ORIGINAL ARTICLE

COMPARISON OF LIPID LOWERING EFFECT OF EXTRA VIRGIN OLIVE OIL AND ATORVASTATIN IN DYSLIPIDAEMIA IN TYPE 2 DIABETES MELLITUS

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Background: Extra virgin olive oil (EVOO) is fruit oil with rich source of monounsaturated fats and powerful antioxidants. It acts as hypolipidemic agent and significant decrease of plasma lipids level was observed with EVOO use. Atorvastatin is hypolipidemic drug commonly used for treatment of hyperlipidaemia. The purpose of this study was to determine & compare the lipid lowering effect of EVOO with atorvastatin in type 2 diabetic dyslipidaemia which is leading cause of microvascular diseases. **Methods:** This randomised controlled trial was conducted on 60 already diagnosed cases of type 2 diabetes mellitus with dyslipidaemia. All sixty subjects were divided randomly into 2 groups. Atorvastatin 40 mg was given to Group One and two tablespoons of extra virgin olive oil orally per day was given to Group Two. Blood was collected for estimation of plasma lipids level at base line, 4th week, and 6th weeks in two groups and was compared statistically. **Results:** The present study demonstrated 20–40% lipid lowering effect of atorvastatin on plasma lipids level with 9–16% increase in HDL while extra virgin olive oil showed 14–25% reduction in plasma lipids with 8–12% increase in HDL-cholesterol level. **Conclusion:** This study concludes that both atorvastatin and extra virgin olive oil are effective in reducing plasma lipids level in type 2 diabetic dyslipidaemia with more prominent effect of atorvastatin than EVOO.

Keywords: Extra virgin olive oil (EVOO); Atorvastatin; Diabetic dyslipidaemia

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INTRODUCTION

Diabetes Mellitus (DM) is caused by relative or absolute deficiency of insulin. There are two types of diabetes mellitus: Type 1 & Type 2. Diabetes mellitus is one of the most common metabolic disorders, leading to abnormalities in carbohydrates, protein and lipid metabolism.[1] Classic diabetic dyslipidaemia is characterized by elevated Plasma total cholesterol (PTC), triglycerides (TG), low density lipoprotein (LDL) and decreased level of high density lipoprotein (HDL) levels leading to various microvascular diseases.[2]

Dyslipidaemia is characterized by serum cholesterol of greater than 200 mg/dl, serum triglycerides of more than 200 mg/dl, LDL cholesterol greater than 130 mg/dl and HDL cholesterol level of less than 40 mg/dl in men and 50 mg/dl in women. Every 10 mg/dl rise in serum total cholesterol or LDL cholesterol increases the chance of coronary heart disease by about 10% and each 5 mg/dl increase in HDL level lowers the risk of heart disease by about 10%.[3]

The statins or HMG-CoA reductase inhibitors are a class of hypolipidemic drugs, which have lipids lowering ability in patients with combined hyperlipidaemia. Atorvastatin is the most commonly used drug for dyslipidaemia. As HMG-Co reductase activity is maximal at midnight therefore all statins are administered at bed time to obtain maximum effectiveness as most of cholesterol synthesis takes place overnight.[4] A large variety of adverse effects including muscle and liver damage have been reported with long term use of statins.[5] Statin-induced muscle damage is also observed with the use of another class of hypolipidemic agents like Fibrates and Niacin in combination with statins.[6]

Extra virgin olive oil (EVOO) is fruit oil obtained from cold pressing of olives without use of chemical solvents having superior taste with less than 0.8% acidity. The EVOO is free of cholesterol while other animal derived fats contain varying amount of cholesterol. It is rich source of monounsaturated fats and powerful antioxidants like polyphenols which reduce artery clogging lipids in blood.[7,8] EVOO acts as hypolipidemic agent and significant decrease of mean total cholesterol, LDL cholesterol, serum triglycerides and an increase in HDL cholesterol was observed after olive-oil use.[9,10]

So, research on plants products of medicinal importance like EVOO may provide opportunity for use of this safe, effective & harmless hypolipidemic agent in our community even for long time.

MATERIAL AND METHODS

A randomised controlled trial was conducted in Diabetic Centre Services Hospital Lahore, extending

over a period of six weeks. Sixty already diagnosed cases of type 2 diabetes mellitus with dyslipidaemia of either sex aged 40 years or above were included in the study. All sixty subjects were divided randomly into 2 groups. Subjects having history of ischemic heart disease, stroke, renal disease, or peripheral vascular disease were excluded. Pregnant/lactating mothers were also excluded from the study.

