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The effect of 4-weeks aerobic training according with the usage of *Anethum Graveolens* on blood sugar and lipoproteins profile of diabetic women

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ABSTRACT

Abnormal metabolism of lipids in blood of the humans is one of the most important risk factors in type II diabetes especially for cardiovascular disease. Beneficial effects of physical activity and usage of *Anethum graveolens*, each separately has been founded on glucose control and some of cardiovascular risk factors in people with type II diabetes. Therefore, aim of this study was to evaluation the change of lipoproteins profiles and blood sugar, after four weeks aerobic training with usage of *Anethum graveolens* in the type II diabetes. The study was performed on 30 patients with diabetic women (mean age 51.28 ± 1 years old). The subjects were divided in the three groups that consisted of; training and usage of a daily *Anethum graveolens* (900 mg daily), aerobic training and control. The aerobic training and aerobic training with usage of *Anethum graveolens* groups, performed aerobic trainings for 55 minutes in four weeks and three sessions per week with 60 to 75 % of maximum heart rate (HR_{max}). To evaluation of changes in blood sugar and lipoproteins profiles such as; HDL, LDL, FBS, TC and TG, venous blood samples of the subjects (5 ml) were collected before and after training period (four weeks). In comparison of control groups, our results shown that a significantly increase in HDL, decrease in FBS and LDL to HDL ratio ($p < 0.016$), respectively in the aerobic training and aerobic training with usage of *Anethum graveolens* groups. The reduction of LDL, TG, TC and BMI in both experimental groups was showed, but these findings statistically were not significant ($p > 0.05$). Base on obtained results, aerobic training with usage of *Anethum Graveolens* can be useful for reduce of hypoglycemia and lipid disorders in diabetic patients.

Key words: Aerobic, lipoprotein, blood sugar, *Anethum Graveolens*, diabetes.

INTRODUCTION

The growing prevalence of obesity and sedentary are the key causes of diabetes type 2 that becomes the problem of universal public health. Epidemic rising of diabetes type 2 (T2DM:¹) is the result of expanded changes in the society and behavioral patterns of communities in the recent decades. Although genetic combination is the main predispose

¹. type 2 diabetes mellitus

factor in people infection to diabetes, but social changes and growing of universal food calories are effective elements in epidemic diabetes (1).

Lipid disorders in diabetic patients include increase of triglyceride, total cholesterol and low density lipoproteins as well as the decrease of high density lipoprotein (HDL) (2, 3). Diabetes type 2 is associated with decreasing HDL of plasma that is because of catabolism increase in HDL elements (4). Activity decrease of lipoprotein lipase enzyme and activity increase of hepatic lipase in diabetic patients (5) is relevance with the increase of HDL catabolism more than creating LDL- c (4). Studies show that LDL catabolism in diabetic persons is 28 percent less than healthy individuals. Decrease of LDL catabolism is as a result of decrease in LDL B/E receptors' number or decrease in receptors' sensitivity towards LDL while receptors' number in cell level in diabetic persons has a meaningful decrease comparing with healthy people (4). These lipid changes according with increase of oxidative stresses in diabetic patients cause the increased risk of cardiovascular diseases (2, 3). It has been shown that lack of physical activities has a relation with unfavorable profile of lipoprotein serum (7) and increases the peripheral resistance towards insulin (6). These changes are causes for obesity, hypertension, glucose intolerance, cardiovascular diseases and non-insulin-dependent insulin (8). According to this matter that doing exercises according with diet and medicine is the basis of diabetes control (9), diabetics can do exercises for better controlling of blood glucose, weight and blood pressure and besides take advantages from the psychological benefits of anxiety and depression reduction as well as improvement of sleep quality. Different types of exercises are prescribed for diabetic patients like aerobic, strength and stretching exercises (9). Regular physical activity is effective in slowing the growth trend of diabetes and preventing micro vascular disorders like nephropathy, peripheral neuropathy and macro vascular complications like coronary heart, stroke and arterial diseases (10). Physical activity shows a meaningful relation with increase of sensitivity to insulin in healthy peoples as a result of oxidative capacity increase and lipids oxidation growing in the following (10, 11, 12).

