The effect of oral consumption of olive leaves on serum glucose level and lipid profile of diabetic rats

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Background and Objective: Alleviation of serum glucose level and lipid profile in diabetic patients using herbal medications is of great importance. In the present study, the effect of oral consumption of olive leaves on serum glucose level and lipid profile was investigated.

Materials and Methods: Male Wistar rats were divided into four groups including control, control under treatment, diabetic and diabetic under treatment. A single dose of streptozocin (60 mg/kg) was used to induce diabetes in rats. The two groups under treatment were fed with olive leaves powder mixed with the standard food at a ratio of 6.25% for 6 weeks. Serum glucose level and lipids profile were measured before, and at 3rd and 6th weeks after the treatment.

Results: In diabetic rats under the treatment with olive leaves, serum glucose level was significantly lower at 6th week as compared to the diabetic rats without treatment ($p<0.05$). Moreover, there was a significant decrease regarding triglyceride ($p<0.05$) and total cholesterol ($p<0.01$) in diabetic group under treatment with olive leaves as compared to diabetic rats without treatment. Also, treatment with olive leaves led to significant improvement of HDL ($p<0.05$) and LDL ($p<0.01$) as compared to untreated rats.

Conclusion: Oral consumption of olive leaves in experimental model of diabetes had hypoglycemic effect and exerts some beneficial changes in lipid profile.

1. Introduction

Diabetes mellitus (DM) is considered as one of the most important clinical risk factors involved in some disorders like nephropathy, retinopathy, neuropathy, and cardiovascular diseases, which its prevalence is predicted to be increased daily (1). DM prevalence in Iran is about 5-6%, and at the present, about 4 million Iranians are living with DM or prone to become diabetic (2). Although the most common treatment is insulin and drugs with hypoglycemic effects, but their side effects such as increasing body fat storages, body wasting at the injection site, and hypoglycemic shock are worth to mention; however, these drugs do not have many impact on long term debilitating morbidities. Regarding our daily increasing knowledge about the disease, it is really needed to seek for new medications with fewer side effects (3). Herbal medication usage is of great importance in traditional medicine and such plants have been used for the treatment of many diseases for a long time, whereas there are not still enough scientific evidences about the

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effects of most of them (4). From the plants used for diabetes, olive (*Olea europia*) is of great importance.

Olive is a shrub from oleace species with permanent green leaves, which grows wild with about 5m or more height. Used parts of the tree include the fruit and leaves. This plant has been mentioned in traditional medicine as having the following effects; antihypertensive, anti-atherosclerotic, laxative, giving strength, effective on urinary tracts infection, headache treatment, and antioxidant (5). Also, there are some reports available about the effects of olive leaves in the treatment of malaria (6).

In this study, rats were treated with olive leaves to investigate its anti-diabetic effects. For this purpose, serum glucose level and lipid profile were measured during the study.

2. Materials and Methods

2.1. Collection, identification and preparation of the plant

Olea europia leaves were collected and identified by Karaj Agriculture Faculty taxonomists. Plant leaves were dried at 25°C under shade, then powdered with mechanical grinder. Olive leaves powder was mixed with rats food at a ratio of 6.25%, and the mixture was used as the food for rats under treatment (7).

2.2. Animals

This investigation was an experimental study, in which 30 adult male Wistar rats (weight range from 200 to 250 g) were used (Razi Institute). Rats were kept at animal room, and water and food were provided ad libitum.

2.3. Methods

In this study, only male Wistar rats with a serum glucose level lower than 250 mg/dl at normal conditions without fasting were used (8). Rats were randomly divided into 4 groups including control, control under treatment, diabetic and diabetic under treatment. Control and diabetic groups used only standard food, while control group under treatment and diabetic group under treatment used standard food in combination with the olive leaves powder. Treatment lasted for six weeks. Streptozocin at a dose of 60 mg/kg (single dose) dissolved in normal saline was used intraperitoneally to induce diabetes in rats (8). Diabetes signs including weight loss, polydipsia, and polyuria appeared after 5-7 days. More assurance was obtained after detecting glucosuria and serum glucose level of more than 250 mg/dl.

