valuation of liver Aminotransferase Among Type 2 Diabetic Patients Attending Gharyan Central Hospital

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ABSTRACT

Diabetes mellitus is a growing global health concern, characterized by chronic hyperglycemia, resulting from defective insulin action and secretion, T2DM is frequently associated with abnormalities in the liver function, which may reflect underlying metabolic disturbances and early hepatic involvement. This study aimed to evaluate the levels of liver aminotransferase (ALT, AST) and ALP in patients with type 2 diabetes in Gharyan central hospital. The finding showed that patients with T2DM had elevated liver enzyme levels, (ALT, AST and ALP were 19%, 15%, 41% respectively), suggesting possible subclinical liver dysfunction. These results highlight the importance of routine liver enzyme assessment in the clinical follow-up of individuals with T2DM, as early detection of hepatic abnormalities may improve patient management and reduce the risk of diabetes- related complications.

الملخص:

لسكرى النوع التانى مشكلة صحية متنامية, يتميز بإرتفاع مزمن فى نسبة السكرفى الدم, ناتج عن خلل فى عمل الانسولين وإفرازه. يرتبط هذا النوع من السكرى غالبا بإضطرابات أيضية وإصابة كبدية مبكرة. هدفت هذه الدراسة إلى تقييم مستويات ناقلات الأمين الكبدى (ALT, AST, ALP) لدى مرضى السكرى من النوع التانى فى مستشفى غريان المركزى. أظهرت النتائج أن مرضى السكرى من النوع التانى لديهم مستويات مرتفعة من (ALT, AST and ALP) وكانت 19%, 15%و 41% على التوالى, مما يشير الى إحتمال وجود خلل وظيفى كبدى. تبرز هذه النتائج أهمية التقييم الروتينى لإنزيمات الكبد فى المتابعة السريرية للأفراد المصابين بالسكرى من النوع التانى، حيث أن الكشف المبكرعن إضطرابات الكبدية قد يسهم فى تحسين إدارة المرض وتقليل خطر المضاعفات المرتبطة بالسكرى

Introduction:

Diabetes mellitus, particularly type 2 diabetes mellitus (T2DM), is a major global health concern with a steadily increasing prevalence due to factors such as aging, obesity, and sedentary lifestyles. As a multifactorial disease,

T2DM is influenced by both genetic and environmental factors, making its prevention and management a significant public health challenge (Atlas, 2015; Penman et al., 2022).

Type 2 diabetes mellitus is characterized by impaired insulin secretion and reduced insulin sensitivity, leading to chronic hyperglycemia and a wide range of complications that adversely affect quality of life (Hall & Hall, 2020). Early diagnosis through fasting blood glucose testing, glycated hemoglobin (HbA1c) measurement, and oral glucose tolerance testing is essential for effective disease management. Lifestyle modifications, including a balanced diet, regular physical activity, and weight control, remain the cornerstone of prevention and treatment (Kumar & Clark, 2013; WHO, 2020).

According to the International Diabetes Federation (IDF), the prevalence of T2DM has increased dramatically over recent decades. In 2021, approximately 537 million adults aged 20–79 years were living with diabetes worldwide, and this number is projected to rise to 643 million by 2030. In Libya, approximately 9% of adults are affected by diabetes, representing nearly 399,200 individuals. Furthermore, an estimated 50% of individuals with T2DM remain undiagnosed. According to the World Health Organization (WHO) and IDF, the prevalence of diabetes in Libya was reported to be 13.7% in 2016 (WHO, 2020; IDF, 2021).

The liver plays a central role in carbohydrate, lipid, and protein metabolism and is highly responsive to insulin. Consequently, it is closely involved in the pathogenesis of T2DM and non-alcoholic fatty liver disease (NAFLD) (McIntyre, 2008). Poorly controlled diabetes, chronic hyperinsulinemia, insulin resistance, and metabolic syndrome can trigger a series of metabolic disturbances that promote hepatic lipogenesis, oxidative stress, mitochondrial dysfunction, and chronic inflammation. These processes contribute to fat accumulation within hepatocytes and subsequent liver injury, resulting in steatosis or steatohepatitis, conditions commonly associated with T2DM (Kamps, 2017; Rubino et al., 2023).

