perpetuating the cycle of HBV transmission within communities [4]. Efforts to prevent vertical transmission, including timely administration of HBV vaccination to newborns and hepatitis B immune globulin to infants born to HBsAg-positive mothers, are critical in interrupting the transmission chain and reducing the burden of HBV infection among children [1].

Diagnostic markers such as Hepatitis B surface antigen (HBsAg) and surface antibody (HBsAb) play crucial roles in identifying and understanding HBV infections. HBsAg serves as a significant indicator of HBV infections, while HBsAb indicates recovery and immunity in hosts [5]. During infection, the antibody response is instrumental in eliminating HBV from infected liver cells, with some individuals naturally clearing HBsAg and developing HBsAb [5]. However, HBV infections in other individuals may progress to chronic hepatitis, cirrhosis, and ultimately HCC [6]. Consequently, HBsAb emerges as a key marker for diagnosing HBV infection [6]. Despite efforts such as effective antiviral therapy and HBV vaccination, the HBsAg prevalence remains alarmingly high in certain regions, particularly in Africa and the Western Pacific [7,8].

HBV infection affects more than 5% of the population in Africa [8, 9]. However, in regions like Taraba State, Nigeria, data on the epidemiology of HBV are scarce [10]. Therefore, this study addresses this gap by investigating the seroprevalence of HBsAg and HBsAb among individuals

residing in Wukari environs of Taraba State, Nigeria.

Methods

Study Area

This study was carried out in Wukari, which serves as the headquarters of the Wukari Local Government Area in Taraba State. Wukari is a significant town characterized by its diverse linguistic landscape, with major languages spoken including Kutep, Tiv, Fulani Jukun, and Hausa. The town holds importance within Taraba State, particularly due to its agricultural activities alongside other economic endeavors. Wukari experiences an average annual temperature of 26.8 °C, with March typically being the month with the highest temperature (averaging 29.8 °C) and August the coolest (averaging 25.4 °C). The town receives an average precipitation of 1205mm annually. Geographically, Wukari is situated at latitude 7°55'42" North and longitude 9°47'59" East, covering an area of 4,308 km^2. In addition to its administrative significance, Wukari hosts educational institutions such as the Kwararafa University. Federal University Wukari and the National Open University of Nigeria study center.

Study Design/Population

Informed consent was sought and obtained from each of the 100 presumed healthy individuals included in this research before sample collection. Likewise, demographic data including gender and age and level of education, were collected from the participants.

Ethical Approval

Ethical approval was given by ethics committee of the Department of Microbiology, Federal University Wukari.

Sample Collection

Venipuncture procedure was used to aseptically obtain five milliliters of venous blood into sterile containers from all consenting participants of the research. Serum samples were obtained by centrifuging at 1,500 revolutions per minute for 5 minutes and subsequently stored at −20 °C until further analysis, following the protocol described by [11] with minor adjustments.

Detection of HBsAg and HBsAb

Each serum sample obtained was assessed for the presence of HBsAg and HBsAb utilizing the HBV Combo Rapid Test Cassette manufactured by Acro Biotech, Inc, as recommended by [10]. This Combo Rapid test employs an immunochromatographic method, qualitatively detecting HBsAg and HBsAb in human blood, boasting a sensitivity of 99.9% and specificity of 99.75%. The test strips come precoated with monoclonal anti-HBs capture antibody. To conduct the test, two drops of serum were applied to the pad on the test strip using the provided disposable pipette, followed by the addition of a single drop of buffer.

After a 5-minute incubation period, the results were interpreted. A Negative result was indicated by the appearance of a single colored line in the control line (C) without any visible line in the test region (T). In contrast, a Positive result was denoted by the presence of two distinct colored lines, one in the control region (C) and the other in the test region (T). An invalid test, suggestive of a potential error in test execution, was indicated by the absence of any visible band or the presence of only one band in the test region with none in the control area. In such cases, the test was repeated [12].

Results

The Hepatitis B examination results as presented in Table 1 below reveal an overall prevalence of active Hepatitis B infections in the examined population, with 18% testing positive for HBsAg and 15% testing positive for HBsAb. Further analysis across age groups as shown in Table 2 reveals a peak in HBsAg prevalence among males and females aged 15-20, indicating a higher susceptibility to active infection in this demographic. Conversely, females in the 21-25 age group demonstrate a higher prevalence of HBsAb, indicating potential immunity.