Diabetes treatment via traditional medicine and medicinal plants has a long background and 44 plants have been surveyed within the years of 1907-1988 in this regard. For example, the unique combinations of fenugreek, fennel, sage, olive, cinnamon, Anethum Graveolens and other goods that have high insulin-curing properties are effective on biological activities with significant physiological effects (14). Researchers proposed that Anethum Graveolens flavonoid has protective effect on mucosa of the gastric because of having flavonoids combinations of Quercetin and Isorhamnetin (15). These combinations protect the mucosa of gastric against the damages because of indomethacin (16). Moreover, it is confirmed that Quercetin and Isohamnetin can lower the level of total triglyceride. Some part of this decreasing effect of Quercetin is because of production loss of ApoB- 100 via liver. The production loss of ApoB -100 causes the decrease of VLDL (lipoprotein with too low density) of plasma and as a result, decreases of total triglyceride in plasma (17). Moreover, the available flavonoids in Anethum Graveolens prevent from oxidation of LDL particles with activation of antioxidant enzymes (18, 19). Aerobic training mostly are accepted as a cure strategy for diabetes type 2 since it has profitable effects on glycemic profile. The previous studies showed the effect of training with moderate intensity on improvement of insulin sensitivity (20, 21).

According to this matter that most of done researches are about surveying the effect of Anethum Graveolens or aerobic training on some blood factors of diabetic patients separately, the gained results in these researches have differences. Therefore, the goal of the current research is comparing the effect of 4-weeks aerobic training according with Anethum Graveolens usage on blood sugar and lipoprotein profile of diabetic women.

MATERIALS AND METHODS

Studying the impact of aerobic exercises and Anethum Graveolens usage, 30 patients were selected randomly from diabetic patients who referred to diabetic center of Shahid Ghodsi of Mashhad province; the goals and all stages of survey were described for survey subjects in details and each one signed a questionnaire and written consent form. None of samples had chronic diseases (cardiovascular and kidney diseases or thyroid gland disorder or under insulin therapy) and the diet and medicine of samples are controlled and harmonized according to the proposed diet of nutrition specialist of diabetes center.

Determining the anthropometric indicator:

The weight of participants in this study was measured by using analogue scale in kilos (Saka model) and the height was measured by non-elastic tape in standard conditions. BMI was measured via dividing the weight (kilogram) by the square of height (square meter). The fat percentage of samples was measured by caliper (SLIM GUIDED) and

usage of three-points method (pelvis, quadriceps, triceps brachial) (Jackson and Poolak) (22). Removing the individual fault, all measurements were done via one person.

Training protocol:

Randomly, patients were divided in three groups, the first group : aerobic training and Anethum Graveolens usage with 3 capsules daily(900 mg/kg/body weight), the second group : aerobic training and the third group:control without any activity.

4- weeks aerobic that was 3 sessions for 55 minutes in each week and their training included 10 minutes for general and specific warm-up with mild running, 35 minutes (from 35 minutes in the first session to 50 minutes in the last sessions) for doing aerobics training in the standing form with maximum heart rate of 60-70% (23, 24, 25) and cool down was ten minutes. Within this period the controlled group did not use any Anethum Graveolens complementary and did not use exercise activity.

Sampling

For sampling, volunteers were described that should be fasting between 10 to 12 hours because of lipid profile clearance and refer to laboratory in the morning for test. For having a same diet, they were received a proposed diet from researchers one day before testing. Surveying the changes of sugar components, fat and lipoproteins of blood plasma include HDL, LDL, FBS, TC and TG, the venous blood samples of subjects (5 millimeter) were taken 24 hours before and after the end of exercising period in resting with enzymatic method (Pars Azmoon kits , made in Iran) using auto analyzer machine.

