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Liver Enzyme Profile of Hepatitis B Positive Blood Donors in Enugu State University Teaching Hospital

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ABSTRACT

Hepatitis B virus (HBV) remains a major global health problem. This is particularly seen through blood donation, where many carriers are asymptomatic and can unknowingly transmit the virus. This study addresses a gap in local data by investigating the liver enzyme profiles of HBV-positive blood donors at the Enugu State University Teaching Hospital. We conducted a descriptive, cross-sectional study from September to November 2024, enrolling 170 voluntary blood donors. Blood samples were screened for Hepatitis B surface antigen (HBsAg) using a rapid diagnostic strip, and the liver enzymes—aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP)—were measured using standard biochemical assays. Questionnaires were also used to collect socio-demographic data and assess HBV awareness.

The study found a 17.5% HBsAg seroprevalence among the 97 donors included in the final analysis. A high level of HBV awareness (81.4%) was observed, with most knowledge gained from health workers. The donor population was predominantly male (89.7%), and the highest prevalence of HBV-positive cases (54.6%) was in the 26–35 age group. The liver enzyme profiles of the 17 HBsAg-positive donors showed mildly elevated levels, particularly for ALP. The mean values were: AST 17.82 U/L (range 5.0–38.0), ALP 62.02 U/L (range 22.1–108.1), and ALT 11.12 U/L (range 4.0–26.0). These mild elevations suggest potential subclinical liver damage, consistent with either a mild acute or chronic viral hepatitis, emphasizing that even asymptomatic carriers can have subtle liver pathology. The findings highlight the critical need for continued rigorous screening and further clinical investigation of seropositive donors, including comprehensive follow-up and advanced testing (e.g., HBV DNA), to ensure transfusion safety and mitigate long-term health risks.

Keywords: Hepatitis B Virus, Liver Enzyme Profile, Blood Donors, Seroprevalence, Transfusion Safety

INTRODUCTION

Hepatitis B is a potentially life-threatening liver infection caused by Hepatitis B virus and it is a major global health problem (WHO, 2025). The World Health Organization estimates that hundreds of millions of people are living with chronic HBV, which can lead to severe liver diseases, including cirrhosis and hepatocellular carcinoma (WHO, 2021). The asymptomatic nature of the infection in many of its early stages is particularly problematic, as many carriers are unaware of their clinical status and can unknowingly transmit the virus, making them a potential source of infection to others (Bosch, 2019). This poses a critical challenge in transfusion medicine, where ensuring a safe blood supply is paramount. Despite rigorous screening protocols for Hepatitis B surface antigen (HBsAg), asymptomatic carriers with subclinical or even undetectable liver enzyme changes may still contribute to the transmission of the virus (Hoofnagle, 2012).

Infection with HBV primarily targets hepatocytes, triggering an immune response that, while fighting the virus, can also cause liver cell damage (WHO, 2021). Over time, this can lead to progressive liver inflammation and damage, potentially resulting in liver fibrosis, cirrhosis, and cancer (Thad et al., 2019). Liver enzymes, particularly alanine aminotransferase (ALT) and aspartate aminotransferase (AST), are crucial

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biomarkers of liver cell injury and are often used to monitor liver function (Ganem, 2014). Globally, HBV infection contributes to approximately 68,600 annual deaths and is a leading cause of liver cancer, with over 300,000 attributed deaths per year (WHO, 2015; W.H.O.E. Region, 2017).

In Nigeria, a country with high endemicity, the seroprevalence of HBV among blood donors ranges from 8% to 15%, with variations depending on geographical location (Ejele et al., 2021). While a great deal of research has focused on the prevalence of HBsAg among blood donors, there is a critical knowledge gap concerning the liver health of these seropositive, yet asymptomatic, individuals. It is ethically and clinically imperative that a seropositive result prompts further investigation beyond simple discharge from the blood donation center. A comprehensive assessment, including liver enzyme profiling, is necessary to determine the extent of liver involvement and to guide appropriate follow-up care.

