

Impairment of Liver Function Tests and Lipid Profiles in Type 2 Diabetic Patients Treated at the Diabetic Center in Tikur Anbessa Specialized Teaching Hospital (Tasth), Addis Ababa, Ethiopia

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Abstract

Background: The liver is an insulin-sensitive organ. Insulin resistance is recognized as a pathological factor in the development of liver function impairment and in Non-Alcoholic Fatty Liver Disease (NAFLD). Studies on liver function abnormalities in type 2 diabetic patients in Ethiopia are lacking. In this study we assess liver function tests in patients with type 2 diabetes mellitus and we examine factors associated with these biochemical changes.

Methods: A cross-sectional study was conducted on type 2 diabetic patients. Out of 100 randomly selected diabetic patients, 80 individuals fulfilled the criteria set up for inclusion, while 20 were excluded. Analysis was carried out to compare liver function tests and lipid profiles of the patients with 60 non-diabetic control individuals.

Results: Mean values of liver function tests (ALT, AST, ALP, TP, Bilirubin) and lipid profiles (TC, LDL, HDL, TAG) were significantly higher in diabetic patients compared with the non-diabetic controls ($P < 0.05$). In contrast, total protein and high density lipoprotein concentrations in diabetic patients were lower compared with non-diabetic control group ($P < 0.01$). Overall, 22 patients (25%) had at least one or more abnormal liver function tests and lipid profiles. 39 patients (48.75%), 62 patients (77.5%), 47 patients (58.75%), 52 (65%) patients had abnormal total serum Cholesterol, LDL, TAG, and HDL levels, respectively. The liver function and lipid profile tests among different anti-diabetic on taking groups of the study patients were not statically significant at p value < 0.05 .

Conclusion: Elevated parameters were greater among persons with type 2 diabetic patients. There is less association between liver function impairments with the anti-diabetic drugs the patients on taking.

Keywords: LFT; Alkaline phosphatase; Lipid profile; Aminotransferases (ALT & AST)

Background

Diabetes Mellitus (DM) is a group of metabolic diseases characterized by increased blood glucose levels, resulting from defects in insulin secretion, insulin action, or both. Glucose is an important regulator of various pancreatic β -cell processes, including insulin biosynthesis and release. Glucose, over short intervals, stimulates insulin biosynthesis at the level of translation. Glucose thus becomes the final common pathway for the transport of almost all carbohydrates to tissue cells. Normally, rates of glucose influx into the circulation and those of glucose efflux out of the circulation into tissues other than the brain are coordinately regulated largely by the plasma glucose lowering hormone, insulin, and the plasma glucose raising hormones, glucagon and epinephrine. Thus systemic glucose balance is maintained, hypoglycemia as well as hyperglycemia is prevented, and a continuous supply of glucose to the brain is ensured. However, in diabetic patients the body's inability to effectively regulate the sugar balance leads to severe consequences such as hyperglycemia, obesity, Non-Alcoholic Fatty Liver Disease (NAFLD), osteoporosis and diabetic complications including neuropathy, nephropathy, retinopathy, cardiomyopathy, and hypoglycemic coma leading to death [1-2].

In Ethiopia, although large and community based studies are lacking, in the urban community in Gondar in northern Ethiopia the prevalence of type 2 diabetes has been reported to be approximately 0.3% [3]. However, the prevalence of known diabetes amongst a rural community was as low as 0.014%. In urban areas, type 2 diabetes accounts for 71% of people with the diabetes. When compared with the urban population, the proportion of people in the rural areas who are

known to have type 2 diabetes appears to be relatively low, accounting for 23% of people with the diabetes [3]. In 2011, 14.7 million adults in Africa were estimated to have diabetes, with a regional prevalence of 3.8%. The highest prevalence of diabetes in the Africa Region is in the island of Réunion (16.3%), followed by Seychelles (12.4%), Botswana (11.1%) and Gabon (10.6%). Some of Africa's most populous countries also have the highest number of people with diabetes, with Nigeria having the largest number of diabetes (3.0 million), followed by South Africa (1.9 million), Ethiopia (has an estimated 1.4 million adults, with a prevalence of 3.45% in the adult population). The top six countries with the highest number of people with diabetes make up just over half of the total number of diabetes in Africa [4-10].