The amount of glucose in fasting blood (FBS) was measured by enzyme method of oxidase glucose (kit of Pars Azmoon Company with catalogue number of 017 1500, Tehran, Iran with variation coefficient of internal and external assessment of 1.28% and 84%). Serum level of high-density lipoprotein (HDL) was measured by enzyme method via its deposit by magnesium chloride (26, 27).

Analysis the data

All quantitative amounts are recorded as (Mean+ SEM). Statistical survey of gained data analyzed by SPSS software (version 11.5) . Normality of data distribution is determined by Kolmogorov- Smirnov test and the average difference between three groups are measured via one way ANOVA (variance analysis). Meaningful level of test is considered 0.05 ($p < 0.05$).

Findings:

Comparison of variables in groups before and after 4 weeks training presented in table 1.

In the current study, in comparison with the control group, body fat percentage in the group 1 and 2 decreased from 31.66 ± 2 to 29.36 ± 1.2 and 31.38 ± 1.72 to 29.42 ± 2.10 respectively ($p < 0.05$). despite of BMI decrease in group 1 and 2 ,it was not significant.

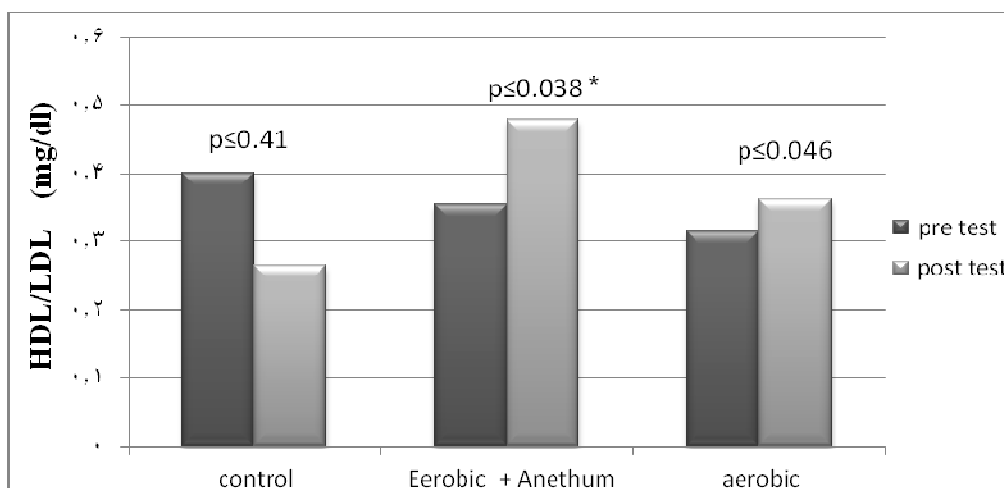
Changes of glucose, total cholesterol, triglycerides, LDL, HDL in groups are compared in table 1 before and after training. The results show a meaningful increase of HDL ($p < 0.029$) and meaningful decrease of FBS ($p < 0.043$), TG ($P < 0.05$) and meaningful increase of the HDL/ LDL ratio ($p < 0.028$) in experimental groups comparing with control group that these changes is significantly differ in group 1 towards the group 2 ($p < 0.05$). This shows that aerobic exercise according with dill usage can have more effect on HDL/ LDL ratio (table 1 and chart 1). Although 4-weeks aerobic training with and without Anethum Graveolens usage cause the decrease of total cholesterol, LDL and TC but these changes are not meaningful from statistical side.

Table 1 - Comparison of serum levels of the variables measured before and after the period

Indexes (Average)	Time	Eerobic training +Anethum Graveolens	P value	Earobic training	P value	Control	P value
LDL(mg/dl)	pre	117.28± 10	2580.	153.16 ± 14.4	0.826	100.00± 16	0.656
	post	101.43 ± 13		151.3± 18.7		154.4± 10	
HDL (mg/dl)	pre	40.00 ± 2	0.029	46.50 ± 1	0.048	39.60 ± 2	0.047
	post	43.85 ± 2		51.00 ± 2		36.80 ± 1	
FBS (mg/dl)	pre	183 ± 12.5	0.043	203.85 ± 19	0.017	202.20± 11	0.014
	post	133.80 ± 13.4		140.74 ± 6.8		203.85 ± 30	