Atorvastatin was given to Group One in a dose of 40mg daily per orally at bed time for six weeks and two tablespoons of extra virgin olive oil orally per day as such for six weeks was given to Group Two, irrespective of the mode of treatment used for diabetes, i.e., Sulfonylurea, metformin, insulin, acarbose, or troglitazone. All the participants were allowed to continue their habitual diets. At base line, at 4th week and at 6th week, 3–5 ml blood was collected before breakfast after 12 hours fast in 5cc disposable syringe from the subjects by venepuncture with aseptic measures. The clotted blood sample in plain vacutainer (red top) was analysed in the laboratory for lipid profile by using Spectrophotometer SP 3000 plus and corresponding reagents & enzymatic kits.

Data was collected on questionnaire proforma and analysed using SPSS-16.0 for description. The data was analysed in terms of mean±standard deviation (SD) in the case of continuous variables and percentages in the case of categorical variables. Data was presented in tables and diagrams. Two-independent student *t*-test was applied to observe group mean differences. Level of 5% (p<0.05) was used for significance testing and associations.

RESULTS

Sixty patients of type 2 diabetic dyslipidaemia were analysed through various laboratory tests, i.e., Total serum cholesterol (TSC), Triglycerides (TG), Low density lipoprotein (LDL), High density lipoprotein (HDL). Out of these 60 patients 26 (43.3%) were male and 34 (56.7%) were female. The age of the selected patients from both groups ranged from 45 to 80 years while the mean age with standard deviation (±SD) was 57.37±8.548, years. Mean differences among patients' lipid profile of two groups was also analysed before and after treatment with atorvastatin and extra virgin olive oil. Mean differences of plasma total cholesterol, serum triglycerides, LDL-cholesterol, and HDL-cholesterol in patients of atorvastatin group were found to be (110.1427±47.74349), (103.1947±29.36867), (67.4320±7.42441), and (3.8993±1.01035) respectively, while in extra virgin olive oil group, the values were (43.0013±6.47505), (45.9667±8.98015), (30.6500±2.79678), and (3.4440±0.44718) respectively. Regarding plasma total cholesterol, serum triglycerides, and LDL-cholesterol, the p-value was <0.05, while it was higher in HDL-cholesterol (p=0.122) (Table-1 & Figure-1)

The results of our study indicated that atorvastatin has reduced plasma level of total cholesterol, serum triglyceride and LDL cholesterol by about 20–40% (Figure-2) & it has increased HDL cholesterol level by 9–16%. On the other hand, extra virgin olive oil has decreased plasma lipids level by about 14–25% (Figure-3) and about 8–12% increase in HDL cholesterol level. This study also shows that atorvastatin has prominent effect in reducing plasma lipids level as compared to extra virgin olive oil.

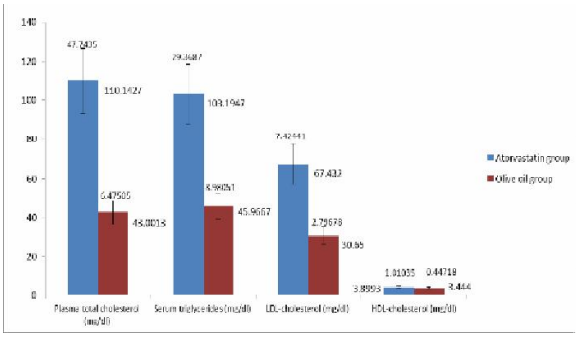

Figure-1: Mean±SD differences among patients of two groups before and after treatment (n=30)

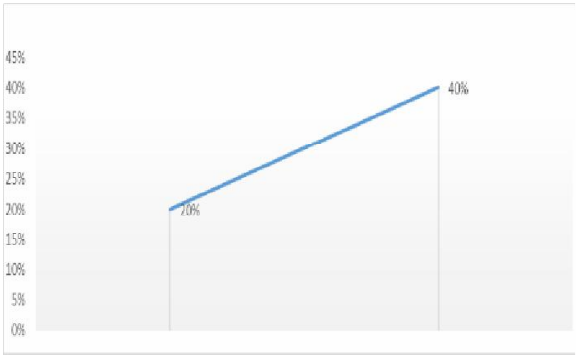

Figure-2: Lipid lowering effect of atorvastatin on plasma lipids (20–40%)

