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Original Article

Prevalence of Hepatitis B Surface Antigen and Associated Factors among Diabetic Patients Attending Bugando Medical Centre in Mwanza, Tanzania

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ABSTRACT

Background: Hepatitis B virus is a significant public health concern, especially among high-risk groups such as diabetic patients. Hepatitis B infection can lead to serious liver diseases such as hepatocellular carcinoma and cirrhosis. Precise data on the prevalence of Hepatitis B infections in these high-risk groups are crucial for executing targeted interventions aimed at reducing Hepatitis B virus transmission. Here, we report the prevalence and factors associated with Hepatitis B infections among diabetic patients in Mwanza, Tanzania. **Methodology**: A cross-sectional study involving 177 diabetic patients was conducted between May and July 2023 at Bugando Medical Centre. Socio-demographic and other relevant information were collected using a structured, pretested data collection tool. Approximately 3-5 mL of blood sample was collected from each participant, followed by HbsAg testing using the One Step HBsAg Rapid Test kit. Descriptive analysis was performed using STATA version 15 software. **Results**: The median [IQR] age of participants was 61 [29-85] years. The prevalence of HBsAg among diabetic patients was 4.5% (8/177); 95% CI [1.4 –7.5]. Sharing cutting equipment was significantly associated with HBsAg positivity (p = 0.022). **Conclusion**: The prevalence of HBsAg among diabetic patients indicates intermediate endemicity as per WHO classification, with sharing of cutting equipment significantly contributing to Hepatitis B virus infection in this group. There is a need to include general education regarding HBV transmission in the management of diabetic patients.

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INTRODUCTION

The Hepatitis B virus (HBV) is a circular-enveloped DNA virus classified within the Hepadnaviridae family (1). Its structure consists of an outer envelope composed of surface proteins (HBsAg) and an inner core containing viral DNA and replication enzymes. HBV has three types of viral particles, including smaller spherical structures and the infectious Dane particle (2, 3). HBV utilizes its polymerase for replication via reverse transcriptase activity (4). The unique structure and genomic organization of the Hepatitis B Virus play critical roles in its diagnosis and treatment. The HBV incubation period ranges from 30 to 180 days, with detectability occurring within 30 to 60 days post-infection (5, 6). Hepatitis B virus usually leads to acute and chronic liver infections. Chronic infection is associated with liver cirrhosis or hepatocellular carcinoma with a different natural course of the disease in children and adults (7). Globally about a quarter of the World population is HBV-infected of which 240 million individuals are chronic carriers (8). In sub-Saharan Africa and regions of East Asia, around 5-10% of the population is estimated to have chronic hepatitis B infections (8).

In Tanzania, the overall prevalence of HBV infection in the general population has been reported to be 4.1% (7) with variations in different populations. In China, a study that was done among patients with type 2 diabetes mellitus reported a hepatitis B surface antigen prevalence of 13.5% (9). Previous studies have reported that diabetic patients are more susceptible to Hepatitis B virus infection as a result of their immune-compromised state due to the defective cellular immune function (8). Furthermore, diabetic patients are at increased risk of infection due to frequent percutaneous exposure to infectious bodily fluids through blood screening such as sharing of blood glucose meters, finger stick devices, and other diabetic care equipment like syringes, insulin pens, improperly sterilized podiatry equipment and other drug injection equipment (10, 11). Hence, there is a need to generate data regarding HBV infection among diabetic patients to ensure appropriate preventive strategies are routinely introduced. Therefore, this study aimed to determine the prevalence and factors associated with Hepatitis B infections among diabetic patients in Mwanza, Tanzania.

MATERIALS AND METHODS

Study design, study area, and study population: This was a hospital-based cross-sectional study conducted between May and July 2023 at Bugando Medical Centre (BMC). BMC is a zonal consultant and teaching hospital serving approximately 16 million people from the Lake and Western zones of Tanzania. BMC has a bed capacity of 950 with about 100 diabetic patients attending the diabetic clinic per week (12).

Sample size estimation, Inclusion, and Exclusion criteria: In this study, we used the Kish Leslie formula to estimate the sample size. The study included all adult inpatients and outpatients with

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diabetes attending the clinic at BMC during the study period. However, those who were in critical condition, unable to read the consent, or who had received the HBsAg vaccine were excluded from the study.

Sampling method, data and specimen collection, and laboratory procedures: A convenient sampling technique was used to recruit 177 diabetic patients. Socio-demographic characteristics and relevant characteristics of the study participants were collected using a questionnaire; information collected included age, sex, residence, marital status, vaccination status etc. Following the aseptic procedures 3-5mls of venous blood was collected in a plain vacutainer tube (Ningbo MFLAB Medical Instruments co.ltd, china from the patient. The tube was labelled and a unique laboratory number was provided. In the laboratory, a blood sample was centrifuged at a speed of 3000rpm for ten minutes to obtain the serum. The serum was then transferred to cryovial tubes labelled with the subject's identification details and stored at -20℃ until analysis. Detection of Hepatitis B surface antigen was done by using the One Step HBsAg Rapid Test (SD bioline HBsAg WB) from Standard Diagnostics, Inc., Korea. The assay had the sensitivity and specificity of 99.8% and 100% respectively (13). All procedures and results interpretation were done following manufacturer instructions.

