Study of lipid profiles in the serum of cardiovascular patients suffering from diabetes.

Bahador Fadaei[1], Pouyan Asadi[2], Elahe Alivaisi[3], Safoura Khajeniazi[4], Peyman Hadi[5], Said Parshang[5], Mahdi Khorshidtalab[5], Salar Bakhtiyari[3]*

[1]Department of Biochemistry, Islamic Azad University, Iran

[2]Young Researchers and Elite Club, Gorgan Branch, Islamic Azad University, Gorgan, Iran

[3]Department of Clinical Biochemistry, School of Medicine, Ilam University of Medical Sciences, Iran

[4]Stem Cell Research Center, Golestan University of Medical Sciences, Iran

[5]Department of Cellular & Molecular Biology, Islamic Azad University, Iran

Abstract

Diabetes is the most common metabolic disease in humans that is increasing in prevalence in the world. The serum lipids are one the most important indicators for control and assessment of Diabetes treatment. The purpose of this study is evaluating the fat levels for prevention and life improvement of diabetic patients with cardiovascular disease. 50 cardiovascular patients with diabetes who were referred for treatment in 2 months and 50 non-diabetic individuals affected with cardiovascular diseases were selected as Control group. After 8 hours of fasting blood samples were taken. After centrifugation and separation of serum, blood lipids in the samples were measured. The level of harmful fats like cholesterol, triglyceride, LDL, VLD in Cardiovascular patients suffering from diabetes increased and HDL level decreased. Statistically, all these differences in indicator levels were significant in diabetic and non-diabetic groups. The results showed that to decrease the harmful fats increased in diabetic patients, lipid- lowering drugs should be used.

Introduction

Diabetes is the most Common metabolic disease in human. This disease causes a group of metabolic disorders that decrease of insulin secretion or resistant to its function [1]. Today, diabetes is the fourth leading cause of death in the most developed countries. According to the international Diabetes Federation in 2003, the number of diabetic patients in the world were 194 million ones and it is estimated that the number of people with diabetes will reach to 366 million ones by 2030 (about 4/4 percent of the world population) [2]. This non-contagious epidemic disease is growing rapidly, it is estimated this disease will affect 48 million people by 2050 [3,4]. Treatment through diet is one of the principles to control diabetes. At the moment, more diabetic patients are the middle-aged people that are overweight and affected by a series of defects in insulin secretion. On the other hand, the response of their cells to insulin has decreased. Study of fat levels and antioxidant enzymes activities is important in cardiovascular disease affected with diabetes and it is essential for further investigations. Epidemiological studies show that more than 40 percent of people with type 2 diabetes have high blood cholesterol and more the 23 percent of them suffer from high cholesterol and triglyceride as well as low HDL [5]. Several studies have shown that type of dietary fat affects insulin sensitivity through the membrane fatty acid composition and the large amounts of unsaturated fats consumption may cause insulin signalling by increasing the membrane flexibility [6]. Studies have shown that high unsaturated fat and carbohydrate diet improves the sensitivity of insulin and glucose consumption [7].

Study of Metabolic diseases has revealed that consumption of fats and saturated oils instead of carbohydrates can lead to increase cholesterol and LDL level and decrease HDL. Vice versa, substituting the unsaturated fats lowers the cholesterol, LDL and VLDL and higher the HDL levels [8]. Some experts in 2005 investigated the differences of antioxidant activities in patients with type 2 diabetes. In this study antioxidant activity were measured by spectrophotometry and, total cholesterol and triglyceride were measured by using enzymatic methods [9]. Based on other results, on cardiovascular disease among diabetic women with type 2 diabetes, trans and saturated fats consumption increases the risk of coronary heart disease and

conversely, unsaturated fatty acids reduces this risk [8]. According to the studies of Framingham research institute, it has been proven that people with diabetes are susceptible for cardiovascular disease 2 -3 times more the other people at risk of [10,11]. During the investigation done by Donahue on patients with diabetes and cardiovascular disease, medical records and documents relating to the 62036 patients were studied that all of them were suffering from acute coronary syndrome heart. By studying the rate of heart attack among these patients found that the mortality rate within 30 days after stroke among people with diabetes is much more higher than non-diabetics (5.8 *vs.* 4.5 percent; p<0.001) [12]. Reduction of mortality due to cardiovascular disease in diabetics depends on other factors such as weight loss, increased physical activities, precise control of blood pressure, blood glucose, lipids and cholesterol [13]. The purpose of this study is evaluating the fats levels for prevention and life improvement of diabetic patients with cardiovascular disease.

