

## COMPARATIVE STUDY OF LIVER FUNCTION TEST IN TYPE-1 AND TYPE-2 DIABETES MELLITUS

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### ABSTRACT

The association of abnormal liver function tests are not uncommon encounter in diabetes mellitus patients. Previous data on evaluation of liver function tests in patients with type 1 and type 2 diabetes mellitus showed considerable debates, so this study is conducted to evaluate the comparison of LFTs in patients with type 1 and type 2 DM. It is a case control comparative study included biochemically and clinically confirmed 25 cases of Type 1 DM and 25 cases of Type 2 DM (age ranges 12-60Years) and results are compared with each other and also with 25 age and sex matched healthy controls. LFTs were performed using standard methods. Our study shows that serum AST (SGOT), ALT(SGPT), ALP, GGT significantly increase in type 2 DM patients when compared to type 1 DM subjects. No association was observed in values of serum total bilirubin, total protein and albumin of type 2 DM subject when compared to type 1 DM. Thus the emerging evidence suggests the abnormal LFTs may be marker for diagnosis and prognosis of diabetes mellitus.

**KEYWORDS :** *Diabetes mellitus, AST, ALT, GGT, ALP*

Diabetes is a syndrome characterized by disordered metabolism, hyperglycemia, resulting from low levels of insulin production by beta cells of pancreas. Two main types of diabetes mellitus exist, Type 1 diabetes also known as insulin dependent diabetes mellitus (IDDM) & Type 2 diabetes also known as non-insulin dependent diabetes mellitus (NIDDM). Type 1 DM and Type 2 DM are not completely distinctive clinically or etiologically and may overlap considerably such as acute presentation or insulin requirement may be present in type 2 DM and autoimmune phenomena may arise in combination with insulin resistance. The possible relationship between Type 1 DM and Type 2 DM is controversial subject. Formally, the two are considered to be etiologically distinct. Type 1 DM is characterized by autoimmune destruction of pancreatic beta cells, resulting in a failure to produce insulin. Type 2 DM is caused by impaired beta cell function and capacity to secrete insulin, coupled to a decline in tissue sensitivity to insulin (Cervin,C.et al;2008). Type 2 DM is generally occurring after age 40 and so, it is known as adult-onset diabetes and it occurs due to insulin resistance or reduced insulin sensitivity.

The prevalence of diabetes worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of diabetes is projected to increase from 171 million in 2000 to 366 million in 2030. Diabetes is more prevalent

in men than women. Diabetes affects 25.8 million people of all ages, diagnosed 18.8 million & undiagnosed 7.0 million.

The liver plays a major role in the regulation of carbohydrate metabolism, as it uses glucose as a fuel, it has the capability to store glucose as glycogen and also synthesize glucose from non-carbohydrate source. This key function of liver makes it vulnerable to diseases in subjects with metabolic disorders, particularly diabetes (Levinthal GN and TavillAJ; 1999).

Several biochemical tests are useful in the evaluation and management of patients with hepatic dysfunction. Liver Function Tests (LFTs) are commonly used in clinical practice to screen for liver disease. The most common LFTs include the serum aminotransferases (ALT, AST), alkaline phosphatase, bilirubin and albumin. Increased activities of liver enzymes such as aspartate aminotransferase (AST), alanine aminotransferase (ALT) and  $\gamma$ -glutamyltransferase (GGT) are indicators of hepatocellular injury. Increased activity of these markers is associated with insulin resistance (Marchesine G, Brizi M and Bianchi G; 2001).

### MATERIALS AND METHODS

The present study was conducted on 50 clinically established diabetic patients. The patients were diagnosed

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depending on the results of clinical examinations, blood HBA1C and serum fasting and post-prandial glucose levels. The subjects selected for the study were grouped as follows:

Group I

Healthy control subjects (n=25) (Age 18-60 years)

Group II

This group consists of type 1 (IDDM) diabetic subjects

(n=25) (Age 12-35 years)

Group III : This group consists of type 2 (NIDDM) diabetic subjects

(n=25) (Age 36-60 years)

**Exclusion Criteria**

The alcoholics, subjects with systemic and other hepatic disease, pregnant women, patients with infectious diseases, post operative patients, smokers, patients on drugs (except antidiabetic therapy), genetic disorders and age <12 years and >60 years were excluded from study.