Table 1 Sero-prevalence of HBsAb and HBsAb by gende

Sex	No. of Examined Cases	No. of Positive		No. of Negative	
		HBsAg	HBsAb	HBsAg	HBsAb
Male	35	7 (20%)	4 (11.4%)	28 (80%)	31 (88.6%)
Female	65	11 (16.9%)	11 (16.9%)	64(98.5%)	64 (98.5%)
Total	100	18(18%)	15(15%)	92(92%)	95(95%)

Table 2 Sero-prevalence of HBsAb and HBsAg by age Group

Age	Sex		Male (+)		Female (+)	
	Male	Female	HBsAg	HBsAb	HBsAg	HBsAb
15-20	6	10	2(33.3%)	3(50%)	6(60%)	1(10%)
21-25	10	20	4(40%)	1(10%)	2(10%)	6(30%)
25-30	4	15	1(25%)	0	3(20%)	2(13.3%)
31-35	13	20	0	0	0	2(13.3%)
36-40	2	0	0	0	0	0
41-45	0	0	0	0	0	0
Total	35	65	7(20)	4(11.4%)	11(14.7%)	11(14.7%)

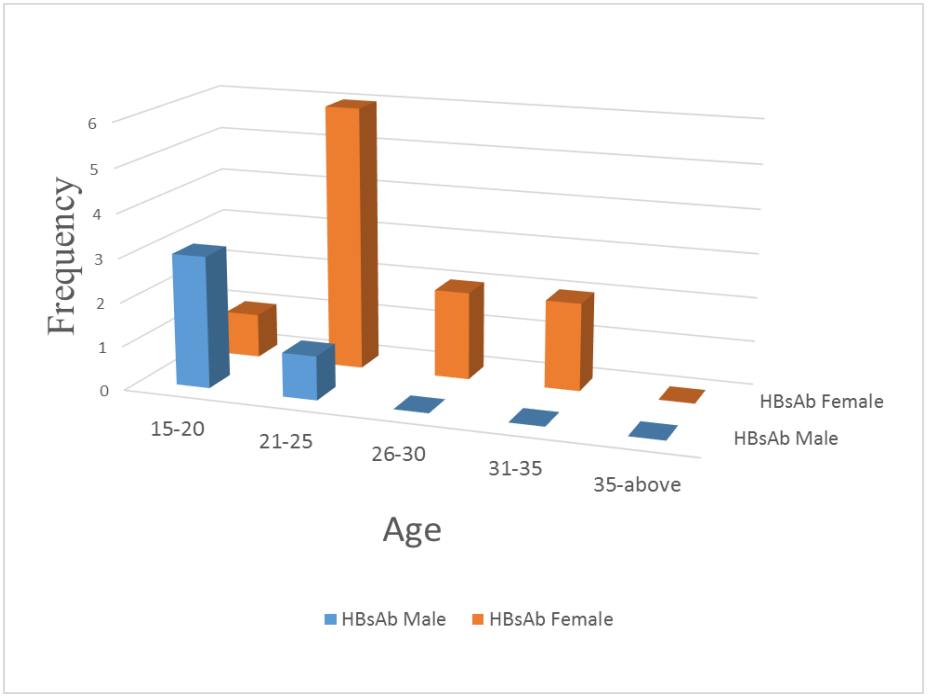

Figure 1 Distribution of HBsAb by age and gender

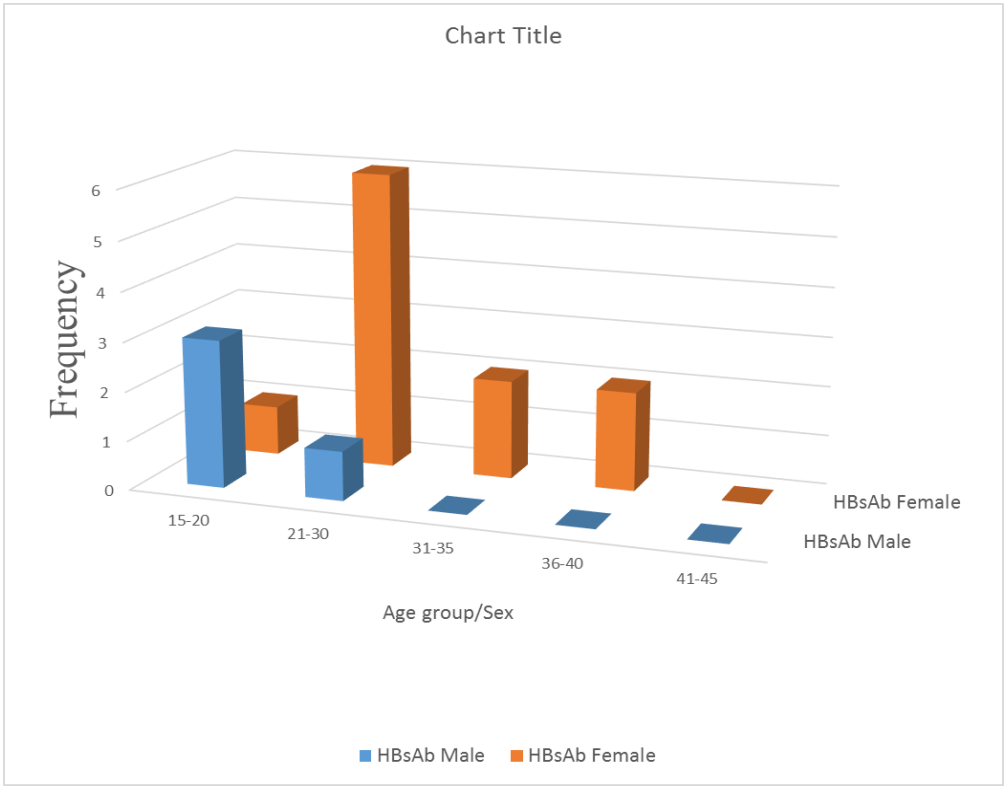

Figure 2 Distribution of HBsAb by age and gender

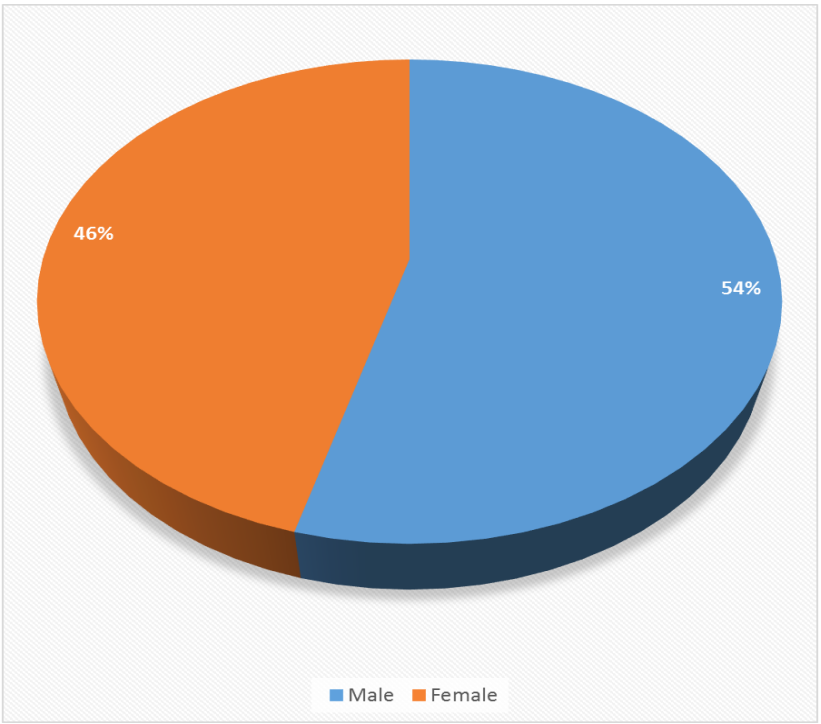

Figure 3 Distribution of HBsAb by gender

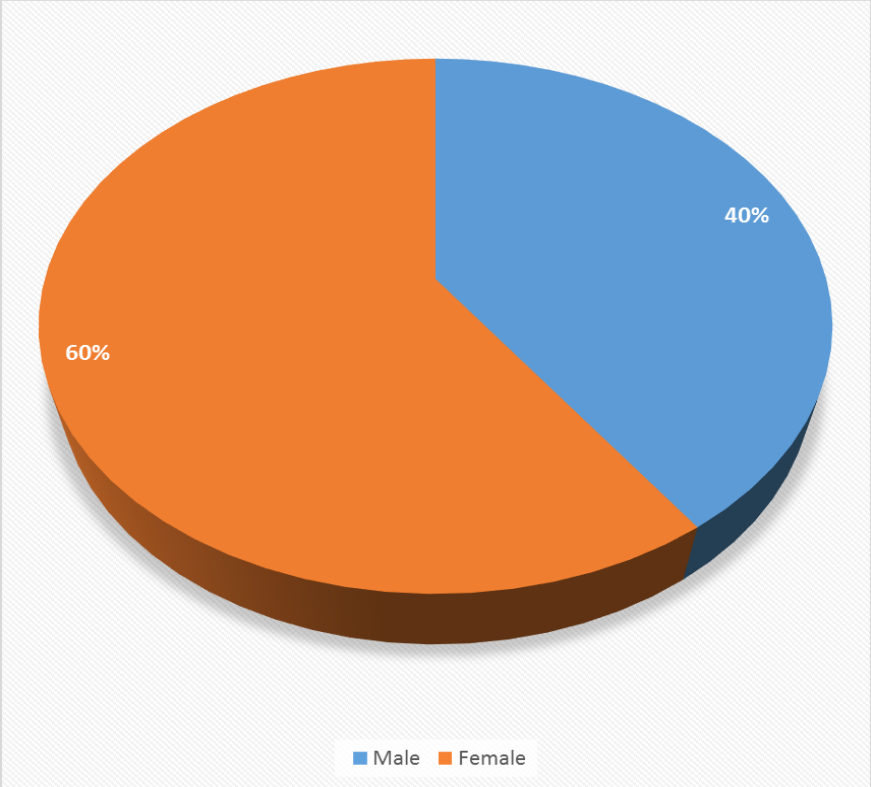