Materials and Methods

This statistical study began in heart hospital lab of Khorramabad, and after two months, blood serum obtained from patients and healthy individuals separately, then all samples transferred to biochemistry laboratory of Razi herbal medicines research center in university of Khorramabad medical sciences until examination performance. 50 cardiovascular patients with diabetes who were referred for treatment during two months and 50 healthy individuals were selected, after 8 hours of fasting,6 ml blood samples obtained from patients, then samples were centrifuged and separated their serum, biochemical analyses were performed. In this research also demographic data were collected, such as age, sex, weight, height, BMI, smoking, drugs and a history of hormonal and metabolic disease of patients. After centrifugation within 5 minutes, 3 ml serum obtained and was cast in three graded micro tubes (250 µl) and at -30°C until all samples were collected stored at the end of the study were used. For measure of HDL, 200 µl standard sample (serum albumin protein) were cast in a test tube and 500 µl reagent 1 (precipitating solution) are added into it.

Then were incubated at room temperature for 10 minutes and it was centrifuged at 4000 rpm for 10 minutes. The 100 µl of supernatant were removed and 1,000 µl reagent 2 (precipitating solution) was added to it and incubated at room temperature for 20 minutes was placed. Then the pipe materials were cast in cuvette and was placed in a spectrophotometer and read at a wavelength of 546 nm. 1000 µl of reagent 2 was poured into a test tube and then putting the blank, the samples were placed in the device, 100 µl distilled water and 1000 µl reagent 2 Mixed together for blank preparation. Then it was read at a wavelength of 546 nm. To measure the concentrations of metabolites, such as LDL, VLDL, triglycerides and cholesterol, was used as the BT1000 auto analyser. Fat values measured in this experiment, such as cholesterol, LDL, VLDL were obtained through Friedewald formula [14] and the results were recorded in Table 1. The results were expressed as mean

± Standard deviation. Statistically significant results and the differences between groups were analyzed using SPSS software.

Results

In this study, changes in lipid profile and Anthropometric factors were measured in diabetic and non-diabetic patients as a control group. After determining the anthropometric factors, Blood samples were taken from both groups and transferred to the Department of Clinical Biochemistry, University of Medical Sciences, Khorramabad, and biochemical parameters were measured and the results were recorded. The data in the following table (Table 1) are shown as mean ± SD. Given that all biochemical parameters are less than 0.05, there are significant relationships between diabetes and control group in biochemical parameters.

Table 1. Clinical parameters of the participants.

Parameters	Group		P-Value
	Control	Diabetic	
Number of people (women and men)	50 (20-30)	50 (22-28)	
Age (years)	63.96 ± 11.76	72.88 ± 10.08	0.52
Weight (kg)	71.03 ± 14.77	72.33 ± 10.55	0.529
Height (cm)	159 ± 12.51	161 ± 11.51	0.484
Cholesterol (m mol/L)	100.69 ± 43.15	200.00 ± 67.79	0.004
Triglycerides (m mol /L)	59.46 ± 100.29	90/88 ± 100.72	0.007
HDL-C (m mol/L)	48.08 ± 9.69	42/65 ± 6.73	0.005
LDL-C (mmol/L)	89.18 ± 29.03	100.28 ± 64.76	0.001
VLDL-C(mmol/L)	25.31 ± 10.19	35.34 ± 12.59	0.004

Based on the Table 1, the mean ± SD of cholesterol, triglycerides, HDL, LDL and VLDL in diabetic patients and in non-diabetic patients, respectively were 200 ± 67/79 mmol/l, 100/69 ± 43/15 mmol/l, 90/88 ± 100/72 mmol/l, 59/46 ± 100/29 mmol/l, 42/65 ± 6/73 mmol/l, 48/08 ± 9/69 mmol/l, 100/28 ± 64/76 mmol/l, 89/18 ± 29/03 mmol/l, and also, 35/34 ± 12/59 mmol/l, 25/31 ± 10/19. Also statistically, the difference between the values in both diabetic and non-diabetic in all 5 cases was significant (p<0/05). According to the results, Cholesterol, triglycerides, LDL and VLDL values increased in cardiovascular patients affected with diabetes than non-diabetic group, but HDL value in cardiovascular patients with diabetes decreased compared to non-diabetics significantly.

Discussion

People with diabetes have a greater risk of cardiovascular disease. Studies have shown that Patients with type 2 diabetes who does not have any familial history of cardiovascular disease as non-diabetic patients with cardiovascular disease are

at risk. The risk of dangerous and deadly heart attack arises in diabetic patients with cardiovascular. Older age, obesity, familial history of diabetes, poor nutrition and physical inactivity are considered principal risk factors for these diseases [15]. The results of this study, significantly, showed increased cholesterol, triglyceride, harmful fats such as LDL and VLDL and also decreased HDL in cardiovascular patients with diabetes than non-diabetics with cardiovascular disease. The results of this study show the people with diabetes who suffer obesity and overweight are at higher risk of cholesterol, harmful fats such as LDL and VLDL increase in their blood. Also the weight loss in these patients can decrease amounts of total cholesterol, LDL and HDL. This shows that obesity itself can cause interference in the levels of cholesterol and harmful fats in the body. On the other hand, the type of fat affects cell membrane sensitivity to insulin through changing the membrane fatty acid composition and large amounts of unsaturated fat consuming may cause insulin signalling by increasing the fluidity of the membrane.

