THE EFFECT OF OLIVE-POMACE OIL ON DIFFERENT BLOOD PARAMETERS IN STREPTOTOCIN INDUCED DIABETIC RATS

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ABSTRACT

Objective: To determine the effects of olive-pomace oil on glycemic status and lipid profile in diabetes.

Study Design: Randomized controlled trial.

Place and Duration of Study: Department of Biochemistry, Army Medical College, Rawalpindi in collaboration with Centre for Research in Experimental and Applied Medicine, Army Medical College, Rawalpindi and National Institute of Health, Islamabad from March 2010 to June 2011.

Material and Methods: Seventy male albino rats of Sprague-Dawley strain were randomly divided into two groups of 35 rats each. Rats were rendered diabetic by injecting streptozotocin. Group 1 and group 2 were given normal rodent diet and olive pomace oil supplemented diet respectively for 6 weeks. At the end of the experiment fasting blood glucose and lipid profile were measured for comparison.

Results: There was significant increase in high density lipoprotein and significant decrease of blood glucose, total cholesterol and low density lipoprotein of group II rats when compared with group I (control).

Conclusion: Olive pomace oil can significantly improve fasting blood glucose and lipid profile in diabetic rats.

Keywords: Diabetes mellitus, Dyslipidemia, Hyperglycemia, Olive pomace oil.

INTRODUCTION

Since the time man has been crowned for the kingdom of earth he has been suffering from multiple diseases and their respective complications. An appreciation of the characteristics of diabetes mellitus (DM) was identified as early as the time of Hippocrates. DM is a chronic metabolic disease characterized by hyperglycemia with disturbances of fat, protein and carbohydrate metabolism. Globally, DM is ranked as the fifth leading cause of death, which is causing a huge burden on the world’s economic resources.

Uncontrolled hyperglycemia and dyslipidemia in diabetics would lead to chronic complications. Mortality due to DM is more often attributed to the complications than from a direct cause such as hyperglycemia or ketoacidosis. Effective glycemic control is the key to improving the quality of life in diabetic patients. Olive oil is one of richest sources of monounsaturated fatty acids (MUFA), whose effect on glycemic status and lipid profile is well documented but very few studies are available regarding its refined types.

Olive-pomace oil is a blend of refined olive-pomace oil and virgin olive oil. Refining is done by filtering, charcoal & chemical treatment and heating of raw pomace oil, obtained from the solid extract residue of olive fruit from which the olive oil has been extracted. Olive-pomace oil contains MUFA and chemically its fat composition is quite similar to regular olive oil. It is cheaper than extra virgin olive oil, having a high smoke point and commonly used for frying purpose. Present study is designed to evaluate the effect of this MUFA enriched olive pomace oil on correction of hyperglycemia and dyslipidemia in diabetic rats.

MATERIAL AND METHODS

This randomized controlled trial was conducted in the Department of Biochemistry and Molecular Biology, Army Medical College, Rawalpindi in collaboration with Centre for Research in Experimental and Applied Medicine (CREAM), Army Medical College and National...
in the animal house of the NIH, Islamabad. They were rendered diabetic by injecting streptozotocin (STZ) 40 mg/kg body weight intraperitoneally dissolved in citrate buffer (pH 4.6). On the third day, their fasting blood glucose levels were measured by taking blood from tail veins under aseptic conditions. Rats with blood glucose level more than 126 mg/dl were considered as diabetic and were used in the study. These diabetic rats were randomly divided into two groups of 35 rats each:

Group-1 (Diabetic control group)

Thirty five diabetic rats in group –I served as control animals for the experimental group of study. They were fed standard pelleted diet as per requirement, prepared at NIH, Islamabad, for 06 weeks.

Group-2 (Diabetic experimental group)

Thirty five diabetic rats in group –II fed with olive pomace oil supplemented diet as per requirement, prepared at NIH, Islamabad, for 6 weeks. Olive pomace oil supplemented diet is the diet containing 100 grams olive pomace oil per kilogram of pelleted diet.