TG (mg/dl)	pre	184.2 ± 11	0.030	185.5 ± 16	0.016	204.6 ± 34	0.833
	post	142.7 ± 16		126.00 ± 14.2		235.6 ± 57.3	
TC (mg/dl)	pre	162.5 ± 20	0.843	193.3 ± 15.3	0.280	187.60 ± 19.5	0.488
	Post	152.8 ± 24		175.5 ± 18.9		237.2 ± 14	
HDL/LDL (mg/dl)	pre	0.035 ± 0.35	0.280	0.315 ± 0.02	0.030	0.40 ± 0.06	0.11
	post	0.32 ± 0.05		0.038 ± 0.36		0.26 ± 0.03	

Figure 1 - Comparison of HDL to LDL ratio before and after period



DISCUSSION

Medical plants are rich resources of natural antioxidant and are used in traditional medicine for control and cure of a lot of diseases. It is estimated that more than 800 types of plants are used as traditional local medicines for diabetes therapy (28). The ratio of LDL-C/ HDL-C is mentioned as the atherosclerosis factor that this ratio should be in the minimum level less than 4 (29).

The research results showed that after 4-weeks aerobic training, the glucose amount of plasma decrease and the ratio of HDL to LDL has a meaningful increase (p<0.028) in experimental groups. Regarding the possible mechanisms, we can mention to the following matters.

According to this matter that obesity is the most important factor in resistance development to insulin, decrease of fat weight can cause the sensitivity improvement to insulin (23, 30). Several studies are recorded the decrease of fat weight after aerobic training. Aerobic training increase the oxidative capacity of skeletal muscle via increase of using fat acid of plasma and increase of protein carrier of fatty acids (10). After reduction of fat weight, the lipids oxidation decrease and glucose homeostasis increase. Moreover, insulin secretion and plasma insulin concentration decrease after weight loss of the body significantly (16). According to the research, the activity of PI3K (Phosphatidylecoline inositol 3 kinase) and insulin receptor's substrate (IRS) and tyrosine are doubled after weight loss (30). Decrease of fat weight with reduction of liver glucose, increase of insulin secretion from the pancreas and increase of sensitivity to insulin cause blood sugar control. According to the mentioned mechanisms, it is probable that the meaningful decrease of fat percentage as well as weight loss of tested persons in experimental groups for the group 1, is one of the decrease causes of the ratio LDL to HDL. With these results in group1, it seems that aerobic training and Anethum Graveolens usage have better effect on lipoproteins and blood sugar.

It has been shown that resistance to insulin is associated with high triglyceride concentrations (31). Some effective adaption according to aerobic activities is the increase of mitochondria volume and after that it is the activity of responsible lipolize enzymes that cause the increase of fat catabolism ability during exercise activity (32). Aerobic training cause the increase of fat oxidation and decrease of triglyceride in diabetics patients. Moreover, it is shown that the increase of lipoprotein lipase activity according with the activity and time of recovery cause the increase of

triglycerides application and uptake (10) and the sum of mentioned matters can probably be one the causes for positive changes in diabetic patients' blood fat profile after aerobic training.

In the current research, TG is decreased that is the same with the results of Yazdan Panah (33) and Haj Hashemi (34)'s research but is differed with the results of Ghahremani (35) research.

In the most of done studies on the effect of Anethum Graveolens usage and blood fats like Ghahremani (35), Davoodi (36), Kazemi (37), Yazdan Parast (38) and Haj Hashemi (34), the serum cholesterol average has a meaningful decrease according to the Anethum Graveolens usage (although it is not used the exercises activities in these researches). Although the total cholesterol average of tested persons after 4 weeks decrease from ± 15.3 193.3 to 175.5 ± 18.9 in aerobic group and from 162.5 ± 20 to 152.8 ± 24 in exercise group according with Anethum Graveolens usage in our research but this decrease is not meaningful and is the same with Shahjerdi (39) results and has difference with the results of Hal and et al (40). The available difference between the results of various researches can be as a result of the difference between the age and sex as well as kind of research samples. The positive changes that is seen in the level of blood cholesterol can be as the result of body composition change following the exercises (39) and mean while it seems that no significant changes of patients' TG maybe is for 4-weeks exercises. It is probable if the exercises are continuing more than 4 weeks, these changes will be clearer.