Damage to hepatocytes disrupts cellular membrane integrity, leading to the release of intracellular liver enzymes such as alanine aminotransferase (ALT) and aspartate aminotransferase (AST) into the bloodstream. Elevated serum levels of these enzymes are commonly observed in individuals with T2DM and NAFLD. Furthermore, elevated ALT and AST levels have been identified as independent predictors of the development and progression of T2DM, even

in the absence of overt fatty liver disease, indicating a complex relationship between diabetes and liver function (Uslusoy et al., 2009).

Several studies have demonstrated that T2DM is associated with a spectrum of aminotransferase abnormalities that are collectively linked to NAFLD. Therefore, the present study aimed to evaluate serum levels of ALT, AST, and ALP among patients with T2DM attending Gharyan Central Hospital. In addition, demographic and clinical factors including age, gender, body mass index (BMI), and disease duration were investigated.

Materials & methods:

Study population: This comparative cross-sectional case-control study was conducted at Gharyan Central Hospital between January and June 2025. A total of 150 participants were enrolled, comprising 100 patients diagnosed with T2DM (case group) and 50 apparently healthy individuals (control group).

Inclusion and exclusion criteria: Patients with a confirmed diagnosis of T2DM were eligible for inclusion in the study. Participants were excluded if they had a history of liver disease, pregnancy, recent surgery, alcohol consumption, genetic disorders, infectious diseases, or evidence of hepatotoxic drug use.

Data collection and blood sampling: Data were collected using a structured questionnaire and subsequently entered into Microsoft Excel for analysis. Demographic information included age, gender, and BMI. Venous blood samples were collected under aseptic conditions into heparinized tubes. Samples were centrifuged at 3500 rpm for 10 minutes at room temperature. All procedures were performed according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Serum levels of ALT, AST, ALP, fasting blood sugar (FBS), and HbA1c were measured using an automated biochemistry analyzer (Selectra Pro M).

Ethical permission: Ethical approval was obtained from the appropriate authorities before the start of the study. Written informed consent was obtained from all participants prior to sample collection and all questionnaires were completed through direct interviews.

Data analysis: The study used the Statistical Package for the Social Sciences (SPSS) version 20 for coding, data entry, and statistical analysis. Descriptive statistics were computed to illustrate the characteristics of the study population. The data were summarized as frequencies, percentages, and figures to compare quantitative data between two

independent groups; the t-test analysis was employed. In all tests, a p-value less than 0.05 was considered significant.

Results:

A total of 150 participants aged 30–75 years were included in this study, comprising 100 patients with type 2 diabetes mellitus (T2DM) and 50 healthy controls. Among all participants, 96 (64%) were female and 54 (36%) were male. The majority of diabetic patients were within the age group of 55–75 years, whereas most non-diabetic participants were between 35 and 45 years of age.

Regarding body mass index (BMI), 33% of participants were classified as obese, 27% as overweight, and 36% had a normal BMI. More than half of the diabetic patients (56%) had developed either microvascular or macrovascular complications.

Table (1) Comparison of blood parameters of non-diabetics and diabetic groups.

Blood parameter	Type	N	Mean	Std Deviation	St. Error	P- value
FBS	Non diabetic	50	97.12	20.87	2.95	0.000
	Diabetic	100	156.81	49.73	4.97	
HbA1c	Non diabetic	50	7.77	14.33	2.03	0.87
	Diabetic	100	7.99	1.55	0.155	
BMI	Non diabetic	50	26.69	4.19	0.59	0.024
	Diabetic	100	32.78	25.89	2.59	
ALT	Non diabetic	50	14.78	5.46	o.77	0.000
	Diabetic	100	28.41	21.41	2.14	
AST	Non diabetic	50	16.18	4.93	0.69	0.001
	Diabetic	100	24.33	16.22	1.62	
ALP	Non diabetic	50	100.5	30.24	4.27	0.000
	Diabetic	100	126.5	43.28	4.33	

Table(2) shows the activity and percentage of liver aminotransferase among diabetic and non-diabetic groups, ALT was elevated in 19% of diabetic patients, whereas AST was elevated in 15%, and about 41% had elevated ALP, Figure (1).

