Original Article

The effect of Aerobic exercise and Malva Sylvestris supplements on the lipid profile, glucose and WHR in obese and inactive women

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ABSTRACT

The purpose of this study was to investigate the effect of aerobic exercise and Malva Sylvestris supplements on the lipid profile, glucose and WHR in obese and inactive women. Fifty-two obese and inactive women with BMI more than 30 and age range of 20-45 years were selected and randomly divided into four groups: control, exercise, supplement and supplement-exercise groups. The exercise included 12 weeks and 3 sessions per week with an intensity of 80-85% heart rate. The results showed that Malva Sylvestris supplement had a significant effect on decrease of blood glucose, triglyceride, cholesterol, LDL, and WHR, and exercise alone had an effect on LDL and blood glucose decline. Supplement and exercising together had a significant effect on decreasing blood glucose, cholesterol, LDL and increasing HDL. Considering the positive effect of sport exercises with appropriate volume and intensity on sugar index and lipid profiles, as well as the effect of Malva Sylvestris supplement on some of these factors, the use of both interventions in inactive and obese women is recommended.

Keywords: Aerobic exercise, Malva Sylvestris, lipid profile, glucose, WHR.

Introduction

Sedentary life style and obesity has been considered as one of the top 10 health problem by WHO (World Health Organization).

This type of life style is the most important risk factor for cardiovascular disease which leads to some disorders such as increased blood lipids, high blood pressure and obesity. Obesity and overweight are a multifactorial phenomenon that have genetic and environmental bases such as life style. In fact, in developed countries, lack of physical activity and inappropriate diet are among the causes of obesity and cardiovascular disease [1].

The prevalence of obesity has led to an increase in researches about strategies to against obesity and cardiovascular disease and it's associated with metabolic risks has increased. In women, following menopause, the move toward the rise in obesity, and especially abdominal obesity, increases the risk of metabolic syndrome and cardiovascular disease. The main risk factors for coronary heart diseases in women include increasing the amount of low-density lipoprotein (LDL-C), total cholesterol (CT) and the decrease level of high-density lipoprotein (HDL-C). Obese people have excessive levels of harmful fats such as TC, LDL, and triglyceride (TG). These fats sediment in arteries, causing their obstruction of the arteries and consequently, the narrowing of the wall of the veins and leads to hypertension. [2]

Changes in lifestyle such as the increase of physical activity and the use of low-calorie diet are recommended as the first

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intervention for reducing excessive body fat and the development of cardiovascular disease and metabolic disorders complications [3]. In fact, comparing to polyphagia, inactivity is a more effective factor in the increase of obesity. To lose weight, a negative energy balance is needed through the decrease of calories intake and the increase of burnt calories. [4]

In this regard, some researchers has considered inactivity to be more important than calorie intake, and said that lack of attention to physical activity is a main characteristic of obese people. The more a person performs activities, the more energy he consumes daily and he will lose weight faster. Therefore, compulsory muscle activity is often considered as an essential step in obesity treatment. Because of the high risk of obesity, solutions that help to reduce or maintain weight are of particular importance. [3] In addition to the harmful effects of obesity on physiological health, it can lead to risky disorders in the function of organs. Todays, being inactive is one of the problems of society which causes obesity and cardiovascular diseases among people. It seems that using Organic plant materials are so effective in losing weight. [5]

Using organic plant foods and supplements as a way of losing weight, treating diseases and metabolic disorders is increased among the people. Foods containing flavonoids reduces the mortality rate due to cardiovascular disease. The main sources of flavonoids include tea, berries, apples and onions. These sources contain mainly catechin such as epigallocatene gallate (EGCG), epigallocatechin, epicatechin gallate and epicatechin. The most abundant catechin in Tea and especially green tea is EGCG which mainly have been studied for its effects on cancer prevention and cardiovascular disease; there are evidences which show that EGCG has a metabolic role and can be effective in reducing body fat and food intake. [3] EGCG also lowers triglyceride, cholesterol and leptin of blood; on the other hand, stimulates energy metabolism and increases HDL level. [6]

Le Mura et al. (2000) showed after six weeks detraining in young women had not changed on blood lipid profile in endurance and decreased strength in all three groups (strength, endurance, aerobic) [7]. In another study, a four-week aerobic exercises also reduced LDL and TC, and increased HDL in healthy women and men [8]. Some researchers believe that exercises rarely affect the levels of LDL and TC unless they are accompanied by diet or weight loss [9]. Other studies prove that exercises, independently and regardless of the effect of weight, can have a positive effect on the lipid profile of the blood [10]. Other researchers believe that weight loss and fat loss are important for the exercise to be more effective on blood lipids, but weight loss is not a necessary for changes in plasma lipoproteins [9]. In people with normal level of TG, aerobic and strength exercises will not have much effect on lipid profiles [11]. In other words, the exercise mainly affects the lipid profiles of individuals whose LDL or TG is higher than base level or the ones who have lower HDL [12].