Blood samples were taken 3 times from rats, the first and second times were performed using capillary tubes from retroorbital capillary vessels, and the third time was performed from the heart. Samples were kept in microtubes at -70°C to measure glucose, cholesterol, triglyceride, HDL and LDL using available commercial kits (ZistChem Co., Tehran).

2.4. Statistical analysis

Data were expressed as positive and negative mean standard deviation. ANOVA test with repeated measures was used to compare each parameter in each group before and after the treatment. Also, one-way ANOVA and Tukey's post-test were used to compare groups with each other. In addition, $p<0.05$ was considered statistically significant.

3. Results

3.1. Serum glucose level

Serum glucose level significantly increased in diabetic rats as compared to control rats ($p<0.0001$). Also, serum glucose level showed a 38% statistically significant decrease in diabetic group under treatment with olive leaves as compared to diabetics without treatment ($p<0.005$).

3.2. Serum lipids

Serum triglyceride level was higher in diabetic group ($p<0.005$). After the 6th week, triglyceride level showed a 77% statistically significant decrease in diabetic group under treatment as compared to untreated rats.

Moreover, diabetes caused significant elevation of cholesterol and olive leaves consumption led to a significant decrease of cholesterol level in diabetic group under treatment as compared to those without treatment ($p<0.005$). HDL cholesterol level showed a 48% increase at 6th

week in diabetic group under treatment which was also significant versus diabetics (p<0.01). Despite a significant increase of LDL cholesterol in diabetic group, its level significantly decreased in diabetic group under treatment as compared to those diabetics without treatment (p< 0.01).