The management of liver injury associated with diabetes is a global problem until now and successful diagnosis and treatment is not yet available. It has been increasing worldwide. The incidence of liver function abnormality associated with type 2 diabetes has recently been found to be increasing in developing countries. However, the association

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of type 2 diabetes with micro-vascular and macro-vascular disease well established, but the association of type 2 diabetes with liver function impairment has been recognized more recently and probably is less well-known to physicians. The aim of this study is, to assess the association between abnormal liver function tests and type 2 diabetes mellitus.

Liver function tests (LFT) are a helpful tool, for assessing hepatic injury. In this study, we used Aspartate-Aminotransferase (AST), Alanine-aminotransferase (ALT) and Alkaline phosphatase (ALP), lipid profiles (Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), Cholesterol (CL), Triacylglycerol (TAG), Total Protein (TP), and Total and Direct bilirubin (TB and DB) to assess liver function.

Methods and Materials

Study setting, period and design

Study area was Addis Ababa city, Tikure Anbessa Specialized Teaching Hospital, Diabetic centre. The hospital is one of the major referral and teaching hospital found in the capital city of Ethiopia, Addis Ababa and the serves gives for patients from every corner of the regions. The study period was from May, 2012 to April, 2013. The study design was hospital based cross-sectional study design.

Source population, study population and eligibility criteria

The source population was all patients who visit the diabetes centre of the hospitals during the study period. The study population was all Type 2 diabetic patients who visit the hospitals' diabetes clinic at the time of data collection period and fulfilling the inclusion criteria. Study subjects included in this study were those who were with age of greater than 18 years, diagnosed with type 2 diabetic, fasting serum venous glucose of (126 mg/dl) and made follow up for at least one year. Study subjects excluded from this study were those who ,were unable to answer the questions because of impaired cognitive status and who had a history of alcohol intake, know hepatotoxic drugs like amiodarone, antituberculosis drugs, history of liver disease or clinical evidence of acute hepatitis, and those who were found to have evidence of hepatitis B and C virus infection (HBsAg positive and HCV antibody positive) , severe or chronic diseases such as cancers and severe anemia (hemoglobin<10 g/dL). Patients with HIV and using HAART, and pregnant women were excluded from the study. Past and present medical histories were assessed using their medical files and open- and close- ended questionnaires. The non- diabetics were selected from any clinics in the hospital who fulfilling the inclusion criteria for control within the same age and sex ratio of the diabetic selected group.

Sample size determination and sampling procedures

The final sample size for this study was 80. Systematic random sampling technique was utilized for this study.

Sample size was determined by using a 5% absolute precision and 95% confidence interval.

$$n = \frac{1.96^2 \times P(1-P)}{d^2}$$

d^2

Where n = the total sample size

P= expected prevalence

d^2 = absolute precision

$$n = \frac{1.96^2 \times 0.087(1-0.087)}{(0.0025)^2} = 122$$

(0.0025)

Since no previous study in the area indicating the prevalence rate of liver functions impairments, the population proportion of NAFLD in type 2 diabetic patients was taken as 0.087 based on previous study [11] which is conducted in Lagos state teaching hospital, Nigeria. However only eighty (80) patients were fulfill the criteria for the inclusion set up while the rest subjects (42) were excluded.

Data collection procedure and tool

Data was collected using standardized structured questionnaire and two diploma completed Nurses with previous experience of data collection and multi lingual ability were recruited. Continuous follow up and supervision were made by the supervisors and principal investigators throughout the data collection period. Data collection was accomplished within fourteen weeks duration (September 1st week to December, 2013). Interviewer administered structured questionnaire data collection tool was used, it contains two parts, Part I was used to collect socio demographic data, part II was used to collect clinical status data of the study subjects.

Data quality assurance, entry and analysis

To assure data quality, instruction, training and orientation was given for the data collectors by the principal investigators and the questionnaire was pre-tested prior to the actual data collection on 5 respondents outside study area and the respondents were excluded from the actual study. The questionnaire was initially prepared in English and then translated in to Amharic version. The Amharic version was again translated back to English to check for consistency of meaning. However since the dominant resident in Addis Ababa and nearby town is fluent with Amharic language then the study subjects were interviewed with Amharic version questionnaire. Moreover questionnaire was pre-tested and necessary corrections and amendment was considered.

