**ORIGINAL ARTICLE**

# Lipid Profiles and Lipid Oxidation in Type 2 Diabetic Patients with Good Glycemic Control

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## ABSTRACT

OBJECTIVE: The aim of this study was to evaluate the effect of good glycemic control on serum lipids levels and lipid peroxidation, and to find out the relationship between the level of malondialdehyde and HbA1c in type 2 diabetes.

MATERIALS AND METHODS: Fifty type 2 diabetic patients aged 40-60 years with the history of diabetes for more than 10 years were studied. Glycemic control was stable for six months which included: having a healthy diet, doing adequate levels of daily exercise, using medicine for diabetes control, control and measuring blood glucose more often. HbA1c, fasting blood glucose, serum levels of lipids, lipoproteins and oxidation parameter (malondialdehyde level) are measured at the base line and after 6 months good glycemic control**.**

RESULTS: Good glycemic control decreased fasting blood sugar (FBS), HbA1c, total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and malondialdehyde. However, the level of high density lipoprotein cholesterol (HDL-C) increased. There was no significant relationship between malondialdehyde and HbA1cin type 2 diabetes.

CONCLUSION: These results demonstrated that glycemic control in type 2 diabetic patients, in addition to beneficial effects on lipid profiles, may contribute in lowering lipid peroxidation parameter (malondialdehyde).

KEY WORDS: Good glycemic gontrol, Lipid profiles, Lipid peroxidation.

## INTRODUCTION

Diabetes mellitus is a major medical problem in developing countries (1). Diabetes mellitus causes lipid metabolism disorder and especially increases lipid and lipoprotein peroxidation (2). Lipoprotein oxidation such as LDL-C oxidation accelerate atherosclerosis and risk of cardiovascular disease which can increase morbidity and mortality in patients with type 2 diabetes mellitus (3,4). Hyperglycemia is an independent risk factor for cardiovascular diseases in diabetic patients. Since hyperglycemia causes an increased production of oxygen free radicals through autoxidation of glucose and non-enzymatic protein glycation, oxidative stress may be increased in diabetic patients (5). Increased levels of the products of oxidative damage to lipids and proteins have been detected in the serum of diabetic patients and their presence correlate with development of complications (6). There are few reports on the effect of glycemic control of lipid peroxidation in type 2 diabetic patients. So this study was designed to determine the changes of serum lipid profiles, lipid peroxidation, FBS and HbA1cand also to find the relation between malondialdehyde and HbA1cin type 2 diabetic

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patients (at Yazd Diabetes Research Center) after 6 months glycemic control.

## MATERIALS AND METHODS

50 diabetic patients referring to Yazd Diabetes Research Center aged 40-60 years with the history of diabetes for more than 10 years were selected. The patients in the study had no hypertension and cardiovascular diseases. None of the study subjects had received antioxidant or vitamins in the past three months**.** Glycemic control was stable for six months which included: having a healthy diet, doing adequate levels of daily exercise, using medicine for diabetes control, control and measuring blood glucose more often. Fasting blood samples were collected before and after 6 months of good glycemic control. HbA1cwas measured by Ion exchange chromatography (Model Vs5). Serum was separated and fasting blood sugar, total cholesterol, triglyceride, LDL-C and HDL-C were measured by autoanalyzer (Autolab-AMS). The malondialdehyde (MDA) concentration (µmol/L) was determined by thiobarbituric acid (TBA) assay. To 0.5 ml serum, 20 µL butylated hydroxytoloene and 2 ml tricholoroacetic acid was added. After centrifugation at 3000 rpm for 10 minutes, the supernatant was separated. Thereafter, 0.5 ml supernatant was added to 0.5 ml thiobarbituric acid and carried in 95 °C water bath for 60 minutes. After cooling in cold water, the resulting pink pigment absorbance was determined at wavelength of 532 and 572 nm. Then absorbance difference 572 from 532 was calculated and malondialdehyde concentration was determined by standard titration curve. The data were analyzed using SPSS version 13. Paired sample test was used for comparison of mean and differences between mean of FBS, HbA1c, lipids profile and malondialdehyde in diabetic patients before and after 6 months good glycemic control. Pearson correlation test was used for evaluation of relationship between malondialdehyde and HbA1cin the study population.

