

Comparative Study of Abnormal Renal Function Tests and Liverfunction Tests in Type1 and Type2 Diabetes Mellitus in Iraq

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Abstract: This study was planned to evaluate the renal function tests and liver function tests and it carried out in Al-Yarmouk hospital, Baghdad –Iraqin patients with type 1 and type 2 diabetes mellitus by measuring (uric acid, urea and creatinine), Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT). Seventy five individuals of Iraqi adults (male) were divided into three groups, 25 patients with type 1 diabetes mellitus, 25 patients with type 2 diabetes mellitus and 25 normal individuals were taken as control group. The mean value of uric acid, urea and creatinine was higher significantly in patients than in control group ($P < 0.05$), while the correlation ($p < 0.01$) between age, creatinine in type 1 and between age and (Urea, Uric acid, creatinine) in type 2 was positive. Our results appear a high significant levels of liver enzymes (AST and ALT) for two types of diabetes mellitus compared with control (healthy group). There were no significant differences between type 1 and type 2.

Keywords: Liver function tests, Diabetes mellitus, Renal function tests, Aminotransferase, kidney dysfunction.

I. Introduction

Diabetes mellitus (DM) is a group of metabolic disturbance characterized by chronic hyperglycemia due to defect in carbohydrate, fat and protein metabolism that are associated with relative deficiencies in insulin secretion, insulin action or both [1]. Blood sugar enters cells by effect of insulin, which is a hormone produced by the B-cells of the pancreas. Factors that contribute to high glucose level include reduced insulin secretion, decreased blood sugar usage by the body or elevated glucose production [2]. The chronic high glucose level of diabetes is related with long-term damage dysfunction and failure of various organs, especially the kidneys, heart, nerves, eyes and blood vessels [3]. There exists a correlation between diabetes mellitus and liver damage. The liver plays a main role of the regulation of carbohydrate metabolism, hepatocellular glycogen accumulation leads to hepatomegaly and liver enzyme abnormalities in poorly planned diabetes patients [4]. Liver function tests (LFTs) are usually used in the clinical practice screen for liver disease, the tests include the serum aminotransferases, bilirubin, alkaline phosphatase albumin and prothrombin time. Aminotransferases such as Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) are measure the concentration of intracellular hepatocellular enzyme that have leaked into the circulation and serve as a marker of hepatocellular injury [5]. In patients with type 2 diabetes have a higher risks of liver function test abnormalities than subjects who do not have diabetes, increase of transaminase with three times the upper limits of normal value is not a contraindication for starting oral anti-diabetic or lipid modifying medication. In contrast, anti-diabetic agents have been shown to decrease alanine aminotransferase levels as tighter blood glucose levels are attained [6]. Chronic mild elevations of AST and ALT are seen in type 2 diabetes patients. In United States, Erbey *et al.* [7] were studied the increased level of ALT enzyme among type 2 diabetes was about 7.8% compared with 3.8% in those without diabetes. The metabolic disease have been seen with many diseases such as endothelial dysfunction, kidney disease and oxidative stress [8]. Hyperuricemia can cause serious health problem including renal insufficiency and it is associated with many disease such as high blood pressure, hypertriglyceride, diabetes mellitus and obesity [9]. Patients with severe but more prolonged forms of high uric acid levels are predisposed to a more chronic tubulointerstitial disorder, often indicate to as gouty nephropathy [10]. Blood urea nitrogen (BUN) is another marker of kidneys can prolong function, no toxins or waste products can be eliminated from the body and causing highly toxic [11]. Plasma creatinine and urea are established markers of Glomerular filtration rate (GFR), While the lower serum creatinine is associated with high risk of type 2 diabetes, which might reflect a lower volume of skeletal muscle [12]. Skeletal muscle is a major target tissue of insulin and a lower volume of it would mean fewer target sites for insulin which causes elevated insulin resistance and leads to the progression of type 2 diabetes [13].