Venous blood (5 mL) was drawn from each randomly selected and interviewed study subjects in this study using a 5mL disposable plastic syringe. The blood was transferred to a plain container and centrifuged after clotting. Serum was removed and kept at -20°C in a sterile condition until used.

The collected data was reviewed and checked for completeness and consistency by principal investigators on daily bases at the spot during the data collection time. The data was recorded, cleaned and analysed using Statistical Package for Social Sciences (SPSS) version 20 software statistical packages. Frequencies and proportions were used to describe the study population in relation to relevant variables. Logistic regression was computed to assess statistical association via calculating Crud Odds and Adjusted odds ratio to see the influence of independent variables on dependent variables, and significance of statistical association was assured or tested using 95% confidence interval and P-value (<0.05). Independent variables were Socio-demographic characteristics and Clinical or disease state and dependent variables were LFTs and Lipid profiles level of the patients.

Ethical consideration

Ethical clearance was secured from the Research and Ethical Committee of the Department of Biochemistry (RECDob), School of Medicine, College of Health Sciences, Addis Ababa University. Official letter of permissions was obtained from Internal Medicine Department of the college, Tikure Anbessa Hospital Medical Director Offices and the selected respondents ware well informed about the purpose of the study, then information was collected after written consent from each participant was obtained. Information was recorded anonymously and

confidentiality and beneficence were assured throughout the study period.

Biochemical procedures

AST, ALT, ALP, TC, HDL, TAG, and SG were measured and analyzed using an automated machine, Roche Diagnostic/Hitachi 902, Germany, according to the manufacturer's procedures. Concentrations of TP, TB and DB were determined manually.

Results

A total of 80 patients diagnosed with type 2 diabetes, with diabetic duration more than one year, and 60 non-diabetic individuals as control group were selected to perform this study. The average age of diabetic patients was 54 ± 9.70 years, ranging between 35 and 76 years. The average age of non-diabetic patients was 43 ± 4.10 years, ranging from 22 to 70. For diabetic patients, the mean duration of diabetes was 12.5 ± 7.21 , ranging from 1 to 37 years. Body mass index (BMI) was <18 kg/m²; in 17 patients (21.25%); 30 patients (37.5%) had a BMI between 18 and 25 kg/m²; 28 patients (35%) had a BMI between 25 and 30 kg/m²; 5 patients (6.25%) with BMI >30 kg/m². For non-diabetic controls, 11 (18.33%) had BMI <18 kg/m², 40 (66.33%) had a BMI between 18 and 25 kg/m², 9 (15%) had a BMI between 25 and 30 kg/m², and none had a BMI >30 kg/m² (Table 1).

Variables (factors) which may assume to affects the dependent variables (LFTs and lipid profiles) were like waist to hip ratio (WHR), age, BMI and Diabetic Duration (DD). However, these factors had no strong correlation with most of the LFTs and lipid profile (liver biomarkers). But, there was significant weak positive correlation between: BMI and TAG (Figure 2), age and WHR ($r=0.307$, $P<0.006$), age and DD ($r=0.357$, $p<0.001$), WHR and DD

Characteristics	Patients (N=80)	Controls (N=60)
Mean age (years)	54	43
Male/female (No.)	42/38	28/32
BMI (kg/m ²)	80 (24.75±34)*	60 (22.33 ± 0.26)
Underweight	17 (21.25%)	11 (18.33%)
normal	30 (37.5%)	40 (66.33%)
Overweight	28 (35%)	9 (15%)
Obese	5 (6.25%)	0 (0%)
Waist to hip ratio (Gw/Gh)	80(0.93 ± 0.01*)	60 (0.7813 ± 0.01)

*The mean is significant at the $p<0.05$ (By using independent t test analysis)

Table 1: Demographic and clinical characteristics of diabetic patients and non-diabetic controls.