Informed consent was secured from all subjects for participating in the study. Individuals in control group were matched with the patients for their place of residence and sex.

Blood samples were obtained by antecubital vein puncture, between 8 and 9 AM after an overnight fast (10-12 hours). Standard aseptic precautions were taken and samples with signs of hemolysis were discarded. The blood was centrifuged at 3000 rpm for 15 minutes (40C) and serum was stored at -40C until the day of the test.

Serum were subjected for estimations including Blood Glucose,(fasting and post prandial), serum Total and direct bilirubin, serum AST, ALT, Total protein ,Albumin ,ALP, GGT by using commercially available kits and methods on fully auto analyser. Serum Indirect bilirubin, Globulin ,and A:G ratio were estimated by standard calculative methods.

**RESULT AND DISCUSSION**

The serum SGOT levels also showed significant increase in type 2 diabetes mellitus subjects (Group III) when compared to type 1 diabetes mellitus subjects (Group

II) (P<0.05). The serum SGPT levels also showed significant increase in type 2 diabetes mellitus subjects (Group III) when compared to type 1 diabetes mellitus subjects (Group II) (P<0.05).

Serum ALP levels showed significant increase in type 2 diabetes mellitus subjects (Group III), when compared to type 1 diabetes mellitus subjects (Group II) (P<0.05).

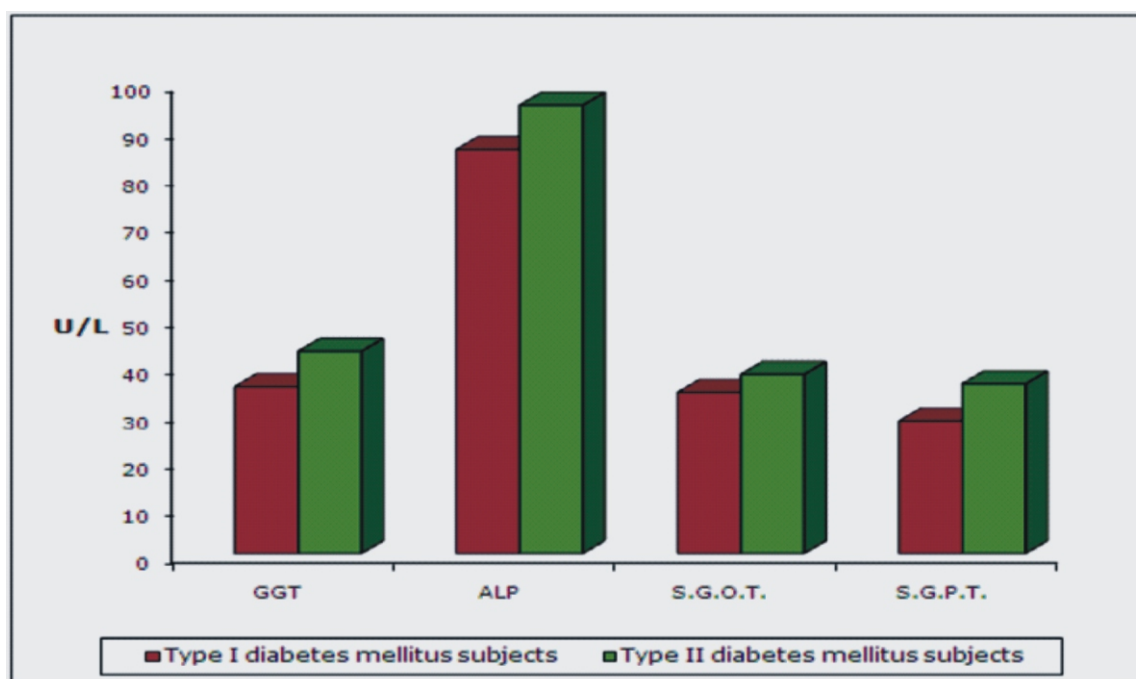
GGT in type 2 diabetes mellitus subjects (Group III) also showed significant increase when compared to type 1 diabetes mellitus subjects (Group II) (P<0.05). No significant association was observed in values of total serum bilirubin of type 2 diabetes mellitus (Group III) subjects when compared to type 1 diabetes mellitus subjects (Group II). Serum Total protein levels also showed non significant values in type 2 diabetes mellitus subjects (Group III) when compared to type 1 diabetes mellitus subjects (Group II).