This study was designed to bridge this gap by investigating the liver enzyme profiles of HBsAg-positive blood donors at the Enugu State University Teaching Hospital. By providing a detailed analysis of these biomarkers, this research will offer insights into the subclinical effects of HBV infection on liver function in this key population. The findings will not only reinforce the need for meticulous screening but will also provide a robust scientific basis for implementing comprehensive post-donation counseling and long-term management strategies for seropositive donors. Ultimately, this research aims to enhance the safety of blood transfusions and contribute to the broader efforts of HBV control and management in Nigeria.

Statement of the Problem

Hepatitis B virus (HBV) infection is the most common cause of liver disease and liver cancer, despite education and availability of an efficacious vaccine(Tan et al., 2020). Screening for hepatitis B virus infection is simple and relatively inexpensive. Yet it is underused in everyday practice, leaving some HBV-positive patients unaware and at risk for serious health consequences, including cirrhosis, liver failure, and hepatocellular carcinoma (Rizzo et al., 2022). While routine screening for Hepatitis B surface antigen (HBsAg) is standard practice, there is a lack of data on the liver health status of these asymptomatic, HBsAg-positive donors, particularly in the Enugu State region of Nigeria.

This study aims to address this critical knowledge gap by determining the liver enzyme profiles of HBsAg-positive blood donors at the Enugu State University Teaching Hospital. Liver enzymes, such as aspartate aminotransferase (AST) and alanine aminotransferase (ALT), are key indicators of liver cell damage and function. By analyzing these biomarkers, we seek to uncover potential subclinical liver pathology in seemingly healthy donors.

Justification of the Study

Early detection of liver damage, especially in Hepatitis B positive individuals, is critical in preventing the progression to more severe liver diseases. Blood donation is an essential part of healthcare systems globally, providing lifesaving treatments for individuals requiring transfusions (Alao *et al.*, 2019). Despite rigorous screening protocols, asymptomatic carriers of Hepatitis B with mild or undetectable liver enzyme changes may still contribute to the transmission of the virus (Hoofnagle, 2012).

The findings from this research will not only highlight the importance of rigorous screening but will also provide a robust scientific basis for implementing comprehensive post-donation follow-up and management strategies for seropositive donors. Ultimately, this study's contribution is to enhance the safety of blood transfusions and contribute to the ongoing efforts to control and manage HBV infection in Nigeria.

Significance of the Study

This study will provide valuable insights into the liver health of HBV-positive blood donors in Enugu State University Teaching Hospital, potentially leading to improved screening protocols and safer blood transfusion practices. The findings could also guide clinical management of HBV in blood donors and help mitigate the risks associated with liver damage in these individuals.

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Aim

To Determine Liver Enzyme Profile of Hepatitis B Positive Blood Donors in Enugu State University Teaching Hospital, G.R.A Enugu.

Specific Objectives:

1. To Screen Blood Donors for Hepatitis B Virus attending Enugu State University Teaching Hospital.
2. To determine their Liver Enzyme Profile Particularly (AST, ALT and ALP) of Hepatitis B Positive Blood donors in Enugu State University Teaching Hospital.
3. To Asses awareness among blood donors attending Enugu State University Teaching Hospital.

METHODOLOGY

Study Design

A descriptive, cross-sectional study was conducted using a consecutive sampling method, enrolling all eligible voluntary blood donors who presented at the Blood Bank Centre of Enugu State University Teaching Hospital from July to September 2024. This a hospital is a major reference hospital for the whole southeastern region of Nigeria and so was a good representation.

Study Area

The study was carried out in Enugu State University Teaching Hospital (Parklane). G.R.A Enugu Urban, the capital city of Enugu state, Nigeria.

Study Population

People who Tested Sero-Positive for Hepatitis B virus among Blood donors attending ESUTH, Parklane, during the study period.

Inclusion Criteria

- Patients Tested Sero-Positive with Hepatitis B virus.
- Individuals who provided informed consent to Participate in this Study.
- All eligible blood donors aged 18-65 years.
- Hemoglobin level within the normal range for male ≥13.5 mg/dl; for female ≥12 mg/dl

Exclusion Criteria

- Donors with known liver disease or other co-infections (HIV, Hepatitis C).
- Blood donors who refused to give their consent.