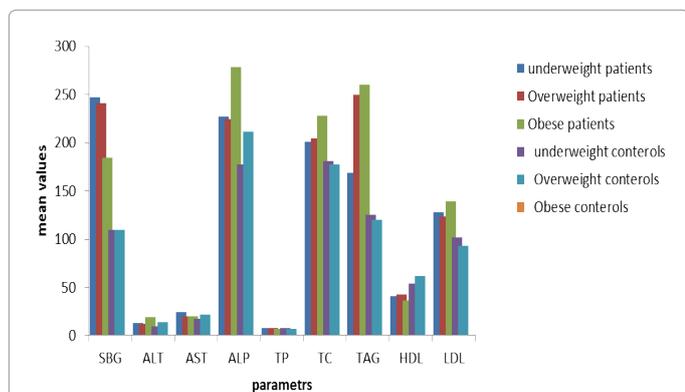


Figure 1: Comparison of mean values different parameters of patients with non-diabetic control group.

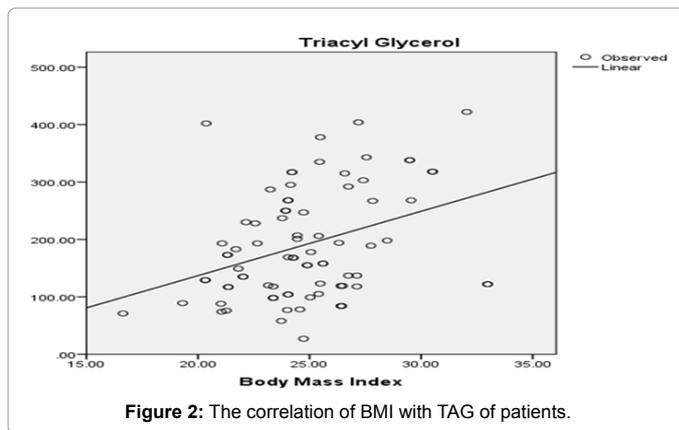


Figure 2: The correlation of BMI with TAG of patients.

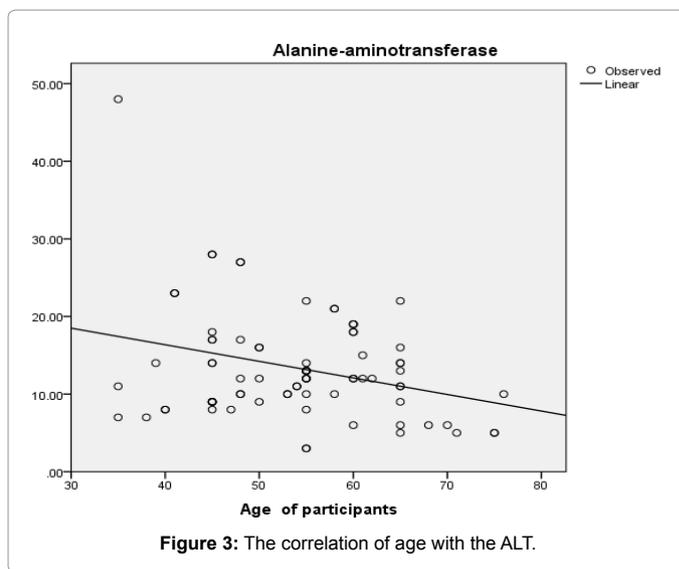


Figure 3: The correlation of age with the ALT.

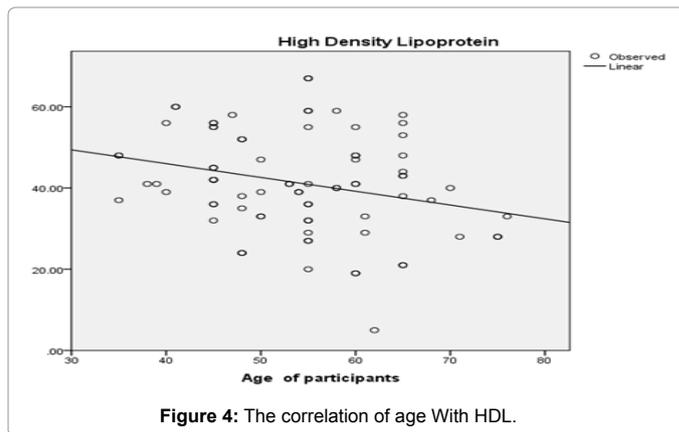


Figure 4: The correlation of age With HDL.

