



ORIGINAL ARTICLE

Comparison of Biochemical Factors and Liver Enzymes in type 2 Diabetes Patients and Healthy Individuals

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ABSTRACT

Diabetes mellitus is one of the most common global health threats (is endocrine malfunctions) that is considered as one of the five major causes of death in all communities. About 90% of the patients suffer from type 2 diabetes. It has been demonstrated that the serum concentration of Alanine and Aspartate aminotransferase enzymes (ALT, AST) and the triglyceride (TG) and cholesterol (Chol) metabolites are increased in type 2 Diabetes. In this research, the population study was selected from 2240 patients who referred to diabetes center (Hamadan, Iran) for checking the hepatic enzymes and biochemical factors. Blood samples under fasting condition were collected. The concentrations of ALT, AST, TG and Chol in serum were measured. The results showed that diabetic patients had more increased TG concentration than healthy subjects; the increase of TG concentration was higher in the women than men (about 7%). The difference of Chol concentration between diabetic and healthy individuals was not significant. But, the results suggested that the gender of the patients affects the TG and Chol concentration, so that diabetic women showed more amount of TG and cholesterol than the diabetic men. The body mass index (BMI) investigation showed that the diabetic women had more overweighting than the diabetic men. There was direct relation between the BMI and TG density. The hepatic enzymes examination showed that the ALT concentration was significantly higher in both male and female diabetic patients in comparison with healthy individuals. Final results of the study suggested that we could use the TG and ALT as the markers for type 2 diabetes in human populations.

Key words: Diabetes mellitus, Triglyceride, cholesterol, ALT, AST, Iran

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INTRODUCTION

Diabetes mellitus is one of the most common threatening and growing problem in over the world (1). According to the last survey in 2000, over 171 million people are suffered from diabetes disease, and it is anticipated that this amount reaches to 366 million patients by 2030 (2). The known mechanisms involved in diabetes disease including failure in insulin secretion, insulin resistance and overproduction of glucose by liver [3]. Insulin resistance in addition to diabetes, it is involves in atherosclerosis, hyper blood pressure and dyslipidemia disorders. Diabetes affects various organs and could be caused several disease such as retinopathy, neuropathy, cataract, atherosclerosis, nephropathy, embryopathy and wound healing retardation [4]. Type 2 Diabetes is identified with a set of interrelated disorders such as decreased HDL, increased LDL and TG [5]. These changes are also characteristics of the insulin resistance syndrome (also known as metabolic syndrome) that seen in many patients with type 2 Diabetes. In fact, more susceptible people to diabetes, before development of diabetes shows the atherogenic pattern of risk factors including high levels of total Chol, LDL cholesterol, TG and lower levels of HDL cholesterol [6, 7]. Insulin resistance has the significant effects on concentration of VLDL, LDL and HDL [8]. In the other hand, insulin resistance leads to an increase in free fatty acids, which has direct toxic effects on the liver.

The identified mechanisms including the destruction of the cell membrane, mitochondrial dysfunction, impaired metabolism in liver cells and toxin formation [9]. The oxidative stress induced by lipid peroxidation, peroxisomal Beta-oxidation and activation of inflammatory cells is other mechanisms of liver damage in insulin resistance. In addition, increases in pro-inflammatory cytokines such as tumor necrosis factor (TNF), which can cause damage to the liver cells, have been observed in insulin resistance [10]. These factors in patients with type 2 Diabetes are the reasons for over expression of hepatic enzymes such as ALT and AST [11]. Ferrannini et al demonstrated that the detection of events before the onset of diabetes may be useful for prevention or treatment strategy [12]. Several studies evaluated the relationship between these factors and type 2 Diabetes. But similar studies are needed to confirm the results of previous studies, so in present article the relationships between TG, Chol, ALT and AST with the developed type 2 Diabetes were examined.

If they have a relationship, as a selective marker can be used for predicting risk of type 2 Diabetes. This is the first study that taken place for finds the best marker in type 2 Diabetes in Iran.

MATERIALS AND METHODS

Sampling

This study is a frequency matched case-control. Among population who were referred to diabetes center of Ghaem Hospital in Hamadan (west of Iran) during 2012-2013, 2240 were selected and divided to diabetic patients and healthy individuals. The average age of the participants was over 30 years. 380 patients with type 1 diabetes, 38 pregnant women and finally 192 women and men because of not keeping the study were excluded from the study. At the final 1630 individuals remain in study. Diabetes mellitus were confirmed by two times fasting blood sugar test over 126 mg/dl.