Sample Size determination

The sample size was calculated using the standard formula for calculating the minimum sample size (Charan J, 2013). Sample size (n) is given by Crochan's formula

n= Z^2pq

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d^2

Where;

n = Minimum sample size =?

Z = Standard normal deviation at 95% level of confidence = 1.96

P = (the percentage of target population estimated to have a particular characteristic) = 50% (0.5)

q = 1-p = 1-0.5 = 0.5

d (margin of error) = 10% (0.1)

Therefore, n = $\frac{(1.96^2 * 0.5 * 0.5)}{0.1^2}$

Sample size = 97.

The sample size targeted at 97 subjects.

Sample Collection

The blood sample was taken from each participant aseptically for the serological with a sterile disposable syringe and needle, after disinfection of the selected venipuncture site with 70% alcohol in an expanding circular scrub from the center to the periphery of the needle insertion. About 5ml of blood was collected by venipuncture and was dropped into a plain bottle labeled with corresponding sample number, the plasma was separated and used for serology For Hepatitis b virus screening.

Laboratory procedure

Serum was separated from the collected blood samples in a test tube by centrifuging at 2000 rpm for 2 minutes. The separated blood samples were serologically investigated for viral infection of hepatitis B by Palmitic Hepatitis B Rapid Diagnostic strip. All blood collection was done following laboratory protocols ensuring the accuracy and reliability of the biochemical analysis. The 17 hepatitis B positive (HBsAg positive) serum samples were studied for liver function tests, estimation of levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) by using test kits (RANDOX company, UK and Human Germany).

Serology (Hepatitis B Screening) Materials

Sterile needle, HBsAg rapid test strip, Sample (whole blood, serum, or plasma, Buffer solution (if required), Dropper or pipette.

Interpretations of Result

Positive: Two lines appear, one line should always appear in the control line region (C) and another one apparent colored line should appear in the test line region.

Negative: Once colored line appears in the control region (C). No apparent colored line appear in the test line region.

Invalid: Control line fails to appear; insufficient specimen volume or incorrect procedural techniques are the most likely reasons for control line failure. Review the procedure and repeat the test with a new strip. If the problem persists, discontinue using the test kit immediately and contact your local distributor.

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Alanine Transaminase

Method and Materials

Spectrophotometry (Reitman-Frankel). Buffer/Substrate, 2-4 dinitrophenylhydrazine, water (distilled water), 0.4N NaOH (Sodium Hydroxide solution), Water bath at 37℃, test tube and control serum. The buffer is called Tris's buffer and is contained with substrate which is 2-oxoglutarate.

Aspartate Transaminase.

Method and Material

Spectrophotometry was used. Buffer/Substrate, 2-4 dinitrophenylhydrazine, water (distilled water), 0.4N NaOH (Sodium Hydroxide solution), Water bath at 37℃, test tube and control serum. The buffer is called Tris's buffer and is contained with substrate which is alpha ketoglutarate and is measured at 540nm.

Alanine Phosphatase.

Method & Materials

Spectrophotometry (according the standardized method described by DGKC). Buffer/Substrate, 2-4 dinitrophenylhydrazine, water (distilled water), 0.4N NaOH (Sodium Hydroxide solution), Water bath at 37℃, test tube and control serum. ALP is measured at 405nm.

Procedure

- Into a cuvette was added 0.5 ml of working reagent and 0.01 ml of sample, it was mixed and initial absorbance read at 405 nm and a stop watch started
- The absorbance was further read at 1, 2, and 3 minutes respectively.
- The change in absorbance was then multiplied with factor 2760 to get the activity of the alkaline phosphatase enzyme.

Data Collection and Analysis.

The socio-demographic data and other relevant information of each participant were obtained using a self-administered questionnaire. Data obtained from this study was analyzed using the statistical package for social sciences (SPSS). Data was presented as mean and standard deviations

Ethical consideration

Ethical clearance for the study was sought and obtained from the ethical committee of Enugu State University Teaching Hospital (ESUTH), Parklane, with the reference number, ESUTH/HREC/2024/10/201.