($R=0.307$, $P<0.006$), Serum blood glucose (SBG) and DD ($r=0.377$, $p<0.001$) by using regression linear curve estimation analysis. The correlation equation of TAG and BMI represented by; TAG = $17.37 * BMI + (-233.9)$.

However, there was significant negative weak correlation between: age and ALT ($r=0.297$, $p<0.008$) (Figure 3), age and HDL ($r=0.297$, $p<0.017$) (Figure 4), and DD and ALT ($r=0.294$, $p<0.008$) (Figure 5). The correlation equation of ALT and HDL with age of patients

represented by $ALT = (-0.214) * \text{age in years of patients} + 24.9$ and $HDL = (-0.34) * \text{age of patients in years} + 59.8$ respectively.

In the mean relationship of different parameters in male patients with males controls were statically significant at $p < 0.05$ rather than ALT, AST and TP in which their differences were not statically significant at $p < 0.05$ (Tables 2 and 3). However, females patients compared with control non-diabetic females, the mean values of all LFTs considered were statically significant at $p < 0.05$ by using t-independent test analysis.

As presented in Table 4, mean values of liver enzymes (ALT, AST, ALP) and SBG were significantly higher in type 2 diabetic patients than in the non-diabetic control group ($P < 0.05$). Mean values of lipid profiles (TC, TAG, LDL) and bilirubin (both TB and DB) were significantly higher in type 2 diabetic patients than in the non-diabetic control group ($P < 0.05$). In contrast, mean value concentrations of TP and HDL were significantly lower in comparison to the non-diabetic control group at the $p < 0.05$ by using independent-t test analysis (Figure 1).

The percentages of patients taking different anti diabetic drugs were different within the patients study group. The mean values of parameters evaluated were not significantly different in a four different

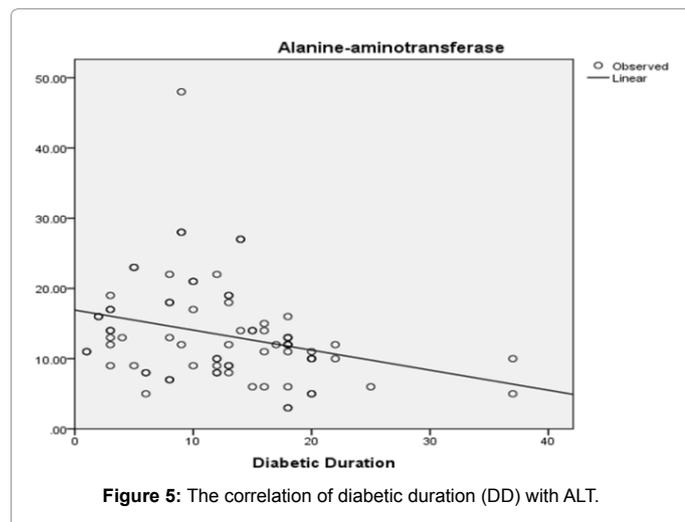


Figure 5: The correlation of diabetic duration (DD) with ALT.

parameters	Patients			P values
	Under w. (BMI ≤ 24.9) (N=47)	Overweight (25 ≤ BMI ≤ 29.9) (N=28)	Obese (BMI ≥ 3) (N=5)	
WHR	0.92	0.97	0.98	0.321
SBG (mg/dl)	247.32	240.75	184.80	0.300
ALT (U/L)	13.36	12.35	18.80	0.133
AST (U/L)	24.04	19.60	20.40	0.817
ALP (U/L)	227.34	224.14	278.60	0.078
TP (g/dl)	7.48	7.48	7.14	0.115
TC (mg/dl)	201.26	204.57	228.00	0.443
TAG (mg/d)	168.62	249.54	260.40	0.921
HDL (mg/d)	40.85	42.64	36.60	0.400
LDL (mg/dl)	128.33	123.53	139.32	0.582
TB (mg/dl)	0.51	0.62	0.40	0.06
DB (mg/dl)	0.09	0.10	0.09	0.557

Table 2: Parameters mean values in patients based on body mass index (BMI) Classification.