The mean± SD value of AST in healthy control subjects was 26.64±4.9 U/L in type 1 diabetes mellitus subjects (Group II) it was 34.16±10.48 U/L and in type 2 diabetes mellitus subjects (Group III) was 38.0±10.0 U/L as shown in Table1. AST level showed highly significant increase (P<0.01) in type 1 diabetes mellitus subjects (Group II) and in type 2 diabetes mellitus subjects (Group III) when compared with healthy controls. The AST levels also showed significant increase (P<0.05) when type 1 diabetes mellitus subjects (Group II) were compared with type 2 diabetes mellitus subjects (Group III) (Table 2) (Fig. 1).

The mean± SD value of ALT level in healthy control subjects was 21.52±7.9 U/L, in type 1 diabetes subjects (Group II) it was 28.08±11.25 U/L and in type 2 diabetes mellitus subjects (Group III) was 36.0±13.25 U/L (Table 1). ALT level showed significant increase (P<0.05) in type1 diabetes mellitus subjects (Group II) and highly significant increase (P<0.01) in type 2 diabetes mellitus subjects (Group III) when compared to healthy control subjects. ALT level was observed significantly high (P<0.05) when type 1 diabetes mellitus (Group II) subjects were compared with type 2 diabetes mellitus subjects (Table 2) (Figure1).

**Table 1 : Biochemical Parameters in Healthy Controls (Group I),  
Type -1 Diabetes Mellitus Subjects (Group II),  
Type 2 Diabetes Mellitus Subjects (group III), (n=25 Each).**

Parameters	Type I diabetes mellitus subjects Mean± S.D	Type II diabetes mellitus subjects Mean± S.D	P value by 't' test
GGT (U/L)	35.4±8.97	42.9±10.91	P <0.05
ALP (U/L)	85.7±12.15	95.1±15.65	P <0.05
S.G.O.T. (U/L)	34.16±10.48	38.0±10.0	P <0.05
S.G.P.T. (U/L)	28.08±11.25	36.0±13.25	P <0.05



**Figure :- Biochemical Parameters of Type-1 (Group II) and Type-2 Diabetes Mellitus Subjects (Group III) (n=25 Each)**

The mean± SD value of ALP in healthy control subjects was 71.36±11.17 U/L, in type 1 diabetes mellitus subjects (Group II) it was 85.7±12.15 U/L, and in type 2 diabetes mellitus subjects (Group III) was 95.1±15.65 U/L (Table 1). The increase in ALP was observed statistically highly significant (P<0.01) in type 1 diabetes mellitus subjects (Group II) when compared with healthy control subjects. On comparing type 2 diabetes mellitus subjects (Group III) with healthy control subjects, the ALP values of type 2 diabetes mellitus subject was increased significantly (P<0.05). The values of ALP was also observed statistically

significant (P<0.05) in type 2 diabetes mellitus subjects (Group III) when compared to type 1 diabetes mellitus subjects (Group II) and it was comparable to type 2 diabetes mellitus subjects (Group III) with healthy control subjects (Table - 2)(Figure-1).

The mean± SD value of GGT level in healthy control subjects was 29.4±5.09 U/L, in type 1 diabetes subjects (Group II) it was 35.4±8.97 U/L, and in type 2 diabetes mellitus subjects (Group III) was 42.9±10.91 U/L (Table 1). GGT level showed significant increase (P<0.05) in type 1 diabetes mellitus subjects (Group II) and highly significant

increase ( $P < 0.01$ ) in type 2 diabetes mellitus subjects (Group III) when compared to healthy control subjects. The significant increase ( $P < 0.05$ ) GGT level was observed in type 2 diabetes mellitus (Group III) subjects when compared to type 1 diabetes mellitus (Group II) subjects (Table 2)(Figure 1).