RESULTS

Table 1: Sociodemographic Data (n = 97)

Variables	Frequency	Percentage (%)
Gender		
- Male	87	89.7
-Female	10	10.3

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Age		
-18–25	22	22.7
-26–35	53	54.6
-36–45	17	17.5
-46 and above	5	5.2
Marital Status		
-Single	58	59.2
-Married	36	36.7
-Divorced	4	4.1
-Widowed	0	0
Level of Education		
- No formal education	10	10.3
- Primary school	17	17.5
- Secondary school	42	43.3
- Tertiary Education	28	28.9
- Occupation		
- Student	26	26.8
- Employed	17	17.5
- Self-employed	35	36.1
- Unemployed	19	19.6
Have you donated blood before?		
- Yes	80	82.5
- No	17	17.5

Table 1 presents the demographic characteristics of the respondents. The study's participants were predominantly male (89.7%), with the largest age group being 26–35 years old (54.6%). The majority were single (59.2%) and had completed secondary school (43.3%). In terms of occupation, most were self-employed (36.1%), followed by students (26.8%). A significant majority of participants (82.5%) reported a history of previous blood donation.

Table 2: Awareness of Hepatitis B Virus (n = 97)

Variables	**Frequency**	**Percentage (%)**

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Have you ever heard of Hepatitis B Virus (HBV)		
- Yes	79	81.4
- No	18	18.6
If yes, where did you learn about HBV?		
- Health workers	63	72.4
- Media (TV, radio, internet)	11	12.6
- Friends/Relatives	5	5.6
Do you know that HBV is a serious liver infection?		
- Yes	37	38.1
- No	60	61.9
What do you think are the main ways HBV is transmitted?		
- Blood transfusion	82	23.2
- Unprotected sexual intercourse	73	20.7
- Sharing needles/syringes	73	20.7
- Mother-to-child during birth	55	15.6
-Contact with contaminated items (e.g., razors, toothbrushes)	70	19.8
Are you aware that HBV can be prevented through vaccination?		
- Yes	76	78.2
- No	21	21.8
Do you believe screening for HBV before blood donation is important?		
- Yes	97	100
- No	0	0

Table 2 presents the awareness of Hepatitis B Virus (HBV) among respondents. Awareness of HBV was high, with 81.4% of respondents having heard of the virus. The primary source of information was health workers (72.4%). While 38.1% of participants considered HBV a serious infection, all respondents (100%) supported pre-donation screening. The most recognized transmission routes were blood transfusion, unprotected sexual intercourse, and sharing needles.

Table 3: Prevalence of Hepatitis B among Blood donors at ESUTH Parklane.

Variables	**Prevalence**	
	N	**%**
Blood donors screened	97	100.0
Hepatitis B positive donors	17	17.5

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Table 3 shows the prevalence of Hepatitis B among blood donors at ESUTH Parklane. Out of 97 blood donors screened, 17.5% tested positive for Hepatitis B, indicating a moderate level of the infection within the donor population.

Table 4: Liver Enzyme Profile of Hepatitis B Positive Blood donors

	N	Minimum	Maximum	Mean	Std. Deviation
AST	17	5.0	38.0	17.82	10.80
ALP	17	22.1	108.1	62.02	27.56
ALT	17	4.0	26.0	11.12	6.13

Table 4 shows the Liver Enzyme Profile of Hepatitis B Positive Blood donors. For aspartate aminotransferase (AST) showing a narrower range, values range from a minimum of 5.0 to a maximum of 38.0 with a mean of 17.82 and a standard deviation of 10.80. Alkaline phosphatase (ALP) measurements shows a significant range, from a minimum of 22.1 to a maximum of 108.1, with a mean of 62.02 and a standard deviation of 27.56. Alanine aminotransferase (ALT) levels, with a mean of 11.12 and a smaller standard deviation of 6.13, range from 4.0 to 26.0.