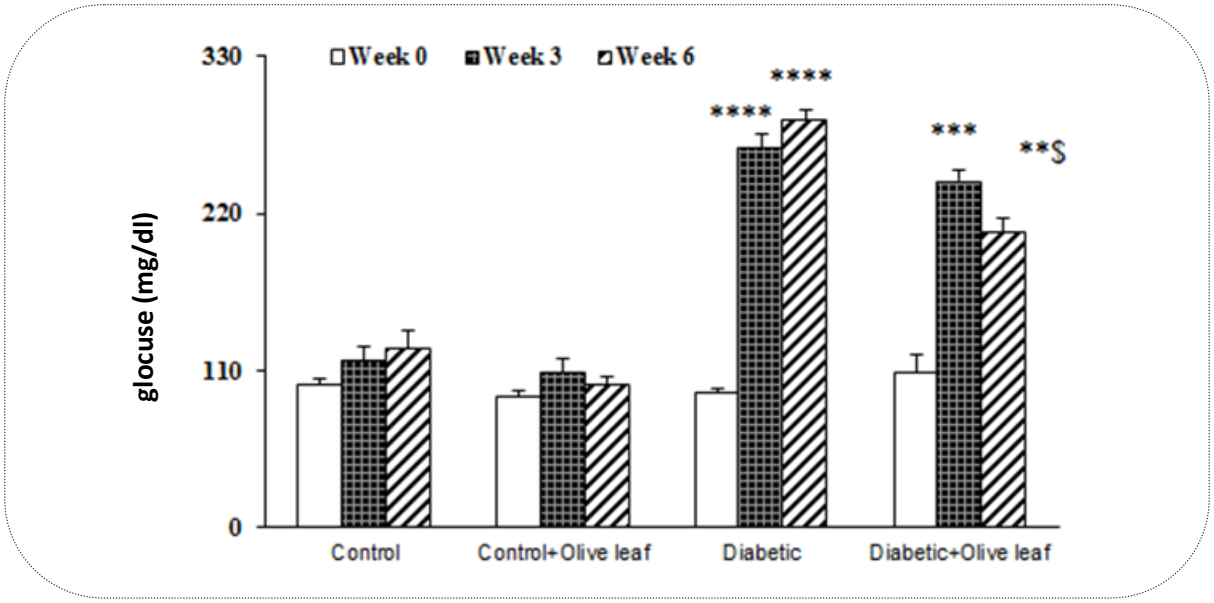

Figure 1. The effect of long-term oral consumption of olive leaves on serum glucose level of control and diabetic rats. ** p<0.005, *** p<0.001, ****p<0.0001 (as compared to week 0 in the same group), $ p<0.01 (as compared to diabetic group in the same week)

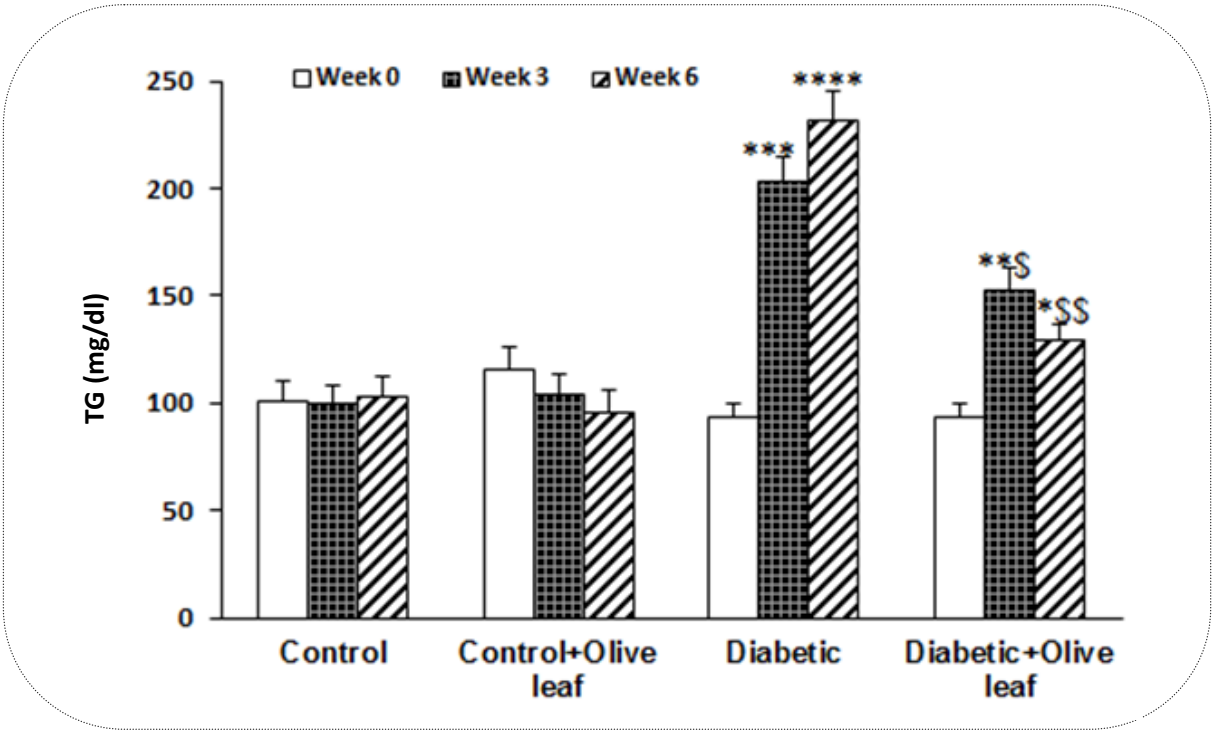

Figure 2. The effect of long-term oral consumption of olive leaves on serum triglyceride in control and diabetic rats. * P<0.05, ** p<0.01, *** p<0.005, **** p<0.001 (as compared to week 0 in the same group), $ p<0.05, $$ p<0.005 (as compared to diabetic group in the same week)