Malva Sylvestris is an almost odorless plant and has taste. Its width is about 3-5 cm and its height is not more than 20mm. dong a research in a region of Syria, archaeologists proved that this plant had edible and medicinal usages according to fossils of teeth. [13] In other researches, its antioxidant and anti-cancer properties have been proven. It is also used as a laxative, liver detoxifier tonic and heals heartburn [14].

M.Sylvestris is commonly used as a vegetable; it is a medicinal plant and is called "Panirak" in Iran. These flowers and bushes are used to treat scars, eczema, infected scars, bronchitis, digestive problems, and inflammation [15]. M. Sylvestris reduces total cholesterol and triglyceride [16]. In a study, this plant is considered as a factor of weight loss [17]. The ingredients of this plant and their effects have been reported in a research.

According to WHO, aerobic exercises can reduce appetite by altering the release of the two main hormones of appetite, called ghrelin, and peptide Y. While new studies show that exercises such as weight lifting only affect the amount of ghrelin, it does not affect the second hormone; its effect on reducing appetite is less. On the other hand, previous studies have shown that lipid profile is improved by aerobic exercise. [12, 18]

To complete the effect or increase the positive effect of exercise, a diet or use of certain foods as supplements are needed. Some researchers argue that exercise exercises rarely affect the level of LDL and TC unless they are accompanied by a reduction of amount in diet or the interactive effects of supplement and exercises [19].

The aim of this research is to study a package of aerobic exercises along with using M. Sylvestris as a supplement on obese and inactive women. Its results can be helpful to control the complications of physiologic obesity by energy metabolism betterment and the weight loss and also help society against obesity complications.

Method

Isfahan obese inactive women who had the Inclusion Criteria for this study, they were entered into the study through a recall in the course of the implementation of the research and after signing voluntary consent. The necessary conditions include body mass index higher than 30, lack of regular physical activities, not being pregnant, not to smoke during recent six months, not having any diseases which are effective in diet or physical activities, not taking any medicine which has effect on heart beats or weight, not having more than 10% increase or decrease in weight in recent six month. A total of 52 subjects were randomly assigned into four groups. Then, they were asked to come to the gym the following day after a minimum of 8 hours of fasting, in which the medical team was stationed for venipuncture and examinations. The exercise test was taken before their menstruation cycle. Samples were randomly divided into four groups as follows.

The first group includes those who daily took two 250 mg capsules of M. Sylvestris supplement and three aerobic exercise sessions per week. The second group daily took two 250 mg capsules of M. Sylvestris placebo and three aerobic exercise

sessions per week, the third group daily received two 250 mg capsules of M. Sylvestris supplement and the fourth group was the control group. Capsules were provided at the Pharmacy Faculty of Isfahan University of Medical Sciences.

The members of supplement group took two 250 mg capsules of M. Sylvestris daily and the ones in placebo group daily took two similar placebo (Lactose) during 12 weeks. At the end of مداخله period, they came again to be checked up considering the physical condition, the taken medicines, their height, weight and blood pressure. The day after, they came again for venipuncture and exercise test (after a minimum 8 hours of fasting). They were asked to keep their usual diet and physical activities during the study. Their adherence was also discussed by considering the residue capsules at the end of 12th week:

Total capsules adherence = capsules they received – non-taken capsules

The exercise program includes 10 minutes warm up, 40 minutes' aerobic exercise and 10 minutes cooling down. The exercise program started with 60-70 percent heart beat and by considering overloading, it reaches to 80-85 percent during 12 weeks. After three days from the final session, all measurements and venipuncture were done like before.

Shaipro-Wilk test was used to evaluate the normality of data. T-test was used to compare the pre-test and post-test for normal data and Wilcoxon test was used in data that did not have normal distribution. To compare the groups, for normal distributed data, one-way ANOVA and LSD post hoc test was used. In non-normalized data, Kruskal-Wallis method was used to compare the groups and Mann–Whitney U test was used to compare the groups two by two.