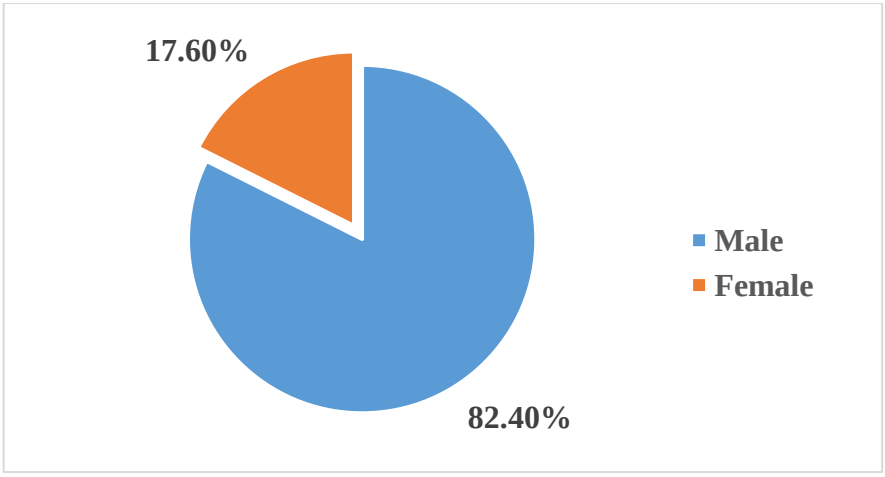

Figure 1: Prevalence of Hepatitis B Positive Cases Among Donors by Gender

Figure 1 illustrates the prevalence of Hepatitis B among male and female blood donors. The prevalence was higher in male donors (82.4%) than in female donors (17.6%).

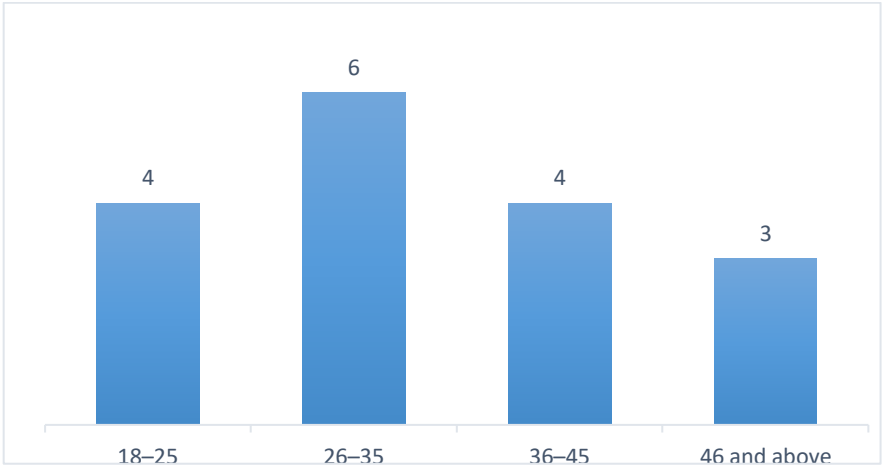

Figure 2: Prevalence of Hepatitis B Positive Cases Among Donors by Age

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This chart illustrates the prevalence of Hepatitis B positive cases among different age groups of blood donors. The 26–35 age group had the highest frequency, with 6 positive cases. The 36–45 age group followed with 4 positive cases. The 18–25 and 46 and above age groups each had 4 and 3 positive cases, respectively.