Table(2) Frequency and Percentage of liver aminotransferase among diabetic and non-diabetic groups.

Enzymes	Diabetic	Non-diabetic
ALT Normal(5-40)	78%	100%
High > 40	19%	0%
AST Normal(5-38)	84%	100%
High >38	15%	0%
ALP Normal(30-129)	58%	44%
High >129	41%	6%

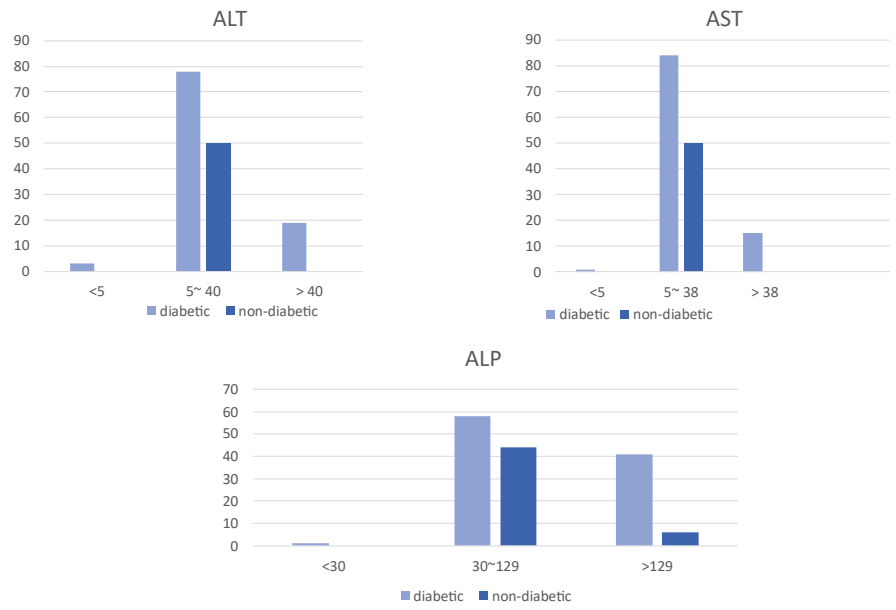
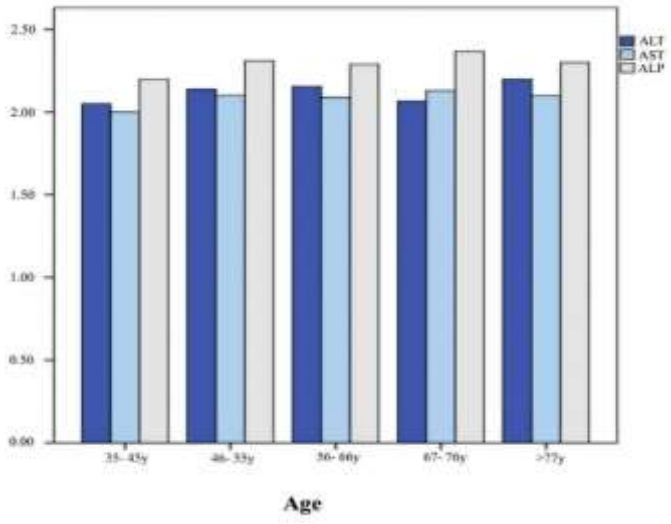


Figure (1): Frequency & percentage of liver enzymes (ALT, AST, ALP).

Liver aminotransferases (both ALT and AST) were found to be statistically significant between the early diabetic population (age ≤50 years) and the prolonged diabetic population (age >50 years). A significantly higher prevalence

was observed among female patients compared to their male counterparts with diabetes (Table 3). Regarding the age-related pattern of enzyme elevations, it was observed that ALP showed the highest increase across all age groups, followed by ALT. In most age categories, ALT levels were higher than AST. However, in the age group 67–76 years, AST was higher than ALT, which differs from the pattern seen in the other age groups (Figure 2).



Figure(2): Enzyme according to age.

Table (3): Frequency and percentage of enzymes according to gender.