Data management and analysis: The collected data were entered into Microsoft Excel 2013, cleaned, coded, and subsequently transferred into STATA version 15.0 for analysis. Percentages were used to present categorical data while median (IQR) was employed for continuous data. Chi-square analysis was conducted to determine associations between HBV and independent variables with a p-value of <0.05 considered statistically significant.

Ethical considerations: The study obtained ethical clearance from the joint CUHAS-BMC Research Ethics and Review Committee (CREC) with clearance certificate reference number No. 2626/2023. Privacy of the data was maintained throughout the study and participants who tested positive for HBV were referred to a physician for further diagnosis and management.

RESULTS

Socio-demographic characteristics

A total of 177 participants with a median [IQR] age of 61 [IQR: 29-85] years were enrolled during this study. More than half of the study participants were male 51.4% (91/177) and the majority were married 82% (145/177). More than half attained primary education 58.8% (104/177) with the majority 96.6% (171/177) residing in the Lake Zone regions while more than one-third 36.7% (65/177) were farmers (Table 1).

Table 1: Socio-demographic characteristics of study participants

Variable	Category	Frequency	Percentage (%)
Median [IQR] Age in year		61 [29-85]	
Sex	Male	91	51.4
	Female	86	48.6
Marital status	Divorced	1	0.5
	Married	145	82
	Single	6	3.4
	Widowed	25	14.1
Education status	No education	7	4
	Primary	104	58.8
	Secondary	45	25.4
	University	21	11.8
Place of residence	Lake zone regions	171	96.6

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Variable	Category	Frequency	Percentage (%)
	Other regions	6	3.4
Occupation	Farmer	65	36.7
	Business	31	17.5
	Teacher	15	8.5
	Others	66	37.3

Prevalence of HBsAg among study participants and factors associated

A total of 4.5% (8/177) 95% CI [1.97 – 8.71] of patients tested positive for HBsAg rapid test among the 177 diabetic patients. Sharing of cutting equipment such as razor blades/ and nail cutters (p=0.022) was statistically significantly associated with HBsAg positivity among diabetic patients (table 2).

Table 2. Factors associated with HBsAg positivity among diabetic patients

VARIABLE	CATEGORY	HBsAg)		CHI SQUARE	
		Negative	Positive	Chi square	p-value
Sex	Female	83 (96.51)	3 (3.49)	0.4123	0.512
	Male	86 (94.51)	5 (5.49)		
Marital status	Married	139 (95.86)	6 (4.14)	0.270	0.603
	Single	30 (93.7)	2 (6.25)		
Education status	Primary education	106 (95.5)	5(4.5)	0.0002	0.999
	Secondary and Tertiary education	63(95.5)	3 (4.5)		
Place of residence	Lake zone region	163 (95.32)	8 (4.68)	0.2940	0.588
	Other regions	6 (100.00)	0 (0.00)		
Occupation	Farmer	61 (93.85)	4 (6.15)	11.3497	0.879
	Business	29 (93.55)	2 (6.45)		
	Teacher	15 (100.00)	0 (0.00)		
	Others	64 (97)	2 (3.0)		
Blood transfusion	No	81 (97.59)	2 (2.41)	1.6126	0.204
	Yes	88 (93.62)	6 (6.38)		
Intravenous drug use	No	125 (93.98)	8 (6.02)	2.7719	0.096
	Yes	44 (100.00)	0 (0.00)		
Intramuscular injection	No	26 (89.66)	3 (10.34)	2.7270	0.099
	Yes	143 (96.62)	8 (4.52)		
Sharp object injuries	No	94 (94.95)	5 (5.05)	0.1466	0.702
	Yes	75 (96.15)	3 (3.85)		
Organ transplant	No	157 (95.73)	7 (4.27)	0.3272	0.567
	Yes	12 (92.48)	1 (7.69)		
Surgery	No	92 (95.83)	4 (4.17)	0.0606	0.806
	Yes	77 (95.06)	4 (4.94)		
Contact with a person with hepatitis B	No	164 (95.91)	7 (4.09)	2.1234	0.145
	Yes	5 (83.33)	1 (16.67)		
Hemodialysis	No	152 (95.00)	8 (5.00)	0.8902	0.345
	Yes	17 (100.00)	0 (0.00)		
Unprotected sex	No	17 (100.00)	0 (0.00)	0.8902	0.345
	Yes	152 (95.00)	8 (5.00)		
	No	10 (100.00)	0 (0.00)	0.5017	0.479