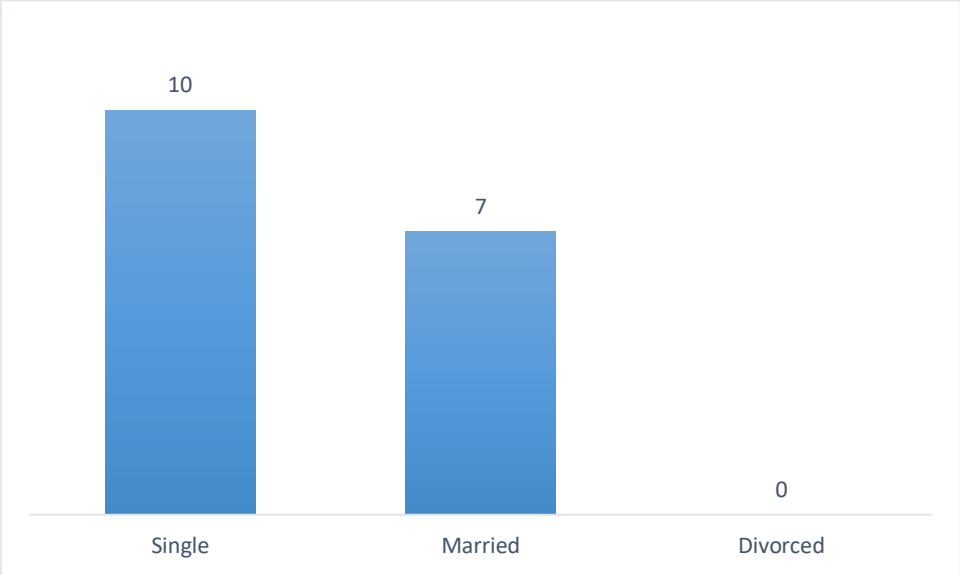

Figure 3: Prevalence of Hepatitis B Positive Cases Among Donors based on Marital Status

This chart shows the Prevalence of Hepatitis B positive cases based on the marital status of blood donors. The majority of positive cases were found among single donors, with a frequency of 10 positive cases. Married donors had a lower frequency, with 7 positive cases. There were no positive cases reported among divorced donors.

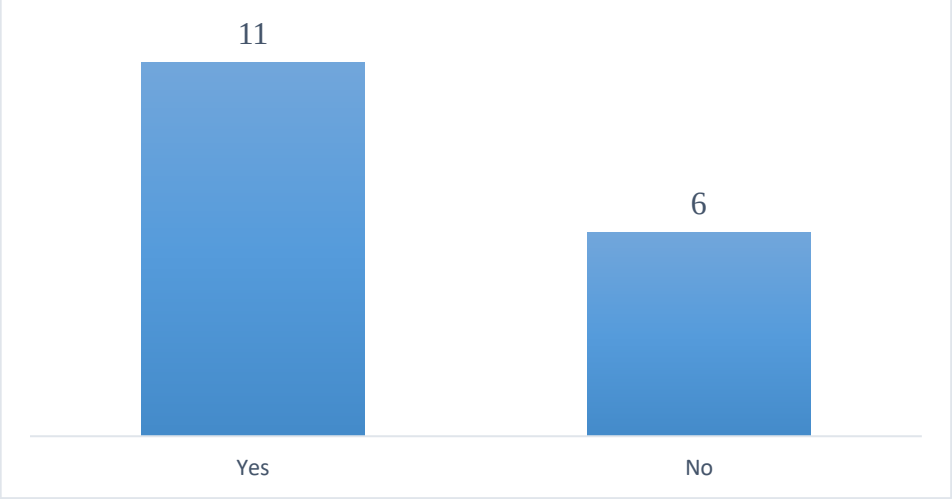

Figure 4: Prevalence of Hepatitis B Positive Cases Among Donors based on Awareness of Hepatitis B

This chart displays the prevalence of Hepatitis B positive cases based on whether blood donors have heard of Hepatitis B Virus (HBV). Among donors who have heard of HBV, 11 individuals tested positive for Hepatitis B. In contrast, among those who have not heard of HBV, 6 individuals tested positive.

DISCUSSION

The result of this study showed that A moderate HBsAg seroprevalence of 10% was observed among the 170 screened blood donors, with 17 individuals testing positive for HBV. This prevalence is considered moderate when compared to other regional findings, such as an 18.1% prevalence reported in Maiduguri, Borno State, Nigeria (Seto *et al.*, 2014). The study's discussion suggests that this comparatively lower prevalence might be attributed to the high level of HBV awareness among the donor population. Indeed, a significant 81.4% of

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respondents reported having heard of HBV, primarily through health workers (72.4%). While awareness of the virus was high, only 38.1% of participants acknowledged HBV as a serious liver infection. Nevertheless, all respondents (100%) emphasized the importance of screening for HBV before blood donation, highlighting a strong public understanding of its role in transfusion safety. The most recognized transmission routes included blood transfusion, unprotected sexual intercourse, and sharing needles/syringes. This underscores the critical importance of rigorous screening to prevent the transmission of this potentially life-threatening virus through blood donations, as asymptomatic carriers can unknowingly transmit the virus.