Enzyme	Male 39%	Female 61%	All patients
ALT (5-40)	33 (84.62%)	48 (78.69%)	81 (81%)
>40	6 (15.38)	13 (21.31%)	19 (19%)
AST (5-38)	34 (87.18%)	51 (83.61%)	85 (85%)
>38	5 (12.82%)	10 (16.39%)	15 (15%)
ALP (30-129)	24 (61.54%)	35 (57.38%)	59 (59%)
>129	15 (38.46%)	26 (42.62%)	41 (41%)

Discussion:

Elevated levels of liver aminotransferases, even within the reference range, are frequently observed among patients with type 2 diabetes, reflecting a close link between metabolic disturbance and liver dysfunction. Hepatic fat accumulations one of the well-known complications of type 2 diabetes, with a reported frequency of 40–70% (Rogha *et al.*, 2011). If fat accumulation in the hepatocytes is accompanied by excess inflammation and

steatonecrosis, it should be considered a cause of chronically increased liver enzymes in asymptomatic diabetic patients (Chandrashekhar, 2018). Understanding the impact of elevated aminotransferases in this population can provide insights into disease progression and guide better management strategies to prevent further complications. The present study evaluated liver function abnormalities among patients with T2DM by measuring serum levels of ALT, AST, and ALP. The study population was predominantly female, accounting for 64% of participants, while males represented 36%. The leading age group in the study was 55-75 years, whereas non-diabetics mostly fell within the 35-45 years range. Regarding weight status, 33% were obese, 27% overweight, and 36% had a normal weight. The prevalence of elevated liver aminotransferases (ALT and AST) is poorly documented among diabetic patients in Gharyan. However, in Western countries, these elevations are common and are associated with diabetes, obesity, and dyslipidemia (Trombetta *et al.*, 2005). According to this study, serum levels of ALT, AST, and ALP were significantly increased in diabetic patients when compared to controls. The levels of ALT, AST, and ALP were elevated by 19%. 15%, and 41%, respectively, which is slightly comparable to a survey conducted in Ambo, Ethiopia, by (Tessema, 2021), which reported 26.4%, and in Malaysia, at 27.3%, by (Thambiah *et al.*2019). This finding was higher than the results of studies in Algeria at 8.7% (Gouri *et al.*, 2013), Saudi Arabia at 9.3% (Almansour *et al.,* 2024), and Sudan at 12% (Idris *et al.*, 2011). The results we observed align with a study from India, which was 19.8% (Mathur *et al.*, 2016), and in Malaysia, at 13%, by (Thambiah *et al.,*2019). However, the prevalence of elevated aminotransferases was lower than in Northwest Ethiopia at 40.1% (Shibabaw *et al.*, 2019), Iraq at 43.3% (Azeez & Saadi, 2019). Both aminotransferase (ALT, AST) showed a significant association with increase in BMI, this finding aligns with a study conducted by (Alzahrani *et al.* 2019) in Jeddah and Nepal at 17% by (Mandal *et al.,* 2018). In this study, the mean values of ALT, AST, and ALP in T2DM were 28.41±21.41 (p-value = 0.000), 24.33±16.22 (p-value = 0.001), and 126.50±43.28 (p-value = 0.000), respectively, and they were significantly higher than those in non-diabetic healthy subjects. These findings are consistent with the results of (Ghimire *et al.* 2012), (Mathur *et al.* 2016), and (Salman *et al.* 2020).

Conclusion:

This study demonstrated a significant increase in serum liver enzyme levels, including ALT, AST, and ALP, among patients with type 2 diabetes mellitus compared with healthy controls. Elevated liver enzymes were common among

diabetic patients and may indicate the presence of underlying hepatic dysfunction or early liver involvement associated with metabolic abnormalities.

Routine monitoring of liver enzymes in patients with T2DM may facilitate the early identification of hepatic abnormalities, allowing timely intervention and improved disease management. Early detection of liver dysfunction may also help reduce the risk of progression to more severe liver disease and other diabetes-related complications.

Further large-scale studies are recommended to clarify the causal relationship between T2DM and liver enzyme abnormalities and to support the development of integrated screening and management strategies for diabetic patients.

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