Result

In the test group two people were omitted and one of them went to control group because she didn't attend in exercises.

The demographic characteristics of individuals in pre-test and post-test are presented in Table 1.

Table 1: Demographic characteristics of individuals in pre-test and post-test, and paired-sample t-test

group	variable	Pre-test		Post-test		T	df	P-value
		mean	Standard deviation	mean	Standard deviation			
control	age	33/7	21/11					
	weight	92/20	9/38	92/63	9/33	-2/825	13	↑ 0/014
	BMI	36/62	2/54	36/8	2/63	-2/902	13	↑ 0/012
	Waist circumference	106/1	6/66	106/4	6/93	-1/794	13	0/096
	Hip circumference	118/3	5/02	118/5	5/03	-4/192	13	↑ 0/001
exercise	age	35/9	82/27					
	weight	93/84	10/90	92/55	11/97	1/245	10	0/242
	BMI	36/26	3/45	35/75	3/81	1/343	10	0/209
	Waist circumference	106/4	5/91	104/7	6/47	-1/845	10	0/095
	Hip circumference	122/8	5/94	118/1	8/38	3/449	10	0/006
supplement	age	40/7	0/29					
	Weight	89/48	15/86	91/58	15/79	3/338	12	0/006
	BMI	38/42	5/15	37/53	5/13	1/355	12	0/000
	Waist circumference	112/7	8/63	110/3	8/68	1/379	12	0/183
	Hip circumference	122/7	8/85	121/0	8/42	4/165	12	0/001
Supplement-exercise	age	31/7	38/14					
	weight	96/83	11/89	101/6	12/27	4/41	12	0/001
	BMI	38/82	4/00	36/97	3/88	6/76	12	0/000
	Waist circumference	109/15	9/00	104/2	7/76	-4/38	12	0/001
	Hip circumference	126/00	10/86	119/3	10/13	4/63	12	0/001

↑ Increase comparing to pre-test

BMI increased significantly by 0.2 in control group. In other groups, it decreased about 2 kg/m^2 which was significant in supplement and supplement-exercise group.

Table 2: Variables measured in pre-test and post-test in different groups as well as paired-sample t-test and degree of freedom, and significant differences between pre-test and post-test

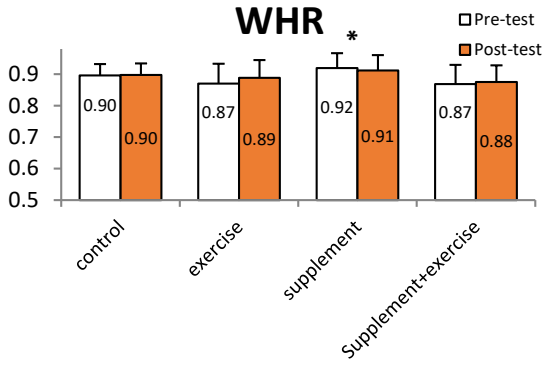
group	variable	Pre-test		Post-test		T	df	P-value
		mean	Standard deviation	mean	Standard deviation			
	WHR	0/90	0/04	0/90	0/04	-0/633	13	0/537
	HDL	51/93	546/	51/43	5/75	0/922	13	0/373
	LDL	113/9	31/62	114/8	31/38	-4/192	13	↑0/001
	TG	149/7	54/75	156/3	63/27	28/0	13	↑0/016

TC	187/1	33/82	182/1	22/92	0/888	13	0/391
GL	97/0	23/9	97/71	19/13	-0/533 [a]	13	0/603
WHR	0/87	0/06	0/89	0/06	-1/787	10	0/104
HDL	50/0	6/54	51/64	6/86	-1/845	10	0/095
LDL	111/7	19/11	105/4	2/53	3/449	10	0/006
TG	114/1	45/83	117/0	47/95	11/50	10	0/844
TC	175/6	25/33	173/7	26/45	2/034	10	0/069
GL	95/27	4/41	92/27	5/29	4/96 [a]	10	0/001
WHR	0/92	0/05	0/91	0/05	2/577	12	0/024
HDL	53/39	7/50	52/39	6/55	1/379	12	0/183
LDL	121/7	30/09	113/8	3/84	165/4	12	0/001
TG	114/8	55/88	100/1	52/40	1/50	12	0/006
TC	186/4	35/89	181/7	33/76	4/243	12	0/001
GL	97/69	5/51	95/15	4/98	6/08 [a]	12	0/000
WHR	0/87	0/06	0/88	0/05	-0/67	12	0/517
HDL	53/39	7/75	57/08	9/96	-4/38	12	0/001
LDL	114/6	20/61	106/1	18/85	4/63	12	0/001
TG	130/0	68/22	130/4	59/35	37/0	12	0/889
TC	181/1	22/40	174/3	17/76	4/18	12	0/001
GL	104/46	15/48	96/38	8/80	3/19 [a]	12	0/008