In the current research, HDL has a meaningful increase ($P < 0.029$) in experimental groups in comparison with the control group. The cause of HDL increase maybe is the increase of lipoprotein lipase enzyme's activity (LPL). LPL enzyme is effective in changing VLDL to HDL; and with its activity increase, the HDL-C level is increase, too. On the other side, lypstyn cholesterol acyl transferase (LACT) changes the cholesterol to HDL particles more than LDL. It is probable that the increase of this enzyme cause the HDL increase as the result of trainings (41). The comparison of serum HDL level is the same with Kazemi (37) results before and after this period in the current research; but it differs with other researches like Ghahremani (35), Davoodi (36), Yazdan Panah (33) and Haj Hashemi (34) since the tested persons did no exercises in these researches.

Glucose lowering effect of a large number of medicinal plants is surveyed in animals' models as well as clinical studies and they are approved. Herbal antioxidants have an effect like insulin and increase the glucose absorption in peripheral tissues. Other possible mechanisms of Anethum Graveolens are the effect of beta cells and repair as well as reconstruction of damaged cells and stimulation of these cells to secrete insulin. The mechanism of antioxidant compounds action in reduction of lipids and lipoproteins is via the inhibition of cholesterol biosynthesis and increase of cholesterol conversion to bile acids as well as the increase of lipoprotein lipase activity (LPL). Therefore, the cholesterol density that is from the components of lipoproteins, decrease and after that, the synthesis of lipoprotein decrease, too. On the other side, activation of LPL cause the decrease of lipoprotein density as the result of its analysis increase (28). Disorder in glucose uptake in diabetic persons usually is as the result of disorder in GLUT4 operation or insulin signals transfer (30).

Contracting skeletal muscles has a huge capability in blood glucose uptake that is independent to the insulin effect. Exercises activity cause the stimulations and change of GULT-4 carrier shape and its transfer to cell membrane (41) and increase the fast uptake of glucose via active skeleton muscles via protein carriers (41, 42). Moreover, exercise with the increase of GULT4 gene expression increase the content of GULT4 muscle (10, 41). The increase of GULT4 gene expression in diabetic type 2 persons is recorded 22% after a period of body activity (12). The average of blood sugar (FBS) decrease after 4 weeks in the tested persons of aerobic trainings and Anethum Graveolens usage as well as aerobic trainings from 203.85 ± 19 mg/dl to 140.74 ± 68 and from 183 ± 12.5 to 133.80 ± 13.4 , respectively that is meaningful via statistical view. It is consistent with Shahjerdi (39), Mesi and et al (43)'s results while it differs with the results of Mohebbi and et al (44), Piri and et al (45) Seghal and et al (46), Kuza and et al (47) as well as Brus and et al (31). In the research of Segal and et al, no medicinal plant like Anethum Graveolens is used via tested persons in exercising period. Moreover, statistical sample of their research include the men and these two factors can affect the results. The results' difference with Koza and et al can be for this reason that the research sample is just for diabetic women besides the Anethum Graveolens usage but in the above research, the old men and women participate and maybe because of their oldness they could not perform their training with the similar intensity as the current research.

CONCLUSIONS

According to this matter that the most effective drugs for lowering the risk of cardiovascular diseases because of lipid disorders is medicines that decrease the low density triglyceride and lipoproteins as well as increase the high density lipoprotein level. Therefore, according to the gained results in this research, it seems that Anethum Graveolens usage according with aerobic trainings can be a suitable method for decrease of lipid disorders as well as decrease of blood sugar in diabetic persons.

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