Parameters	males		P values	Females		P value
	Patients (N=42)	Controls (N=38)		Patients (N=28)	Controls (N=32)	
WHR (cm/cm)	0.94	0.80	0.001*	0.92	0.76	0.001*
BMI (Kg/m ²)	23.91	22.34	0.009*	25.69	22.34	0.001*
SBG (mg/dl)	245.24	111.75	0.001*	236.55	107.41	0.001*
ALT (U/L)	13.86	11.00	0.112	12.79	10.12	0.025*
AST (U/L)	23.90	18.82	0.051	20.45	17.84	0.027*
ALP (U/L)	213.60	182.75	0.038*	246.92	182.28	0.001*
TP (g/dl)	7.50	7.69	0.129	7.41	7.92	0.001*
TB(mg/dl)	0.53	0.44	0.050	0.56	0.46	0.026*
DB (mg/dl)	0.08	0.19	0.001*	0.10	0.22	0.001*

*The mean is significant at the $p < 0.05$ (by independent t-test analysis)

Table 3: Mean values of LFTs and lipid profiles of male and female patients with non-diabetic males and females respectively.

Parameters	Patients (N=80)	Control (N=60)	P value	95% CI
SBG (mg/dL)	241.11 ± 11.76*	109.43 ± 1.34	0.001	(104.70)-(9158.66)
Liver enzymes				
ALT (U/L)	13.35 ± 0.78*	10.53 ± 0.62	0.01	(0.7)-(4.89)
AST (U/L)	22.26 ± 1.10*	18.50 ± 0.68	0.01	(1.19)-(6.73)
TP (g/dL)	7.46 ± 0.05*	7.78 ± 0.07	0.001	(-0.52)-(-0.19)
TB (mg/dL)	0.54 ± 0.02*	0.45 ± 0.02	0.003	(0.03)-(0.15)
Lipid profiles				
TC (mg/dL)	204.09 ± 5.62*	124.41 ± 4.99	0.001	(40.07)-(91.44)
TAG (mg/dL)	190.18 ± 10.60*	124.41 ± 4.99	0.001	(36.78)-(119.73)
HDL (mg/dL)	41.21 ± 1.38*	55.51 ± 4.90	0.001	(-18.41)-(-10.19)
LDL (mg/dL)	127.34 ± 5.24*	100.82 ± 2.05	0.001	(-0.52)-(-0.18)

*The mean difference is significant at the $p < 0.05$ by using independent t-test analysis.

Table 4: Mean values of the liver biochemical parameters in diabetic patients and non-diabetic control groups

anti diabetic based groups at $p < 0.05$ (Table 5). The anti-diabetic drugs have no any correlation with the different parameters evaluated in the patients.

Discussion

DB is the most common metabolic disorder worldwide and has a high prevalence in developing countries; it is common in Ethiopia [4]. The prognosis of diabetes largely depends on the complications seen in the course of illness. Hepatic fat accumulation is a well-recognized complication of diabetes with a reported frequency of 40–70% [12]. Unfortunately, associated obesity is a frequently occurring confounding variable. Fat is stored in the form of triglyceride and may be a manifestation of increased fat transport to the liver, enhanced hepatic fat synthesis, and decreased oxidation or removal of fat from the liver. The steatosis may be micro- or macro- vesicular and may progress to liver function impairments, fibrosis and cirrhosis [13]. Obesity, and in particular central obesity, is one of the strongest risk factors for NAFLD and fibrosis, with NASH being prevalent in 18.5% of obese patients [14].

Out of 80 type 2 diabetic patients (Table 1), 28 patients were overweight, and 5 patients were obese according to WHO criteria of BMI classification. In our study, only 5 (6.25%) of individuals which is lower than other study [2] and may represent the generally lower BMI of the study area.