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VARIABLE	CATEGORY	HBsAg)		CHI SQUARE	
		Negative	Positive	Chi square	p-value
Mouth-to-mouth kissing	Yes	159 (95.21)	8 (4.79)		
Drinking alcohol	No	99 (97.06)	3 (2.94)	1.3900	0.238
	Yes	70 (93.33)	5 (6.67)		
Sharing glucose monitoring equipment	No	151 (95.57)	7 (4.43)	0.0273	0.869
	Yes	18 (94.74)	1 (5.26)		
Sharing cutting equipment	No	151 (96.79)	5 (3.21)	5.2658	0.022
	Yes	18 (85.71)	3 (14.29)		
Sharing toothbrushes	No	162 (95.29)	8 (4.71)	0.3450	0.557
	Yes	7 (100.00)	0 (0.00)		
Manicure/pedicure cuts	No	121 (94.53)	7 (5.47)	0.9649	0.326
	Yes	48 (97.96)	1 (2.04)		
Scarification/tattoo	No	87 (96.67)	3 (3.33)	0.5973	0.440
	Yes	82 (94.25)	5 (5.75)		
Smoking	No	152 (95.00)	8 (5.00)	0.8902	0.345
	Yes	17 (100.00)	0 (0.00)		
Previously screened for hepatitis B	No	132 (95.65)	6 (4.35)	0.0429	0.836
	Yes	37 (94.87)	2 (5.13)		
Having bleeding disorder	No	158 (95.76)	7 (4.24)	0.4338	0.510
	Yes	11 (91.67)	1 (8.33)		

DISCUSSION

Hepatitis B infection is a significant global health concern, leading to chronic infection and increasing the risk of cirrhosis, hepatocellular carcinoma, and mortality (14). Diabetic patients face an elevated risk of hepatitis B due to their immunosuppressed state after acquiring the virus. This vulnerability is exacerbated by practices such as sharing blood glucose screening equipment and other cutting objects like razor blades (8).

In this study, the prevalence of HBsAg among diabetic patients was found to be 4.5%, which is comparable to that of the general population and falls within the intermediate endemicity category as per WHO classification. This observed prevalence is higher than that reported in a previous study in Congo, where a prevalence of 3.4% was recorded among diabetic patients (15). The difference could be attributed to a higher rate of HBV infection in our setting which increases the risk of exposure among diabetic patients (16). However, the prevalence obtained in our study is lower compared to reports from Nigeria and China, which documented prevalences of 13.3% and 13.5%, respectively (8, 17). This disparity may be influenced by differences in geographical location and the endemicity of the hepatitis B virus. Both Nigeria and China are classified as having high endemicity according to WHO guidelines (18, 19).

These findings indicate that the prevalence of HBsAg among diabetic patients attending BMC suggests an intermediate endemicity level according to WHO criteria (20, 21). The significant association between HBsAg positivity and the sharing of cutting equipment such as razor blades and nail cutters aligns with findings from previous studies among diabetics in China and Nigeria (8, 17). These studies have highlighted the role of such practices in increasing the risk of hepatitis B transmission among diabetic populations. Also, this difference may be attributed to the widespread practice among diabetic patients sharing equipment such as glucose screening devices and razor blades, often due to

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inadequate awareness and understanding of hepatitis B transmission routes. This contrasts with findings from a study in Congo, where none of the factors were associated with HBsAg positivity, likely because those factors were not included in the previous study's analysis (15).

CONCLUSION

In this study, we report an intermediate endemicity of HBsAg among diabetic patients attending BMC in Mwanza. A significant association was found between Hepatitis B virus infection and sharing of cutting equipment. The findings underline the importance of screening all diabetic patients for HBV infection to effectively manage its burden. Targeted health education programs are crucial for diabetics who are at risk of HBV infection. Also, integrating education on HBV transmission into diabetes management protocols is essential to prevent new infections. Furthermore, Further studies with larger sample sizes in this setting are recommended to provide a more comprehensive understanding of the burden of hepatitis B virus infection among diabetic patients.

Limitation of the study: The results from this study cannot be generalized to the general population due to the small sample size. The study did not include other potential risks such as glycemic control, duration of diabetes, and history of hospitalization.

LIST OF ABBREVIATIONS

BMC	Bugando Medical Center
CUHAS	Catholic University of Health and Allied Sciences
HBV	Hepatitis B virus
HBcAg	Hepatitis B core antigen
HBeAg	Hepatitis B envelope antigen
HBsAg	Hepatitis B surface antigen
HBsAb	Hepatitis B surface antibody
DNA	Deoxyribo-Nucleic Acid
DM	Diabetes Mellitus
GTT	Gamma-glutamyl transferase
Ig	Immunoglobulin
WHO	World Health Organization

Declaration

Consent for publication: Not applicable

Availability of data: All data have been included in the manual script.

Competing interest: The author declares that there is no competing interest.

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Author's Contribution:

BM, MMM, and RM conceived the idea, BM, HM, RM, MM and SO participated in data collection, specimen transportation, and laboratory analysis of the samples. BM and RM did data interpretation and analysis. BM wrote the first draft of the manuscript. SEM, MMM, HM, and HN did a critical review of the manuscript. All authors approved the final version of the manuscript.

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