Generally, patients with type 2 diabetes compared to healthy ones have different cholesterol metabolism because they synthesis higher level of cholesterol [16]. Also in other studies, by Comparing diabetic people with other individuals show the metabolism of cholesterol and LDL in these patients is more than healthy people [17] and it reflects the situation of lipoproteins and lipids in diabetes. On the other hand, anti-diabetic drugs had no effect on the absorption of cholesterol [18,19]. In addition, higher levels of cholesterol and triglyceride can cause cardiovascular disease. Decreased HDL and increased LDL in patients with diabetes can cause narrowing of the arteries and coronary heart disease [20]. Studying the amount of LDL and HDL cholesterol absorption shows that whatever the higher absorption levels of cholesterol in serum, the level of serum cholesterol is also higher. But some studies do not confirm this conclusion [21]. Some studies showed that lower blood sugar levels can decrease the synthesis of cholesterol and reduce its absorption. All these results in case of weight loss in obese people and diabetics will be evident [22]. Generally, consumption of cholesterol and saturated fats in patients with type 2 diabetes, increases the risk of heart attack and cardiovascular disease. So in the case of diabetes, decrease the consumption of cholesterol and replace saturated fats with unsaturated is very important and should be included in the diet of patients [17].

Studies show that high consumption of trans and saturated fats increases the risk of cardiovascular disease and conversely, consumption of unsaturated fats reduces its risk [8]. Also, researchers showed that high blood sugar with LDL can produce of free radicals andoxidative stress. And oxidative stress leads to damage to the tissues of the patients [23]. The study was done by Newton and Wentworth in 1992, revealed that there is a direct relationship between Deaths due to cardiovascular disease and cholesterol level more than 4.65 mmol/l. This study showed that during the 12 years, 6327 people have been killed from high cholesterol associated heart attack [23]. However, evaluation of lipid profile and cholesterol level is essential to reduce risk factors of type 2 diabetes especially. The research was conducted in 1994 by Colditz et al. confirmed this fact. Of those who were tested, 34% of men 40 to 69 years old with diabetes have high levels of triglyceride (more than 182 mmol/l), whereas, this rate was 6% in healthy people [24].

Based on research Tanaskow et al. in 2004, on the effect of fat and cholesterol in risk of heart disease in diabetic women with diabetes have type 2, It was found that consumption of trans and saturated fats increases the risk of coronary heart disease and conversely, unsaturated fats consumption can reduce the risk. The risk of cardiovascular disease in these patients has been increasing and these diseases among people who consume much saturated fats and cholesterol were more. As statistics show that reduce the consumption of these risk factors, can decreases the risk of cardiovascular disease and stroke from 22% to 37%. Also the study of these women with diabetes shows that unsaturated fats consumption is a better option than carbohydrates [12]. During the investigation by the research institute perspective in Great Britain in 1998 has revealed that glycemic control in diabetic patients is very important to prevent the risk and development of heart disease. But this is not enough and additional control proceedings are needed. Reduction of mortality due to cardiovascular disease in patients with diabetes depends on other factors such as Weight loss, physical activity increase, strict control of blood pressure, blood glucose, lipids and cholesterol levels.

In conclusion, the serum lipids are the most important evaluation indicators, control and treatment of diabetes. Check the fats and the antioxidant enzymes levels, especially in diabetic patients with cardiovascular complications in addition to pharmacological actions and changes in nutrition and diet therapy can be a very effective step to improve diabetes control and treatment [15]. Since the lipid factors Such as VLDL, LDL, cholesterol and triglyceride increased in cardiovascular patients with diabetes compared to the control group significantly And HDL level decrease in patients with diabetes significantly compared to controls, therefore an appropriate strategy to improve the situation is using a diet includes garlic [25,26], Wheat bran [27,28], Soybean [29], Artichoke [30,31], and lipid-lowering drugs Such as Clofibrate, Bezafibrate [32,33], Cholestyramine [34], Statins family such as Simvastatin [35] as lowering triglyceride, cholesterol, LDL and VLDL in the blood. Consumption of saturated fats and cholesterol associated with increased risk of cardiovascular disease. Metabolic studies indicate that replacing saturated fats with carbohydrates may increase cholesterol, LDL and VLDL levels, while replacing and the use of unsaturated fats can help lower cholesterol and LDL [36].

Acknowledgment

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*Correspondence to

Salar Bakhtiyari

Department of Clinical Biochemistry

School of Medicine

Ilam University of Medical Sciences

Iran