In our study, Waist to Hip Ratio (WHR), age, BMI, and diabetic

parameters	Types of anti-diabetic drugs				P values
	Insulin injection (N=34)	Metformin (N=12)	Sulfonylurea (N=12)	Compound (N=22)	
BMI (Kg/m ²)	(24.35 ± 0.36)	(25.60 ± 0.86)	(26.23 ± 1.34)	(25.66 ± 0.54)	0.056
SBG (mg/dL)	(257.17 ± 20.50)	(239.25 ± 18.94)	(208.92 ± 29.18)	(234.87 ± 21.87)	0.581
ALT (U/L)	(12.97 ± 0.85)	(16.67 ± 2.55)	(16.33 ± 3.16)	(12.50 ± 0.99)	0.057
AST (U/L)	(22.09 ± 0.96)	(21.75 ± 1.39)	12(24.08 ± 2.64)	22(21.82 ± 3.41)	0.922
ALP (U/L)	(237.50 ± 9.69)	(209.75 ± 11.43)	(241.58 ± 14.48)	(207.68 ± 13.36)	0.06
TP (g/dL)	(7.45 ± 0.08)	12(7.27 ± 0.07)	12(7.43 ± 0.11)	(7.58 ± 0.10)	0.260
TC (mg/dL)	(198.56 ± 6.67)	(217.08 ± 20.54)	(212.92 ± 20.31)	(200.73 ± 8.70)	0.649
TAG (mg/dL)	(164.09 ± 14.22)	(255.25±27.91)	12(199.50±28.11)	22(235.36 ± 56.06)	0.169
HDL (mg/dL)	(44.47 ± 1.86)	(36.67 ± 3.28)	(36.25 ± 3.27)	(41.36 ± 3.08)	0.113
LDL (mg/dL)	(123.61 ± 6.14)	(129.37 ± 18.67)	(136.76 ± 14.92)	(126.85 ± 10.83)	0.872
TB (mg/dL)	(0.54 ± 0.04)	(0.62±0.07)	(0.56±0.04)	(0.49 ± 0.03)	0.361
DB (mg/dL)	(0.09 ± 0.015)	(0.08 ± 0.01)	(0.09 ± 0.01)	(0.09 ± 0.01)	0.885

Table 5: Mean values of different parameters in patients based on anti-diabetic drugs.

duration (DD) had no correlation with LFTs and lipid profiles. BMI had no correlation with liver biomarkers (LFTs and lipid profiles) rather than TAG. Contrary, Ni et al. found a significant positive correlation between ALT and BMI ($r=0.555$, p -value <0.001). Similarly, AST significantly increased with increase in BMI showing significant positive correlation ($r=0.431$, p -value <0.001). But in this study, there was significant positive correlation only between TAG and BMI ($r=0.36$, p -value <0.001) as TAG increased with increasing BMI. Similarly, there was significant positive weak correlation between: age and WHR ($r=0.307$, $p<0.006$), age and DD ($r=0.357$, $p<0.001$). However, there was significant negative correlation between: age and ALT ($r=0.297$, $p<0.008$), age and HDL ($r=0.297$). There was also significant positive correlation between: WHR and DD ($r=0.307$, $p<0.006$), Serum glucose (SG) and DD ($r=0.377$, $p<0.001$). Contrary, there was significant negative correlation between: DD and ALT ($r=0.294$, $p<0.008$).

As presented in Table 4, mean values of, ALT, AST, ALP, TC, TAG, LDL, TB, DB and serum glucose were significantly higher in type 2 diabetic patients as compared with non-diabetic controls ($P<0.05$). In contrast, values of TP and HDL concentrations in diabetic type 2 patients were significantly lower in comparison to the non-diabetic control group at 95.0% significance level. Similar findings were reported in a study by Idris et al. [6] in which the mean values of ALT, AST and GGT liver enzymes were significantly higher in type 2 diabetic patients than in controls ($P<0.001$). In contrast, values of total protein and albumin concentrations were significantly lower in diabetes than in controls at, a 99.0% significance level [6].

Although the differences between diabetics and non-diabetic controls were statistically significant, the means of ALT, AST, TP, TC, HDL, LDL, TB and DB were within the normal range, whereas ALP, TAG and SBG which significantly higher than normal range values in diabetics (Table 4). Overall, 22 patients (25%) had at least one or more abnormal LFTs and lipid profiles.

