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Seroprevalence of Hepatitis B and C Viruses amongst Type 2 Diabetic Patients in Dutse, Jigawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors BH, MSB, DSU, AMB and IS conceived, initiated and designed the study, drafted and wrote the manuscript and recruited the study participants. Authors JNO, BRJ and MAS conducted the laboratory analysis. Author DSU performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Viral hepatitis is a liver disease with numerous etiologies. Hepatitis B and C virus infections and co infections are pandemics that constitute a major public health challenge in Nigeria. Diabetes mellitus is sought to be a risk factor for HBsAg and HCV coexistence. The study was aimed at estimating the seroprevalence of HBsAg and HCV viruses amongst type 2 diabetic patients in Dutse Jigawa State, Nigeria.
Methods: The study was randomized and cross sectional conducted amongst type 2 diabetics. A total of 192 consecutive type 2 diabetes mellitus patients attending the endocrine clinic and 120 age and sex matched apparently healthy volunteers who consented to participate in the study were recruited. All the participants were screened for HBsAg and HCV using immunochromatographic test kits and confirmed by ELISA technique for seropositive cases.
Results: Prevalence rates of HBsAg was equal 9(4.68%) for the type 2 diabetics and controls while that of Anti-HCV was 3(1.56%) and 1(0.52%) in the type 2 diabetics and controls ($p \leq 0.05$) respectively. Co infection was recorded in the control subjects but not in the diabetes group.
Conclusion: There is a statistical significant association between HCV and type 2 diabetes mellitus with the seropositivity of HCV 3.0 times higher in type 2 diabetic patients compared to healthy controls.

Keywords: Diabetes mellitus; hepatitis B; hepatitis C; prevalence; Jigawa; Nigeria.

1. INTRODUCTION

Hepatotropic viruses are known to be implicated in the pathogenesis of Type 1 diabetes [1] mainly because patients suffering from Type 1 diabetes are more likely to incur high risk of infection as a result of frequent hospitalisation and blood tests [2]. The exact mechanism involved in the pathophysiology of hepatitis B and C viruses' infections with diabetes mellitus remains controversial although insulin resistance has been reported to play an important role [3].

The main site of glucose synthesis is the liver and the connection between liver dysfunction and diabetes mellitus has been long recognised and HCV infection has been linked to insulin injection, frequent hospitalisation and needle exposure in patients with diabetes mellitus [4]. Abnormalities in glucose metabolism have also been reported to be more prevalent in patients with chronic liver diseases [5] with increased liver morbidity and mortality risk in patients with HBV-cirrhosis linked to the presence of diabetes mellitus and poor diabetic control [6].

Liver inflammation and degeneration during hepatitis alter glucose metabolism and inflammatory mediators, such as tumor necrosis factor and nitric oxide, cause insulin dysfunction in the liver, as well as insulin resistance [7] this is due to the fact that increased levels of tumour necrosis factor suppress tyrosine phosphorylation in insulin receptors and cause insulin resistance. The replication of HBV in pancreatic cells also aggravates insulin dysfunction [8].

Several studies have independently associated Type 2 diabetes mellitus with the increased risk of hepatocellular carcinoma in HCV and Chronic Hepatitis B infected patients [9-12], but it is not clear whether HBV infection is related with the development of diabetes or not [13,14].

Diabetes mellitus has also been recognised as an additional metabolic complication of HBV and HCV infection in some studies while [15,16] have reported no significant correlation between HBV and diabetes.

A well-documented, yet under-acknowledged risk associated with blood glucose monitoring is the transmission of blood borne viral pathogens such as HBsAg [17] and chronic hepatitis B virus infection has been found to be associated with increased impaired fasting glucose among Nigerians [18].

Several studies have reported either high or low seropositive rates of HBsAg and anti-HCV amongst T2DM patients ranging from 13.54% and 6.83%, respectively in Taiwan [4], to 13.7% for HCV infection in Pakistan [3], Ethiopia reported a prevalence rate of 3.7% for HBsAg [15] and 9.3% for HCV in northeastern Nigeria [19].

The study was aimed at estimating the seroprevalence of HBsAg and HCV viruses amongst type 2 diabetic patients at Dutse Jigawa State, Nigeria.

The increasing incidence of diabetes and potential danger associated with HBsAg and HCV comorbidity as well as the dearth of literature on the prevalence of hepatitis B and C viruses amongst type 2 diabetic patients in this region necessitated this study.

2. METHODS

2.1 Study Area

The study was conducted at Rasheed Shekoni Specialist Hospital (RSSH) Dutse, Jigawa State. Jigawa State has a total area of 23,154 km^2 and an estimated population of 4,988,888 (2005 population census). RSSH is a Tertiary Care hospital located at Dutse, the capital of Jigawa state, Nigeria.