Figure 4 Distribution of HBsAb by gender

Discussion

This study explicitly determined the prevalence of Hepatitis B surface antigen HBsAg and surface antibodies HBsAb in Wukari. Results from this study shows a prevalence of HBsAg positivity of 18% and HBsAb of 15%. The seroprevalence of HBsAg was more in male (20%) than female accounting (16.9%). In contrast, the HBsAb sero positivity was more in females (16.9%) than males (11.4%). The presence of HBsAg and HBsAb in serum indicates an active infection and immunity, either from past infection or vaccination respectively [13]. The seroprevalence of HBsAg obtained in this study is similar with that from previous studies by [14-18] who reported a prevalence of 20.6% in Keffi, 28.7% in Jos, 30.4% in Ilorin, 70.5% in Kano, and 33.8% in India, respectively. Nonetheless, some other studies have previously reported lower prevalence of HBsAg compared to the one obtained in this study (18%). Studies by [19-23] reported a prevalence of 6% in South Africa, 15%, in Maiduguri, 9.2% in Lagos, 9.7% in the Niger-Delta, and 11% in Nasarawa respectively. Result from this study show that the HBsAg prevalence was higher in males (20%) compared to females (16.9%). This agrees with the findings of [24] who reported a prevalence which was 2.4 times more among males than the females. This gender-based difference may be influenced by different factors including personal behavioral factors and health care seeking behaviors. Males are observed to engage more in risky sexual behaviors that increase the likelihood of Hepatitis B transmission. This can include practices such as unprotected sex, having multiple sexual partners and sharing of contaminated needles for intravenous drug users [25]. Likewise, gender base disparities in access to healthcare may affect testing and vaccination rate. Females have better access than males to