Agreed with a study in Sudan, where 50 diabetic patients and 30 normal control subjects were tested for liver function, the means of ALT, AST, γ GT, total protein and albumin were reported to be significantly higher among diabetes compared to the control. However, the mean values were within the normal range [6]. In this study, 22% had at least one abnormal liver function test [12]. Salmela et al. [15] studied the liver function tests of 175 diabetic patients without known chronic liver disease; 57% were found to have at least one abnormal LFT, and 27% had at least two abnormal LFTs. However, these elevated

liver function tests were rarely more than two times of the upper limit of normal [15].

In a UK cohort study of 959 diabetic patients over a four-year period, 15.7% had raised ALT, 10.4% had elevated ALP and only 3.9% had hyperbilirubinaemia [16]. A similar finding was present in a study by Foster et al., in which the means of ALT, AST, ALP, γ -GT, bilirubin and albumin of 60 study subjects with diabetes were within the normal reference range [17]. Likewise in our study, the means of ALT, AST, lipid profiles, bilirubin and total protein were within the normal range among 80 diabetes patients. According to a study in Myanmar, the means of ALT, AST, ALP, γ GT, bilirubin and prothrombin time were within normal range among 81 diabetics studied. Raised ALT and AST were noted in 18.5% and 14.8%, respectively, and 4.9% had elevated bilirubin and prolonged prothrombin time [12].

According to our study, liver function tests though normal, were greater among persons with type2 diabetes as compared with normal WHO reference range. LFTs and lipid profiles were also higher in overweight and obese type 2 individuals than in normal or low-weight diabetic individuals, though, their difference was not statically significant at $p<0.05$. A similar result of an elevated serum alanine aminotransferase level among persons with type 2 diabetics, individual was reported by Idris et al. in Sudanese patients [6].

McKenna study also shows, elevated aminotransferases are found to some degree in almost all patients with liver disease and represent hepatocellular dysfunction [18]. Not surprisingly, 10-75% of NAFLD patients have T2DM and 21-72% of patients with diabetes are reported to have NAFLD and liver function impaired [9]. The mortality rate of diabetic patients due to cirrhosis is more than twice the general population and patients with both NAFLD and DM have poorer prognoses in terms of higher rates of cirrhosis and mortality [10]. Meltzer and Everhart (1997) previously noted a greater prevalence of abnormal alanine aminotransferase levels among Mexican Americans with diabetes [19].

Patients with one of the criteria: LDL-C >100 mg/dL, total cholesterol >200 mg/ dL, triglycerides >150 mg/dL, or HDL-C <40 mg/dL in males and <50 mg/dL in females were considered to have dyslipidemia [13]. According to the recent study, out of 80 type 2 diabetic patients, 39,62,47,52 patients have abnormal TC, LDL, TAG, and HDL respectively. This means dyslipidemia was highly associated with type 2 diabetic patients, which also associates with liver function

impairments. Fatty liver is associated with increased LDL and TAG, TC, combined with HDL [20].

In the current study, the transaminase were highly elevated among type 2 diabetic patients, but only 1 and 4 patients had ALT and AST elevation respectively above the upper limit of normal range. This result agreed with Prashanth et al. study which was revealed only 6 patients had ALT elevation above the upper limit of normal, all of whom had NASH [14].

According to this study, patients taking anti diabetic drugs were grouped as Insulin injection (N=34), Metformin (N=12), Sulfonylurea (N=12), Compound (N=22). The liver function tests and lipid profiles considered among the above 4 groups were not significantly different at the p value < 0.05. This agreed with there is a rare association between the use of oral hypoglycemic and hepatic injury, but disagreed with sulfonylureas can cause chronic hepatitis with necroinflammatory changes [13].

Conclusion

In conclusion, values of liver function tests, and lipid profiles in patients with type 2 diabetes were significantly higher than those non-diabetic control individuals but were most tests still in the normal range. Moreover, type 2 diabetic patients had lower total protein and high density lipoprotein level in comparison with the controls. These significant differences may indicate liver function impairments associated with type 2 diabetes mellitus. Mean values of different parameters considered were more or less similar in different anti diabetic based individuals. This indicates as less association between liver function impairments and those anti diabetic drugs, but liver function tests and lipid profiles abnormalities had a strong association with obese and type 2 diabetic individual individuals [21-45].

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