↑ Increase comparing to pre-test

a as glucose wasn't distributed normally, U-mann- whitney amounts are considered

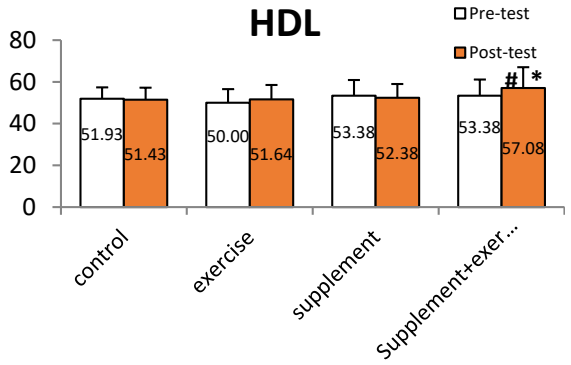
TG and LDL increased significantly in post-test in control group and in other groups, LDL decreased significantly and TG had a significant decrease in supplement group



* significant difference comparing to pre-test

Figure 1: Mean and standard deviation of pre-test and post-test WHR in groups

ANOVA showed that there was no significant difference between the groups. Changes in pre-test and post-test between groups were almost significantly different ($P = 0.09$, $F_{3,\ 47} = 2.3$). In supplement group, WHR significantly decreased comparing to pre-test ($P = 0.024$, $T_{12} = 2.58$).



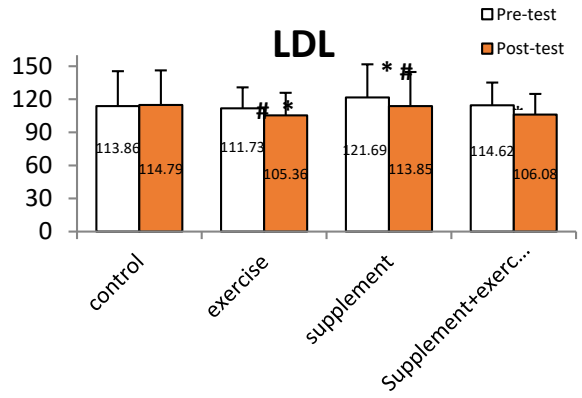
*significant difference comparing to pre-test

#significant difference comparing to control group

Figure 2: Mean and standard deviation of pre-test and post-test HDL in groups

T-test showed that only the exercise and supplement groups had a significant increase in HDL ($P = 0.001$, $T_{13 = 4.38}$).

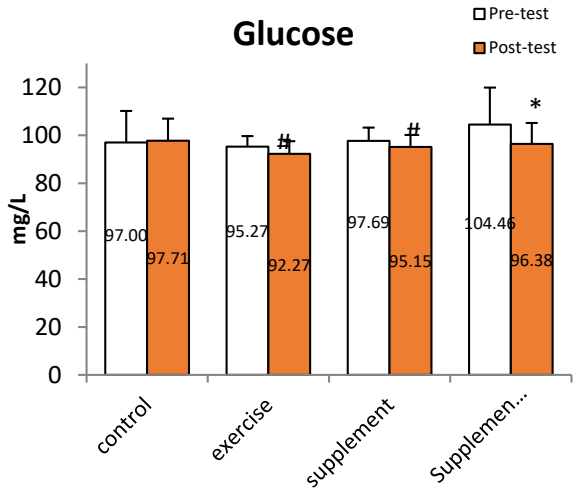
ANOVA results showed that there was a significant difference between the pre-test and post-test changes between the groups ($P < 0.001$, $F_{3,47} = 2.55$), and post hoc test showed that the control group with the supplement-exercise group ($P = 0.001$), as well as supplement group with supplement-exercise group ($P < 0.001$) and with exercise group ($P < 0.025$) had significant differences.