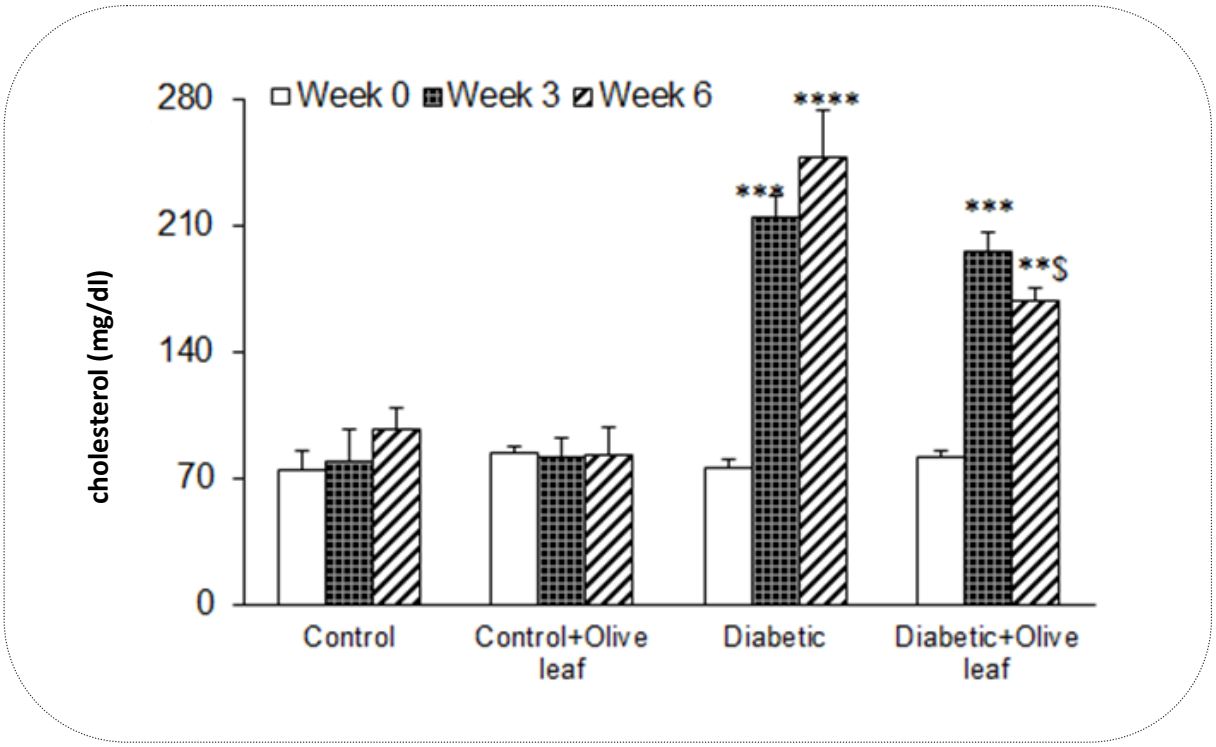

Figure 3. The effect of long-term oral consumption of olive leaves on serum cholesterol in control and diabetic rats. ** p<0.005, *** p<0.001, **** p<0.0005 (as compared to week 0 in the same group), $ p<0.01 (as compared to diabetic group in the same week)