II. Materials And Methods

This study was carried out in the National center for the treatment of diabetes (Al-Yarmouk hospital) in Baghdad – Iraq. Seventy five males patients were divided into three groups, each group include 25 persons as

follows: Group (1), patients of type1 their age range (10-50) year, group (2), patients of type 2 their age range (33-65) year and Group (3) was a control group (health people) their age range (20-20) year. All of the subjects were having blood to measure serum liver enzyme tests Aspartate aminotransferase(AST), Alanine aminotransferase (ALT) and serum renal function tests (Uric acid, Urea and creatinine) levels. From each person, 5ml of blood sample was collected from vein puncture by using a disposable plastic syringe. The blood was poured in a plane container and then centrifuged after clotted at 3000 rpm for 10 min to obtain serum sample. The separated serum samples were analyzed for renal function tests (uric acid, urea and creatinine). Uric acid was determined by the uricase peroxidase method, urea by urease hypochlorite method and creatinine by the alkaline picrate method. Serum samples were also analyzed for liver enzyme tests (AST, ALT) by using colorimetric method [14,15].

Statistical Analysis

The results were analyzed statistically using SPSS- 21. Data were analysis of variance (ANOVA). Correlation between parameters were assessed using bivariate correlation $P < 0.01$, $P < 0.05$ were considered statistically significant [16].

III. Results And Discussion

1. Renal Function Tests

• **The Comparison between levels of uric acid ,urea ,creatinine and type1 and type2 of diabetes mellitus**

The table (1) showed the significant differences ($p < 0.05$) between levels of uric acid, creatinine and the two types of diabetes mellitus compared with control (healthy group). The mean value of uric acid was reached to (5.62 ± 0.61) mg/dl in type 2 compared with the mean value of control group (3.53 ± 0.2) mg/dl. The results presented an evidence that mean value of urea in type1 and type2 were $(31.66 \pm 5.34, 33.40 \pm 9.25)$ mg/dl respectively compared with the mean value of control (24.70 ± 4.56) mg/dl. On the other hands, there is a significant differences ($P < 0.05$) in the mean value of creatinine level between two types of diabetes mellitus and control group, the mean value was reached to (0.98 ± 0.20) mg/dl in the type1 and (0.96 ± 0.24) mg/dl in the type2 compared with the mean value of control (0.71 ± 0.14) mg/dl. Our results indicate that no significant differences between the mean value of uric acid ,urea ,creatinine and type1, type2 of diabetes mellitus.

Table (1): Comparison between Urea, Uric Acid and Creatinine levels in two Types of diabetes Mellitus

Parameters	Age	Mean \pm standard deviation			*P-value
Groups		Urea mg / dl	Uric acid mg/ dl	Creatinine mg/dl	
Control	20 – 60	24.70 ± 4.56	3.53 ± 0.20	0.71 ± 0.14	< 0.05
Type1	10 – 50	31.66 ± 5.34	4.16 ± 0.60	0.98 ± 0.20	< 0.05
Type2	33 – 65	33.40 ± 5.25	5.62 ± 0.61	0.96 ± 0.24	< 0.05

• **The correlation between urea, uric acid, creatinine and Age in diabetes mellitus type1**

The results in table (2) indicate, there is a strong correlation between creatinine and urea in type 1 ($r = 0.723^*$, $P < 0.01$) and with uric acid ($r = 0.710^{**}$, $P < 0.01$). As shown in the same table, there is a positive correlation between uric acid and urea ($r = 0.598^{**}$, $P < 0.01$). The results indicate that no correlation between age with levels of urea and uric acid.

Table(2): The correlation between Levels of Uric acid, Urea, Creatinine and age of Patients in Type1

Parameters	Correlation	Significant
Uric acid, creatinine	0.710	**
Creatinine urea	0.723	**
Uric acid, urea	0.598	**
Creatinine, age	0.537	**
Uric acid, age	0.073	N.S
Urea, age	0.311	N.S
No significant (N.S) , $P < 0.01$ **, ($P < 0.05$)*		

• **The correlation between uric acid urea, creatinine levels and Age in diabetic patients type2**

The statistical results in table (3) show the positive correlation between creatinine and urea ($r = 0.869^{**}$, $P < 0.01$) and there was a significant positive correlation between uric acid and urea levels ($r = 0.750^{**}$, $P < 0.01$). As shown at the same table, there was strong positive correlation between age and urea level (0.55^{**} , $P < 0.01$).