2.2 Study Design and Population

One hundred and ninety-two type 2 diabetic patients attending the endocrinology clinic of Rasheed Shekoni Specialist Hospital, Jigawa North-western Nigeria were recruited in a cross-sectional pattern while one hundred and twenty apparently healthy volunteers enrolled served as the control group. Informed consent was obtained from all enrollees and relevant information was obtained using a standard interviewer based questionnaire.

2.3 Laboratory Procedures

Blood sample was obtained via venipuncture using sterile needles and syringes and samples were collected using appropriate sample bottles and transferred to the laboratory for analysis. The sera was placed in fresh sample bottles after spinning and kept at -20°C prior to use. Serological analysis for the detection of HBsAg and HCV viruses were carried out using rapid immunochromatographic kits Micropoint Inc. (Shenzhen, China) and LabAcon Inc. (Hangzhou China) respectively. Positive cases were later confirmed using third generation Enzyme Linked Immunosorbent Assay kit (Cusabio, Wuhan Hubei, China) for the qualitative detection of HBsAg and anti-HCV antibodies.

2.4 Statistical Analysis

Data were analysed using the statistical package for social sciences (SPSS) program version 20.0 (SPSS Inc. UK 2017) and expressed as mean ± SD or number and percentages. Comparisons between groups were made using Student's t test for continuous variables and Pearson's Chi-square test was used to determine the difference among various categories with respect to HBsAg and HCV seropositivity. The p value of <0.05 was noted to be of statistical significance.

3. RESULTS

A total of 312 participants were recruited for this study, of which 192(61.5%) participants were type 2 diabetic patients and 120 (38.5%) were non diabetic healthy controls. Sex, age, ALT, AST, ALP, HBsAg, and Anti-HCV were compared between type 2 diabetics and the non-diabetic controls (Table 1). Mean age of diabetes and control groups were 40.9 and 31.3 respectively. Equal number of subjects tested positive to HBsAg 9(4.68%) for both groups interpreted as no significant positive difference in the prevalence of HBsAg in type 2 diabetic patients and controls (odds Ratio (OR) = 1.00; 95% CI: 0.2444-4.1; p=1.00).

There were 3 (1.56%) and 1(0.52%) positive tests for Anti-HCV among the type 2 diabetic patients and controls respectively. This shows there is a significant positive difference in the prevalence of Anti-HCV in type 2 diabetes compared to non-DM controls. The mean ALT for the diabetes and control group was 28.3 and 24.4 respectively (p=0.053). The mean AST and ALP for diabetes and control group was 32.4 and 18.3, and 160.5 and 201.8 respectively (p=0.000).

4. DISCUSSION

Besides the macro vascular and micro vascular complications in DM, a compromised immune state is also a condition that increases the susceptibility of diabetic patients to different infections [20]. Some other causes such as prolonged duration of diabetes mellitus, appropriate glycemic control, male sex and advanced age are known to increase the risk of having HCV infection significantly.

In this study, no significant difference was observed in the seropositivity of HBsAg between type 2 DM and control subjects (4.8% versus

4.8%). This is in line with the study of Onyekwere et al. [21] at Lagos, Nigeria, Mekonnen et al. [15] at Ethiopia and Chen et al. [12] at Taiwan.

However, the rate of seropositivity to HCV was 3.0 times higher in the type 2 DM patients than non-DM control subjects in this study (1.56% versus 0.52%). This is in concordance with the study of Nwokediuko and Oli, [22] at Enugu, South-eastern Nigeria which reported a 3.8 times increase in HCV among T2DM patients compared to controls (14.1% versus 3.7%) and Chen et al. [12] in Taiwan, which recorded 2.8 times higher prevalence of HCV in type 2 DM patients compared to non-DM controls (6.8% versus 2.6%).

Olokoba et al. [23] also reported a positive correlation between HCV infection and diabetes mellitus at Yola (9.3% versus 2.4%). on the contrary, Adegoke et al. [24] and Balogun et al. [25] found low prevalence of HCV among T2DM subjects at the south west region of Nigeria.

Table 1. Distribution of variables across groups

Variables		DM	Control	P-value
Age(mean)		40.9±4.0	31.3±5.0	0.001
Age(years)	<30	0(0%)	2(1.66%)	-
	30-39	15(7.9%)	20(16.6%)	-
	40-49	39(19.0%)	35(29.2%)	-
	50-59	60(31.7%)	38(31.6%)	-
	≥60	78(41.4%)	25(20.9%)	-
Sex	Male	83(43.2%)	77(64.2%)	0.000
	Female	108(56.8%)	43(35.8%)	
HBsAg	Positive	9(4.68%)	9(4.68%)	1.000
	Negative	183(95.32%)	183(95.32%)	
Anti-HCV	Positive	3(1.56%)	1(0.52%)	0.000
	Negative	189(98.44%)	191(99.48%)	
ALT (IU/L)		28.3±21.5	24.4±6.3	0.053
AST(IU/L)		32.4±21.3	18.3±7.9	0.000
ALP(IU/L)		160.5±72.5	201.8±64.6	0.000