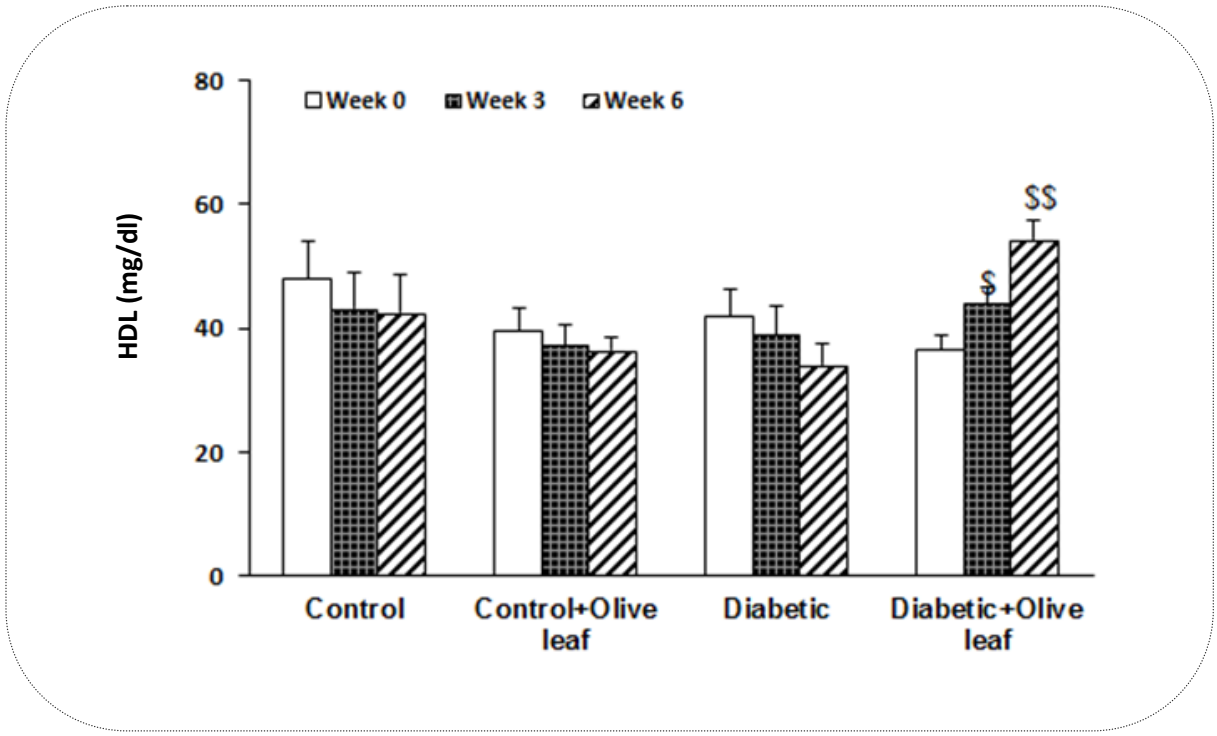

Figure 4. The effect of long-term oral consumption of olive leaves on serum HDL cholesterol level in control and diabetic rats. $ p<0.05, $$ p<0.005 (as compared to diabetic group in the same week)