Table (3): The correlation between levels of uric acid, urea, creatinine and age in diabeticpatients type 2.

Parameters	Correlation factor	Significant
Creatinine, uric acid	0.810	**
Creatinine, urea	0.869	**
Uric acid, urea	0.750	**
Urea, age	0.552	**
Uric acid, age	0.451	*
Creatinine, age	0.453	*
P<0.01)**, (P<0.05)*		

According to our results in table (1), the serum uric acid, urea and creatinine are raised in patients with impaired renal function. *In vivo* and *in vitro* findings suggest that uric acid may contribute to endothelial dysfunction by causing anti-proliferative effects on endothelium and impairing nitric acid production [17]. Probable mechanism for the observed results there is an inverse relationship between increasing uric acid and diabetes mellitus may be related to the inhibition of uric acid reabsorption in the proximal tubule by high glucose level in diabetic individuals [18]. In the same table, also show high level of urea and creatinine in both types of diabetes. These results indicate that there is strong relationship between blood sugar level and urea level because hyperglycemia is one of the major cause of progressive renal damage and an increase in urea level is seen when there is damage in the kidney or the kidney is not functioning properly [19]. Muragurdaet al., [20] were found that elevated urea and creatinine in diabetes indicates the progressive renal damage, higher level of serum creatinine reflects generalized endothelial dysfunction or Prothrombotic state [21]. The plasma creatinine is more sensitive index to renal of kidney function because fulfills most of the requirements for a perfect filtration marker [22]. Serum creatinine level is one of the markers for renal function tests while the Age, gender, protein intake and muscle mass influence on serum creatinine levels [8]. In table (2), (3), there were a positive correlation between creatinine, urea and uric acid in diabetes mellitus type 1 and type 2. The increase of blood sugar level can effects on increase in urea level detected, this corroborates with the results finding of Sugamet al., [23]. Type 1 and type 2 diabetes mellitus distinct disorders resulting primarily from either a lack of pancreatic insulin in effectiveness to control blood glucose within the physiologic range in the latter [24]. The presence of some of the symptoms of kidney disease in the diabetics may be caused the elevated levels of uric acid and creatinine [9]. The positive correlation between age and serum creatinine levels in the same tables agree with the study of Cholongitaset al., [25] who reported that plasma creatinine level is influenced by age and the association between the age and plasma creatinine levels in diabetes due to the risk of developing end stage renal disease (ESRD).

2- The effect of diabetes mellitus type 1 and type 2 on liver enzymes

• **The GOT enzyme in the type 1 and type 2 diabetes mellitus**

The result of abnormal levels of enzymes were summarized in fig.(1) where the activity of Serum GOT enzyme was raised to 23.88 U/L in the type 1 and it reached to 23.23 U/L in the type 2 comparable with healthy control group 8.94 U/L and there was no significant differences between two types as shown in Fig.(3).

• **Comparison of activity GPT enzyme between type 1 and type 2 diabetes mellitus**

The activity of GPT enzyme in serum was increased in type 2 and it reached to 22.85 U/L compared with control 8.94 U/L, while the activity of enzyme was reached to 20.30 U/L in type 1 compared with the same control. The results indicated that no statistical differences between two types of diabetes mellitus.