healthcare including hepatitis B screening due to antenatal care service. Contrastingly, limited availability of healthcare facilities often discourages males to go for regular checkup and counseling, thereby increases the possibilities of higher prevalence of STIs including HBV among males [26]. The assertion is corroborated by [27], which suggests that men are more prone to testing positive for HBsAg compared to women. This gender disparity persists regardless of prevailing risk factors and the level of gender endemicity within a randomly sampled population. Notably, this trend persists even when the number of males sampled slightly outweighs that of females [28]. In addition, [24] has contended that the slower plasma clearance rate for HBsAg observed in males, as opposed to females, contributes to the higher prevalence rates of the virus among males. The age group of 21-25 years exhibited the highest prevalence of HBsAg, recorded at 40%. This heightened prevalence among individuals aged 21-25 years could be linked to various factors associated with HBV transmission prevalent within this demographic, such as engaging in sexual activity, illicit drug use, tattooing, body piercing, and other behaviors. These factors contribute to increased transmission risk within this age group, thereby accounting for the elevated prevalence of HBsAg observed. This observation is in consonant with the findings of [29] which discovered a higher prevalence among young adults compared to any other age demographic owing to their active lifestyle and risky sexual choices. In contrast, the study by [30] suggested that other age demographics may also exhibit risky sexual behaviors which may expose them to STIs including HBV. Noticeably, individuals within the age group of 36 and above had no case of HBV infection as indicated in this current study. This may not be independent to the fact that most HBV complications such as liver cirrhosis and hepatocellular carcinoma occur within the age of 35 and above and individuals infected may have died from such complications [31]. Furthermore, the observed higher prevalence of HBsAg among individuals aged 21-25 years may be further influenced by the ability of older HBV carriers to achieve viral clearance, as suggested by [32]. This phenomenon could contribute to a higher proportion of HBV-positive individuals within the younger age group, thereby influencing the overall prevalence rates observed in this demographic. The seroprevalence of HBsAb (15%) reported in this study is higher than that of [33] and [34] which reported HBsAb prevalence of 1% in Anambra State and 3.0% among blood donors in Kaduna State, respectively. However, a higher percentage (41%) of HBsAb was discovered among female Sex Workers in Enugu State [35]. This indicates higher vaccination rates among female sex workers who are considered as population mostly at risk owing to the nature of their job of engaging in sexual activities with multiple sexual partners who may be infected with HBV [36]. This outcome resonates with the result obtained in this study which suggests that, the seroprevalence of HBsAb was higher in females (16.9%) compared to males (11.4%). This indicates that only 11.4% males and 14.7% females are not at-risk or susceptible to HBV infection in the studied area. The higher prevalence of the HBsAb observed among females is due to the higher vaccination rate observed among females compared to males [37]. A higher priority is usually accorded to women and children during vaccination exercise as public health efforts considers men as a stronger group compared to women and children [38].

Females are more opportune to be vaccinated against HBV during routine

immunization programs and antennal care where pregnant women are frequently screened and vaccinated to prevent mother to child transmission [39]. Females particularly during pregnancy tend to have frequent interactions with health providers and as such results to increased chance of vaccination [40]. Furthermore, health care seeking behavior can also contribute to less susceptibility of female to HBV infection. Women have been observed to have an improved, healthcare seeking behavior compared to their male counterpart who feels less need for medical checkups and vaccination [41].

Moreover, biological and hormonal factors tend to play significant role in immune response to vaccination. Studies have suggested that estrogen, a hormone more prevalent in females may enhance immune response to vaccine [42].

Conclusion

To sum up, the study findings underscore the importance of targeted vaccination campaigns, increased awareness and education, improved access to healthcare, continued monitoring and research, and the integration of Hepatitis B screening into routine care to address the prevalence of HBsAg and HBsAb in Wukari metropolis. Tailoring vaccination efforts to high-risk groups, such as young adult males, and ensuring equitable access to healthcare services for both genders are vital steps in mitigating the spread of Hepatitis B. Moreover, educational initiatives aimed at promoting safer behaviors and regular health check-ups can empower individuals to take proactive measures against HBV transmission. Continued surveillance and research will provide valuable insights for refining prevention strategies and optimizing vaccination efforts, while integrating HBV screening into routine care can facilitate early detection and intervention, ultimately reducing the burden of Hepatitis B and improving overall public health outcomes in the community.

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Conflict of Interest

The authors declare that there are no conflicts of interest to report. Furthermore, all authors unanimously consent to the publication of this scientific work.

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