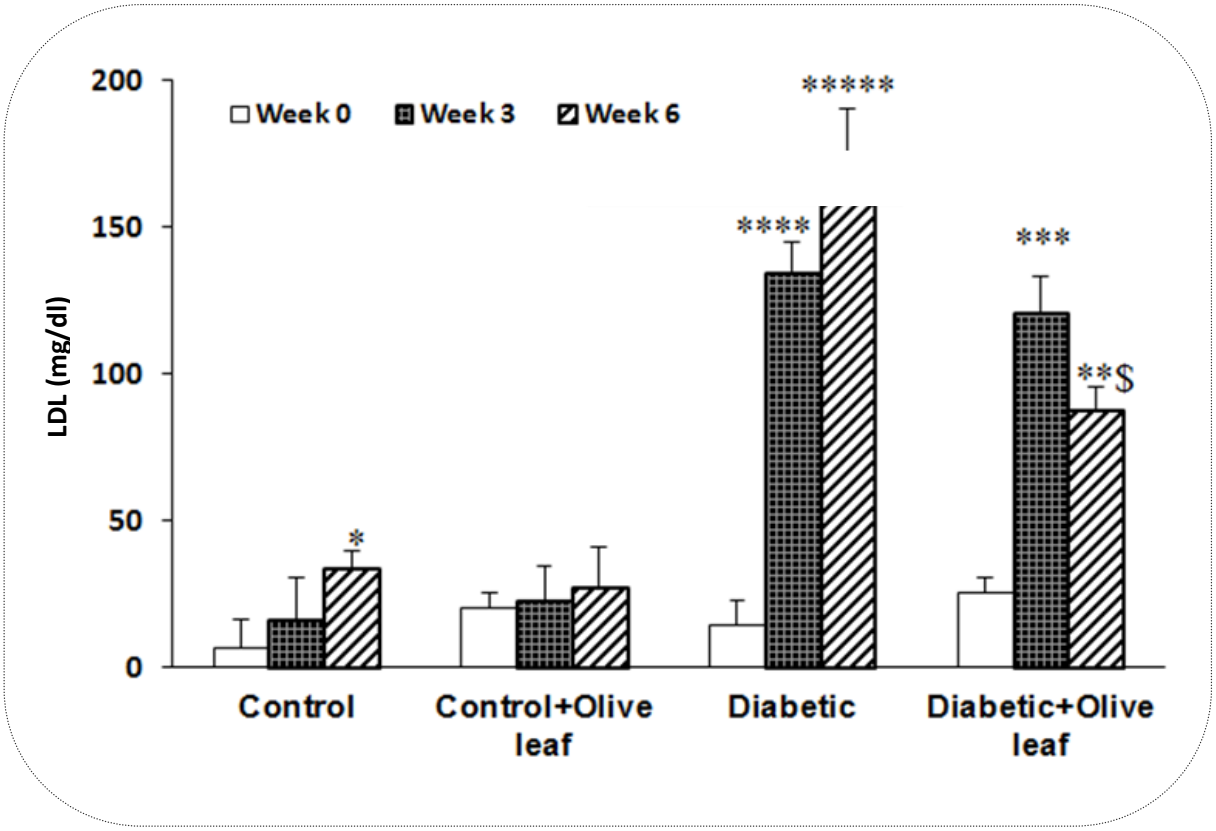

Figure 5. The effect of long-term oral consumption of olive leaves on the LDL cholesterol level in diabetic and control rats. * p<0.05, ** p<0.005*** p<0.001, **** p<0.0005, ***** p<0.0001(as compared to week 0 in the same group), $ p<0.01 (as compared to diabetic group in the same week)

4. Discussion

The results of the present study indicated that oral consumption of olive leaves powder for 6 weeks in diabetic rats has hypoglycemic effect and causes beneficial changes of cholesterol, HDL and LDL levels.

Streptozocin-induced diabetes leads to some changes at metabolic enzymes level due to absence or very low levels of insulin, therefore causes hyperglycemia. Diabetes causes some inappropriate changes of plasma lipids and lipoproteins, in which some body tissues especially liver have a significant role with absorption of serum free fatty acids, then oxidation and metabolic changes of these fatty acids to other undesired molecules, cholesterol and phospholipids synthesis, and secretion of some proteins into the plasma (9). Furthermore, an increase in triglyceride and cholesterol levels in this study is in line with the existing evidence (10). Moreover, increased levels of serum glucose in diabetic rats can increase triglyceride, LDL, VLDL and indirectly decreases HDL (10).

The hypoglycemic effect of olive leaves powder is presumably due to an increase in glucose consumption by the peripheral tissues (11). Olive leaves powder causes glucose consumption maintenance, probably due to continuing the response to insulin and inhibition of intestinal absorption of glucose (12). Eidi et al results showed that olive leaves alcoholic extract leads to a decrease in serum glucose level and an increase in serum insulin level in diabetic rats, but no effect was seen on healthy animals (13).