The mean  $\pm$  SD value of Total serum Bilirubin in healthy control subjects was  $0.66 \pm 0.23$  mg/dl, in type 1 diabetes mellitus subjects (Group II)  $0.92 \pm 0.56$  mg/dl and in type 2 diabetes mellitus subjects (Group III) was  $1.08 \pm 0.90$  (Table 1). The increase in Total serum Bilirubin was observed statistically significant ( $P < 0.05$ ) in type 1 diabetes mellitus subjects (Group II) when compared with healthy control subjects. On comparing type 2 diabetes mellitus subjects (Group III) with healthy control subjects, the total serum bilirubin values were also observed statistically significant ( $P < 0.05$ ). The statistically non significant results are observed when type 1 diabetes mellitus subjects (Group II) are compared with type 2 diabetes mellitus subjects (Group III) ( $P > 0.05$ )

The mean  $\pm$  SD value of Total protein in healthy control subjects was  $7.09 \pm 0.53$  gm/dl, in type 1 diabetes mellitus subjects (Group II) it was  $6.65 \pm 0.65$  gm/dl, and in type 2 diabetes mellitus subjects (Group III) was  $6.69 \pm 0.56$  gm/dl (Table 1). The Total protein level showed significant decrease ( $P < 0.05$ ) in type 1 diabetes mellitus subjects (Group II) and type 2 diabetes mellitus subjects (Group II) when compared to healthy control subjects. The statistically non significant results was observed ( $P < 0.05$ ) when type 1 diabetes mellitus subjects (Group II) were compared with type 2 diabetes mellitus subjects (Group III). Noriyuki N. et al. (2004) ; investigated the association between serum GGT and type 2 diabetes. The type 2 diabetes increased in correlation with the levels of serum GGT, ALT, AST and alkaline phosphatase. L. Tibi et al. (2003) ; measured alkaline phosphatase in type 1, type 2 and non-diabetic control group and concluded that liver ALP was significantly higher in diabetes compared with the control group. Iman Mahomad Paruk et al. (2011) ; analyzed liver function test abnormalities in 146 diabetes patients. Elevations of GGT, alkaline phosphatase and alanine transaminase were found when compared with subjects

with normal results. This also correlates with our study.

Our study also correlates with the Sabanayagam et al. (2009); who examined the association between serum GGT and diabetes mellitus and reported that higher serum GGT levels were positively associated with diabetes mellitus, independent of alcohol consumption, hypertension and other confounders. Jamieson A. (2003) ; studied that deranged liver function tests are common in diabetic population which also supports our findings. The serum Total Bilirubin values was found to be statistically high in type 1 diabetes mellitus (Group II) and type 2 diabetes mellitus (Group III) when compared with healthy controls. The results correlates with the Sherif G et al. (2007) ; reported at 959 patients with diabetes mellitus in which 37 patients had raised Bilirubin and combination of raised Bilirubin and ALP was seen in 7 patients and Bilirubin also showed raised values with ALT in 10 patients.

Serum Total protein levels showed significant decrease in type 1 diabetes mellitus subjects (Group II) and type 2 diabetes mellitus subjects (Group III) when compared to healthy control subjects. Ayman S Idris et al. (2011) ; reported that Total protein and Albumin concentration in patients with type 2 diabetes mellitus were lower compared to control group ( $P < 0.01$ ). Sapna Smith Lal et al. (2009) ; also reported that all diabetic subjects have significantly lower serum Total protein level as compared to non diabetic subjects.

## CONCLUSION

It is difficult to assess the various liver function test in type 1 and type 2 diabetes mellitus in a small study but inclusion of age and sex matched controls simultaneously and analyzing the statistical significance of difference between two groups leaves less chances for these results being a chance association. However, further elucidation is required in large cohort studies to draw conclusion on liver function tests in patients with diabetes mellitus on a firm ground. Thus, individuals with diabetes mellitus have a higher incidence of LFT abnormalities than individuals who do not have diabetes. The emerging evidence suggests that abnormal LFTs may be a marker for diagnosis of diabetes mellitus. Because of high liver enzyme level in serum of

patients with diabetes mellitus, performance of liver test is highly recommended for diabetic patients.

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