Key: AST: Aspartate transaminase, ALT: Alanine transaminase, ALP: Alkaline Phosphatase, HBsAg: Hepatitis B surface antigen, Anti HCV: Anti-Hepatitis C virus, DM: Diabetes Mellitus. (n): percentage

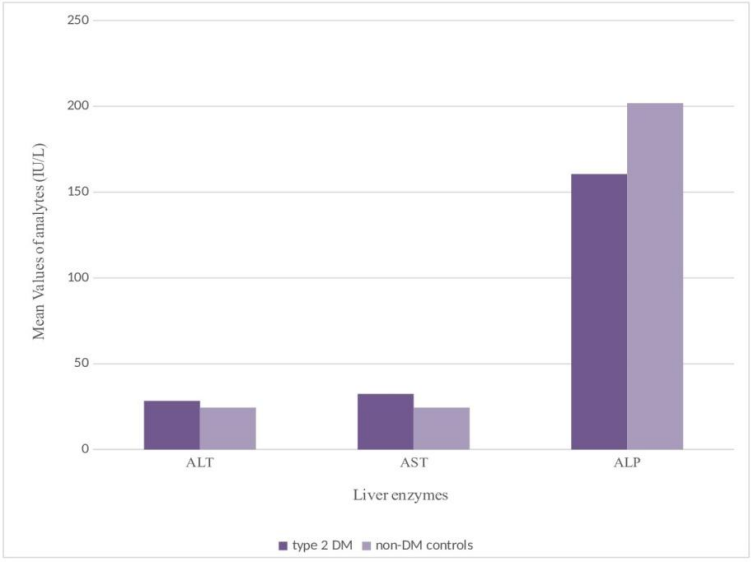

Fig. 1. Bar chart showing liver enzymes pattern in type 2 DM and non-DM control subjects
Key: AST- Aspartate transaminase, ALT- Alanine transaminase, ALP-Alkaline phosphatase

AST and ALT levels were significantly higher in the diabetic subjects compared to the non-DM controls although within normal reference limits. This is chiefly because ALT is a more specific indicator of liver inflammation as reported by some studies [26,27] and AST elevation may be attributed to diseases affecting other organs the liver inclusive. ALP levels were decreased in the diabetic patients compared to controls even though increased ALP levels have been regarded as a better diagnostic marker for hepatitis due to the integral role ALP plays in metabolism within the liver considering the multifactorial nature of type 2 diabetes mellitus.

The strength of this study lies in its content and concept while the limitations may include the small sample size which may not give a basis for generalisation of the findings in type 2 diabetes and the use of only microparticle enzyme immunoassay test to find the presence of HCV infection in the absence of HCV RNA and additional recombinant immunoblot assay, which might have resulted in some false-positive HCV results. There were no liver biopsies performed for the type 2 diabetic patients infected with hepatitis, therefore the exact pathologic grade and staging of chronic hepatitis was not done.

The future direction on this research should perhaps focus on multi center studies with larger sample size to determine the influence of hepatotropic virus on liver enzymes of type 1 DM patients because they are more prone to needle exposure during monitoring and assessment of β cell function in order to determine the influence of insulin on the comorbidity.

5. CONCLUSION

The findings of this study showed there is a high prevalence of HCV amongst type 2 DM patients. However, the same cannot be established for HBsAg amongst type 2 diabetes mellitus patients. Screening type 2 diabetic patients for hepatitis and liver function is of paramount importance as it may give relevant clinical information that will aid the proper management and treatment of such chronic conditions simultaneously.

WHAT IS ALREADY KNOWN ABOUT THE TOPIC

- Hepatitis B and C viruses are involved in the pathogenesis of type 1 diabetes but controversial findings exist on the exact mechanism involved in type 2 diabetes mellitus.
- There is an interconnection between diabetes mellitus and liver disorders and infections.
- A link exists between blood glucose monitoring and transmission of blood borne viral pathogens such as HBV and HCV.

WHAT THE STUDY ADDS TO KNOWLEDGE

- Appropriately controlled diabetes mellitus might be one extrahepatic manifestation of Hepatitis C considering its increased seroprevalence in type 2 diabetes mellitus.
- Elevated serum transaminases even within normal reference limits are associated with liver viral infections in type 2 diabetes mellitus.
- There is a strong association between Hepatits C and type 2 diabetes mellitus.

CONSENT

Informed consent was obtained from all enrollees and relevant information was obtained using a standard interviewer based questionnaire.

ETHICAL APPROVAL

Ethical clearance for the study was obtained from the Ethics Review Committee of Rasheed Shekoni Specialist Hospital Jigawa State.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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