Moreover, komeyli et al study indicated the hypoglycemic effect of aqueous extract of olive leaves in diabetic rats, blood cholesterol and triglyceride also decreased and HDL cholesterol increased, which is in accordance with our results (14). Although Jamae et al evaluated the effects of some other extracts of olive leaves on alloxan-induced diabetic rats, they concluded that serum glucose and cholesterol levels significantly

decreased and this effect is due to antioxidant properties of olive leaves (15). In an investigation conducted by Alazavi et al on healthy and alloxan-induced diabetic rabbits for 16 weeks, hypoglycemic and antioxidant properties of olive leaves were approved and long-term administration of olive leaves led to a decrease in lipid peroxidation products like MDA (16).

In conclusion, long-term oral consumption of olive leaves by streptozocin-induced diabetic rats has hypoglycemic effect, decreases serum triglyceride, total cholesterol and LDL cholesterol and increases HDL level.

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References

1. Thripathi BK, Sivastava AK.Diabetes mellitus: complication and therapeutic. Medical Science Monitor 2006;12:RA130-47

2. Wadell PE,Quality of life of patients with diabetes mellitus.an overview of research in primary health care in the Nordic countries. Scandinavian Journal of Primary Health Care 2005;23:68-74

3. Shapiro K,Gong WC. Natural products used for diabetes. Journal of the American Pharmaceutical Association 2002;42:217-226

4. Zargari A.medical plants. Tehran University Press 1993;2:125-127

5. Smova LI,Shode FO,Ramnanan P,Nadar A. Antihypertensive, antiatherosclerotic and Ethnopharmacol. 1996;54:41-46

6. Zargary A,medical plants.Tehran University Press 1996; 3: 319-329

7. Baluchnejadmojarad T, Roghani M.Garlic extract attenuates time-dependent changes in the reactivity of isolated aorta in streptozotocin-diabetic rats. Life Sciences 2003; 73: 2281-9

8. Choi JS, Yokozava T,Oura H, Improvement of hyperglycemia and hyperlipidemia in streptozotocin-diabetic rats by a methanolic extract of prunus diadiana stems and its main component, pruning.Planta medica 1991; 57: 208-211

9. Schutz K, Kamerer D, Carle R, Schieber A. Identification and quantification of caffeoylquinic acods and flavonoids from artichoke[Cynara scolymus L.] heads, juice, and pomace by HPLC-DAD-ESI/MS[n]. Journal of Agricultural and Food Chemistry 2004; 52: 4090-6.

10. Yanardag R, Bolkent S, Ozsoy-sacan O, Karabulut-Bulan O.The effect of chard (beta vulgaris L. var. cicla) extract of the kidney tissue, serum urea, and creatinine level of diabetic rats.Phytotherapy Research 2002; 16: 758-761 .

11. Chattopadhyay RR. Possible mechanism of antihyperglycaemic effect of Azardirachata indicaleaf extract . Part IV . General Pharmacology 1996 ; 27: 431-434 .

12. Pari L , Saravanan G. Antidiabetic effect of Cogent db , a herbal drug in alloxan-induced diabetes mellitus . Comparative Biochemistry and Physiology Part C 2002 ; 131 : 19-25 .

13. Eydi A, Eydi M, Oryan Sh, Flahian F,Darzi R.Hypoglycemic effect of olea extract in diabetic rats. Journal of Medicinal Plants 2004; 12: 36-40.

14. Comeyli GH,Miri Moghadam E.The effect of olea extract on glucose and lipid in diabetic rats. Iranian Journal of Endocrinology and Metabolism 2008;4 : 389-394.

15. Jamei H, El Feki A, Sayadi S. Antidiabetic and Antioxidant Effects of Hydroxytyrosol and Oluropein from Olive leaves in Alloxan – diabetic Rats. Journal of Agriculture Food Chemistry 2009; 14: 1275 – 84.

16. Renis H.Invitro antiviral activity of calcium enelonate. 1969; Antimicrobial Agents and Chemotherapy 9; 167-172.