## RESULTS

Glycemic control in type 2 diabetic patients decreased levels of fasting blood sugar, LDL-C and malondialdehyde significantly ($P$ < 0.001), but the level of HbA1c, total cholesterol, and triglyceride decreased significantly. The level of HDL-C increased significantly ($P$ < 0.001). Comparison of fasting blood glucose (FBS), HbA1c, total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL-C), high density lipoprotein (HDL-C) and malondialdehyde (MDA) before and after 6 months good glycemic control are summarized in Table 1. Table 2 shows differences between mean concentration of FBS, HbA1c, TC, TG, LDL-C, HDL-C and MDA before and after 6 months good glycemic control.

There was no relationship between malondialdehyde level and HbA1c. Before glycemic control, correlation coefficient was 0.093 ($P$ = 0.52) and after glycemic control correlation coefficient was 0.093 ($P$ = 0.519).

**Table 1- Comparison mean concentration of biochemical parameters in type 2 diabetic patients before and after glycemic control**

| Biochemical parameters | Before control (Mean± SD) | After control (Mean± SD) | *P* value |
|---|---|---|---|
| HbA1c (%) | 8.90 ± 1.57 | 7.72 ± 1.66 | 0.5 |
| FB S (mg/dl) | 196.38 ± 31.91 | 161.64 ± 37.47 | <0.001 |
| TC(mg/dl) | 180.02 ± 29.16 | 161.04 ± 11.98 | 0.98 |
| TG (mg/dl) | 170.64 ± 10.70 | 158.08 ± 9.02 | 0.7 |
| HDL-C (mg/dl) | 37.58 ± 4.60 | 45.36 ± 5.56 | <0.001 |
| LDL-C (mg/dl) | 102.29 ± 15.78 | 86.12 ± 13.94 | <0.001 |
| MDA (µmol/L) | 0.074 ± 0.046 | 0.031 ± 0.021 | <0.001 |

**Table 2- Comparison of the difference of mean concentration of biochemical parameters in type 2 diabetic patients before and after glycemic control**

| Biochemical parameters | Difference of mean concentration | *P* value |
|---|---|---|
| HBA1C (%) | 1.18 ± 0.08 | 0.5 |
| FBS (mg/dl) | 34.74 ± 44.03 | <0.001 |
| TC (mg/dl) | 18.98 ± 21.80 | 0.98 |
| TG (mg/dl | 12.56 ± 8.40 | 0.7 |
| HDL-C (mg/dl | 7.78 ± 5.19 | <0.001 |
| LDL-C (mg/dl) | 16.16 ± 10/03 | <0.001 |
| MDA (µmol/L) | 0.043 ± 0.041 | <0.001 |

So good glycemic control in type 2 diabetic patients exhibits in decreasing levels of fasting blood sugar, LDL-C and malondialdehyde and increasing HDL-C levels.

## DISCUSSION

Several studies have reported an increased susceptibility to lipid peroxidation in type 2 diabetic patients (7). However, the influence of blood glucose control, lipid characteristic of diabetes on the susceptibility of LDL-C to oxidation remains controversial (8). In this study, we have evaluated serum MDA levels and its relationship with other biochemical findings: FBS, HbA1cand lipid profiles. Lipid peroxidation products (MDA levels) were higher in patients with uncontrolled type 2 diabetes compared to patients with controlled type 2 diabetes (9). The serum cholesterol and triglyceride had significant difference before and after glycemic control. These results agree with the findings by Tan et al. (10). Also it confirms the findings by Hiroshi et al. (11) that demonstrated diabetic patients had higher serum LDL- cholesterol and lower HDL – cholesterol.

In Conclusion, the results of this study demonstrated that patients with good glycemic control had lower MDA levels on their blood serum, serum glucose level and HBA1C. We also found that oxidative susceptibility was decreased with glycemic control. So the physicians may consider the different ways of glycemic control and explain them to their diabetic patients.

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