The laboratory Methods

Glucose is measured automatically by an enzymatic assay. Chol, TG, ALT, and AST were measured using Kit (Pars Azmon, Iran) by auto-analyzer RA 1000 (Technicon/Bayer RA 1000 Chemistry Analyzer). Amounts of TG over 160 mg/dl and Chol over 200 mg/dl were considered as hypertriglyceridemia and hypercholesterolemia. Alanine aminotransferase and Aspartate aminotransferase over 40 u/l were considered as increasing density of these two enzymes.

Statistic analysis

Statistical analysis was carried out by SPSS V.13. A P value of <0.05 was used as the criterion for a statistically significant difference. All results are expressed as mean values \pm standard error.

RESULTS

The participants (1630 individuals) divided in two groups: type 2 diabetes group (812 patients that were composed of 382 and 430 man and woman respectively) and healthy individuals (818 healthy individuals whom were composed of 434 and 384 man and woman respectively). The results showed that hypertriglyceridemia among the diabetic patients is remarkably much more than healthy individuals (table 1). This increasing among the women was more than the men (43% vs. 34%). There was not significant alterations in Chol among the two groups (table 1).

The results showed that gender affects on density of TG and Chol, so that the diabetic women had hypertriglyceridemia and hypercholesterolemia more than the diabetic men. It was seen that the alternations about Chol were more than TG among these two genders (table 1). About hepatic enzymes changes, it was demonstrated that ALT and AST enzymes concentration were increased in diabetic group compared with healthy groups. The alteration about ALT was more than AST (table 1). Also, the results of BMI showed that the diabetic women were fatter than the men (table 2).

Table 1: Comparison of biochemical factors among the diabetic healthy groups

Participant factors	DW(N:430)	HW(N:384)	DM (N:382)	HM(N:434)
Chol > N.R	43 %	42 %	34 %	32 %
TG > N.R	43 %	38 %	36 %	29 %
AST > N.R	5 %	4 %	5 %	4 %
ALT > N.R	17 %	8 %	24 %	12 %

DW, diabetic women; HW, healthy women; DM, Diabetic men; HM, Healthy men; Chol, Cholesterol; TG, Triglyceride; AST, Aspartate aminotransferase; ALT, Alanine aminotransferase; N.R, Normal Range; %, percents of total population of each group

Table 2: The body mass index in different individuals

BMI groups	BMI (kg/m ²)		
	< 25	25-30	> 30
Diabetic women	73%	20%	7%
healthy women	76%	18%	6%
Diabetic men	81%	15%	4%
healthy men	85%	10%	5%

The amounts are reported by percent in total

DISCUSSION

Pattern of changes in blood sugar and related factors before onset type 2 diabetes have been investigated, recently Ferrannini *et al.* have investigated diabetes situation in Mexico City for 3 years and 4 months. Their results showed that onset of diabetes can be fairly fast and cause to disease gradually. The reason was reduction in glucose-induced insulin response. On the other hand, in fat patients with insulin resistance disorder, the malfunction of pancreatic beta-cells that is responsible for insulin secretion cause of diabetes. But, function of beta-cells decrease in this situation compare with normal [13]. We have investigated Chol, ALT, and AST in type 2 diabetes patients and healthy individuals. Effects of BMI on the above factors were investigated in both two groups. It was found that the diabetic patients had over-increasing of factors than healthy. It can be related to storage disease of TG and lipolysis disorders in insulin sensitive tissues like liver that it could be seen in insulin resistance [14]. Increasing fatty acids have direct toxic effect on hepatocytes that it can cause to release ALT enzyme of the liver cells [9]. Our results about ALT concentration are consistent with the previous results. It was also demonstrated that majority of diabetic females than males were suffering from hypercholesterolemia and hypertriglyceridemia in blood that it can be the result of increasing BMI in the females more than the males. Previously, the direct relation between BMI and TG has been shown. In the study that was investigated by Ford ES *et al.* it was showed that 80% of the participants that suffering from overweighting (BMI 25 to 30) and obese (BMI \geq 35), had TG over 150 mg/dl (15). The results showed that TG and ALT are two factors that increased in the type 2 diabetes patients significantly. So, we suggest the investigation of TG and ALT factors accompanied by fast blood sugar in healthy individuals to monitor and early diagnosis of at risk people for type 2 diabetes. This claim needs to be more confirmed by more study.

Limitation of the study

The limitations of this study were small sample size and we hope to investigate the same study with more and more sample size.

Conflict of interest

The authors declare that there are no conflicts of interest.

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