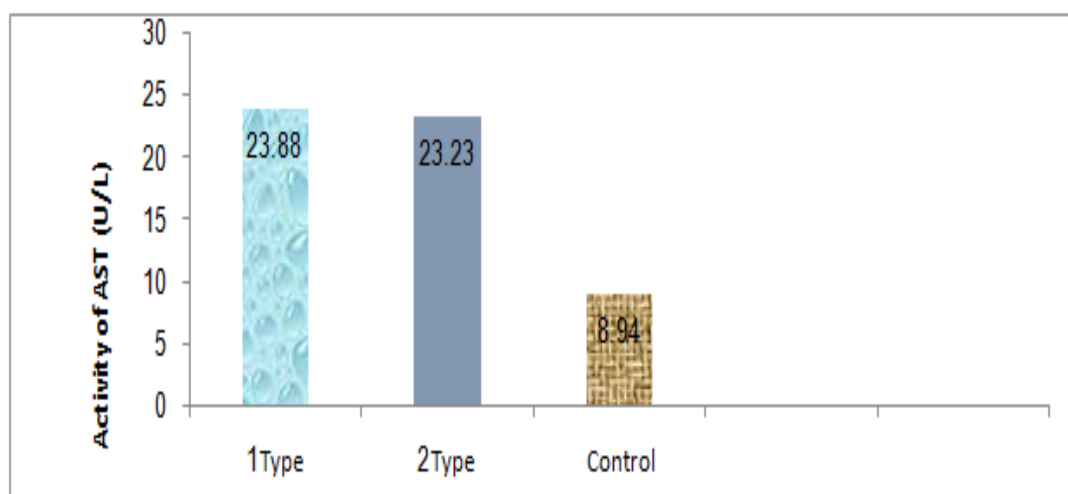


Fig.(1): The levels of AST in normal individuals and diabetic patients

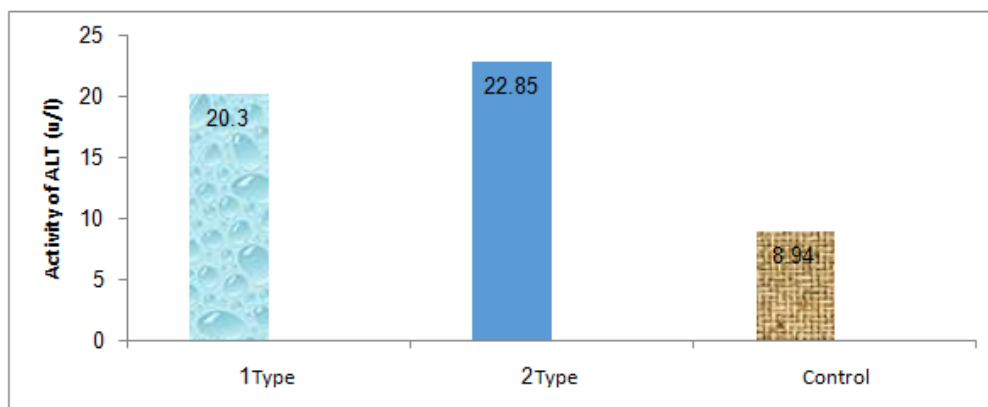


Fig. (2): The levels of ALT in normal individuals and diabetic patients

The abnormal levels of AST and ALT enzymes of diabetic patients in our results can be attributed to many factors, the most common cause being no alcoholic fatty liver disease associated with insulin resistance and metabolic syndrome in diabetes. Stain therapy can also contribute to abnormal liver function tests [26]. Our results agree with Mamta *et al.* [27] who reported that levels of AST and ALT were elevated in type 1 and type 2 diabetes patients compared with control, there were no significant results observed between two types. The type 2 diabetes was highly correlated with the levels of serum of GGT, ALT, AST and ALP [28]. Disturbance of metabolic capacity of the liver appears to correlate with routine liver function tests (LFT) and thus impairment of metabolic capacity of the liver is unlikely to contribute significantly to poor control of diabetes [29]. Mild chronic elevation of transaminases often reflects underlying insulin resistance [30]. Type 2 diabetes is a heterogeneous disorder with a more complex etiology and is far more common than type 1, but much less is known about its pathogenesis [31].

IV. Conclusion

In the present study, the levels of urea, creatinine, uric acid and levels of liver enzymes (AST, ALT) were significantly increased for diabetic patients in type 1 and type 2 compared to the normal patients. The individuals with diabetes mellitus have a higher incidence of abnormalities for renal and liver function than individuals who do not have diabetes.

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