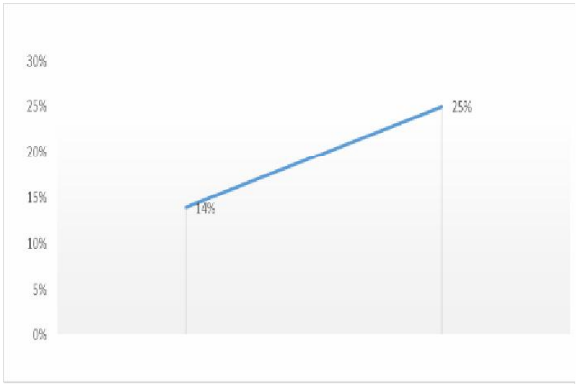

Figure-3: Lipid lowering effect of extra virgin olive oil on plasma lipids (14–25%)

Table-1: Mean differences in lipid profile among patients of two groups before and after treatment:

Lipid profile	Mean differences among patients before and after treatment						*p*-value
	Atorvastatin group			Olive oil group			
	n	Mean	SD±	n	Mean	SD±	
Plasma total cholesterol (mg/dl)	30	110.1427	47.74349	30	43.0013	6.47505	0.000*
Serum triglycerides (mg/dl)	30	103.1947	29.36867	30	45.9667	8.98015	0.000*
LDL-cholesterol (mg/dl)	30	67.4320	7.42441	30	30.6500	2.79678	0.000*
HDL-cholesterol (mg/dl)	30	3.8993	1.01035	30	3.4440	0.44718	0.122

DISCUSSION

It is evident by various research studies that early and proper management of hyperglycaemias and prevention of other risk factors like dyslipidaemia can delay or reduce life threatening complications of diabetes mellitus.[11,12] The present study was conducted to compare the lipids lowering effect of these two products. Atorvastatin a member of hypolipidemic drug group showed significant reduction in the level of plasma lipids as compared to EVOO (Figure 2 & 3). But expanded use of statins has been questioned by some researchers and they observed that the safety and beneficial effects generally considered with the use of statins are still doubtful.[13]

As Stefano *et al* reported that liver damage and muscle toxicity are the major unwanted effects of statins and the frequency of these side effects is dose and time related further underscores the long-term use of statins.[6] Kane and Lipsky observed that the diabetes mellitus, renal or liver disease, hypothyroidism, surgery and trauma are major pathological factors that are implicated in the high incidence of muscle toxicity. Many other physiological factors like female gender, old age, pregnancy, debilitated status, heavy alcohol consumption and even extreme exercise can also predispose to myopathy in patients receiving co-administration of statins.[14] This also raises question on the expanded use of statins, limiting its use due to wide range of its precautions.

Liver toxicity is another serious side effect seen with statins. Study by Castro *et al*, reported that statins are associated with increased hepatic enzymes and various hepatic lesions both in animals and in humans. He also reported a case study of a 72 years old man who developed acute cholestatic hepatitis after taking higher doses of atorvastatin than used previously.[15]

Kok and Kromhout concluded that extra virgin olive oil being a rich source of monounsaturated fats reduces artery clogging lipids in blood.[7] Arrigo *et al* also reported that the polyphenols which are powerful antioxidant are present in good amount in olive oil that promote good health and play a vital role in preventing lipids clogging in blood vessels by reducing the oxidation of cholesterol particles.[16] Clinical data shows that consumption of olive oil has a favourable effect on lipid profile and it also has vasodilatory, antihypertensive, antithrombotic and anti-inflammatory effects in humans as well as in animals.[17] Baggio *et al* observed a significant decrease of mean total cholesterol, LDL cholesterol and total triglycerides after olive oil use with no or acceptable adverse effects.[9] The results of present study demonstrated that two tablespoons of extra virgin olive oil is effective in reducing all plasma lipids level by about 14–25% and had beneficial effect on HDL-cholesterol level by about 8–12% in comparison with the atorvastatin. Similar findings were reported by Haban *et al*, that 2 tablespoons of EVOO every day in addition to daily normal diet resulted in significant drop in plasma lipids and increase in protective HDL cholesterol level.[18]

CONCLUSION

It is concluded that both products have lipid lowering capability while atorvastatin has prominent lipids lowering effect as compared to extra virgin olive oil. So, extra virgin olive oil can be used alone or in combination with low dose atorvastatin to achieve desired plasma lipids level with minimal or acceptable side effects already observed with large doses of atorvastatin or long term therapy with traditional statins. One of the strength of this study is that it was carried out on an important and common metabolic disorder like type 2 diabetic dyslipidaemia.

AUTHORS' CONTRIBUTION

TMK, SI: Conception and Design. TMK, SI, MAR: Data collection, analysis & interpretation. TMK, MAR: Manuscript writing.

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