Demographic analysis of the study participants revealed a strong male dominance (89.7%) in the donor population. This finding contradicts some previous reports (Uneke, 2005) but is consistent with others that found higher blood donation rates among males in both rural and urban areas, including studies in Lagos, Nigeria (Balogun, 2010), and Ibadan, Nigeria (Lukhwareni, 2009; Mehmet, 2005). The highest prevalence of HBV-positive cases (54.6%) was observed in the 26–35 age group. This aligns with studies noting higher HBV prevalence in younger individuals aged 20–29 years (Buseri, 2009), possibly due to more active sexual activities and other risk behaviors. This finding contrasts with earlier reports suggesting a higher prevalence in older subjects (Lawal, 2009; Luka, 2008). The majority of HBV-positive cases were found among single donors, with 10 cases, compared to 7 among married donors. Most respondents had completed secondary education (43.3%) and were self-employed (36.1%). A significant majority (82.5%) reported a history of previous blood donation.

The liver enzyme profiles of the 17 HBsAg-positive donors showed mild elevations in Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), and Alkaline phosphatase (ALP). Specifically, AST ranged from 5.0-38.0 U/L (mean 17.82 U/L), ALP from 22.1-108.1 U/L (mean 62.02 U/L), and ALT from 4.0-26.0 U/L (mean 11.12 U/L). These values suggest subtle liver damage, consistent with either a mild acute or chronic viral hepatitis.

It is important to note that AST is not a specific marker solely for liver damage, as its mild elevation can be attributed to various factors, including intense exercise. Given AST's shorter half-life of 17 hours, a slight elevation might indicate an "acute phase" of viral infection. In contrast, ALT is considered a more specific marker for liver damage, and its longer half-life (48 hours) often associates elevations with chronic liver conditions. The relatively lesser elevations in both ALT and AST compared to ALP in this study, while still suggestive of viral hepatitis, indicate either mild acute viral hepatitis or diffuse and focal chronic liver diseases. Elevated ALP levels typically reflect impaired biliary tract function and could be indicative of a recent hepatitis B attack. Although liver function test results can be normal in HBsAg carriers, severe cases of liver disease like cirrhosis or fulminant liver failure commonly show AST and ALT values exceeding 1000 U/L. The observed mild increases, particularly in ALP, are crucial in suggesting subclinical liver damage, even in asymptomatic carriers.

CONCLUSION

The study confirms that HBV infection significantly affects liver enzyme profiles, leading to subtle liver damage. The findings shows the critical importance of rigorous screening, including routine liver function tests for HBV seropositive individuals, and the necessity for further clinical investigation of seropositive donors. These measures are vital to mitigate long-term health impacts on individuals and enhance transfusion safety by preventing the spread of HBV through blood donations

RECOMMENDATION

1. It is recommended that all blood donors undergo comprehensive HBV screening, including HBsAg and, where feasible, additional markers or HBV DNA testing, as part of the routine blood donation process, particularly during their first visit, to ensure maximum transfusion safety

2. HBV seropositive individuals should undergo regular and comprehensive clinical follow-up, including routine liver function tests to monitor enzyme levels and detect liver damage early. This follow-up should

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ideally include HBV DNA testing and other serological markers to assess disease activity and stage (acute vs. chronic), guiding appropriate clinical management and mitigating long-term health impacts.

3. Increased public health campaigns are needed to educate individuals about the Causes of HBV, their transmission route, prevention and treatment.

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Competing Interests

Authors have declared that no competing interests exist.

Consent

All authors declare that written informed consent was obtained from the participants for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

Ethical Approval

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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