Rats were kept under standard conditions with a daily photo period of 12 hours light and 12 hours dark at 23 ± 2°C. All groups had free access to food and water. At the end of experiment, fasting blood samples were drawn through intracardiac puncture for measurement of blood glucose and lipid profile. Serum lipid profile and blood glucose were measured by enzymatic colorimetric and glucose/oxidase method respectively.

**Statistical Analysis**

The data was entered and analyzed using SPSS version 15.0. The arithmetic mean and standard deviation (SD) of blood glucose, total cholesterol (TC), triglycerides (TG), low density lipoproteins (LDL) and high density lipoproteins (HDL) were calculated. The statistical significance of difference across the groups was determined by applying independent sample’s t test. The difference was considered significant if p value was found less than 0.05.

**RESULTS**

There was a significant increase of HDL and significant decrease of serum glucose, TC, and LDL of group II rats when it was compared with group I (control), (table-1 and figures 1,2).

**DISCUSSION**

Streptozotocin (STZ) is a commonly employed compound for the induction of DM in experimental animals. It has a high affinity for cells of the islets of Langerhans and achieves hyperglycemic status in a short period of time. Mechanism of action of STZ is not known exactly but; it might be responsible for the damage to pancreatic β-cell membrane or depleting the nicotinamide dinucleotide in islet cells. It may even cause DNA strand breakage in pancreatic cells.

Olive oil is associated with a lower incidence of diabetes, obesity, atherosclerosis, cardiovascular disease, metabolic syndrome and certain types of cancer mainly breast, colorectal and prostate cancers. Experimental studies...
both in vivo and in vitro show that olive oil improves cardiovascular risk factors, such as lipid profiles, blood pressure, hyperlipidemia, oxidative stress and antithrombotic profiles but very limited studies are available regarding olive-pomace oil.

In our study, olive pomace oil induced significant improvement in fasting blood glucose in diabetic rats. It contains MUFA, which may regulate blood glucose level by enhancing secretion of glucagon-like peptide-1 (GLP-1) from intestinal cells. GLP-1 is the potent antihyperglycemic hormone, which stimulates the proliferation and differentiation of insulin-secreting β-cells, insulin biosynthesis, glucose-dependent insulin secretion, restores glucose sensitivity of pancreatic β-cells and also suppress glucagon secretion.

Cardiovascular disease is the major source of mortality both in developed and underdeveloped countries. Atherosclerosis is caused by deposition of lipids, mainly cholesterol and cholesterol ester, in the connective tissue of arterial wall. HDL is considered as good cholesterol because it plays a key role in reverse cholesterol transport, while LDL is considered as bad cholesterol because it delivers cholesterol to peripheral tissues. A positive correlation exists between hypercholesterolemia and ischemic heart disease.

In our study, olive pomace oil showed significant increase of HDL and significant decrease of total cholesterol and LDL. These finding are strengthened by multiple series of research work carried by Tsantila and his colleagues in cholesterol-fed rabbits, in which they found that olive pomace polar lipid extract have antithrombotic and antiatherosclerotic properties. So olive pomace oil has cardioprotective effects and decreases the chances of ischemic heart diseases.

These findings are in accordance with those reported by Paniagua et al, who proposed that MUFA-rich diet improves blood glucose and lipid profile in diabetic patients. Our study also synchronizes with Gorinstein et al, and Garg’s research work in experimental animals and diabetic humans, which concluded that MUFAs enriched diets have anti-hyperlipidemic and anti-hyperglycemic action. So MUFA enriched diets are preferred over carbohydrates (CHO) enriched diets because of their lipid and glucose lowering effects.

Findings of present study are partially in contrast with Visioli et al., studies in mildly dyslipidemic persons, which showed that MUFA
enriched olive oil, had no significant hypolipidemic action.

**CONCLUSION**

Olive pomace oil significantly improves glycemic status and lipid profile in diabetic rats. Future implications of this study suggest the use of MUFA enriched olive pomace oil in daily diet especially in diabetic patients for better prognosis and control of glycemic profile and lipid index.

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**REFERENCES**