* significant difference comparing to pre-test
# significant difference comparing to control group

Figure 3: Mean and standard deviation of pre-test and post-test LDL in groups

T-test showed that there is a significant decrease in LDL among three groups, exercise, supplement and supplement-exercise. By comparing the changes between pre-test and post-test, ANOVA showed that there is a significant difference among groups ($P < 0.001$, $F_{3,47} = 8.28$). Post hoc test showed that there was a significant difference between control group and supplement group ($P = 0.001$) exercise- supplement group ($P < 0.001$) and also exercise group ($P < 0.001$).



* significant difference comparing to pre-test
# significant difference comparing to control group

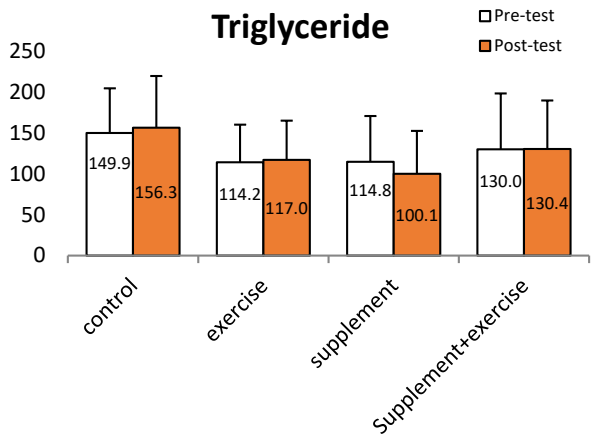
Figure 4: Mean and standard deviation of pre-test and post-test glucose in groups

Wilcoxon signed-rank test showed that there is a significant decrease in glucose serum between exercise, supplement and supplement- exercise groups ($P < 0.001$, $Chi2_3 = 21.20$)

Since the data was not distributed normally, Wilcoxon signed-rank test was used for comparing the groups. The results showed that the changes from the pre-test to post-test had significant relationship among the groups.

By comparing the groups two by two using Whitney test, it became clear that the changed amount in control group comparing to the three groups, exercise ($P = 0.003$, $Z = -3.01$), supplement ($P < 0.001$, $Z = -3.56$) and supplement – exercise ($P = 0.003$, $Z = -3.01$) had significant differences.

There was also a significant difference between exercise and supplement exercise group ($P = 0.044$, $Z = -2.01$).



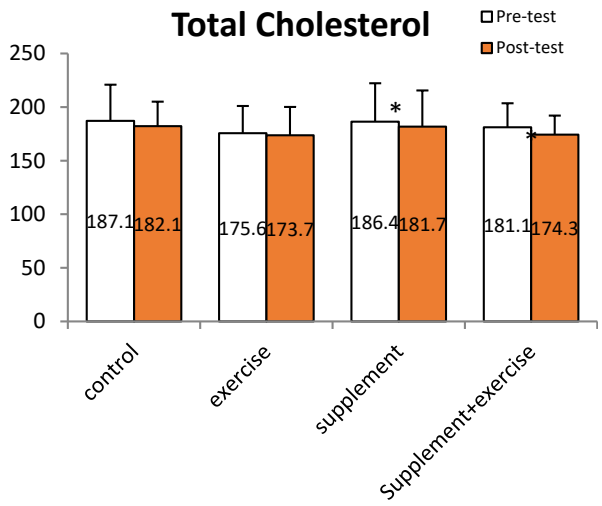
* significant difference comparing to pre-test
# significant difference comparing to control group

Figure 5: Mean and standard deviation of pre-test and post-test Triglyceride in groups

The Wilcoxon test showed that among the three groups, only the supplement group had a significant decrease in triglyceride level ($P = 0.027$, $Chi2_3 = 14.9$).

Since the distribution of data was not normal, Kruskal-Wallis test was used to compare the groups. The results showed that there is a significant difference in changes comparing the pre-test and the post-test between the groups.

By comparing the groups two by two using Mann Whitney test, it was found that only the changes in the control group were significantly different from the changes in the supplement group ($P = 0.003$, $Z = -3.02$).



*significant difference comparing to pre-test

Figure 6: Mean and standard deviation of pre-test and post-test total cholesterol in groups

T-test showed that supplement group (P=0.001, T_{12} = 4.24) and supplement-exercise group (P=0.001, T_{12} = 4.18) had significant decrease in post-test. It can be concluded from ANOVA results that there is no significant changes among the groups, comparing pre-test and post-test.

Discussion

In this study, the effect of aerobic exercise and Malva Sylvestris supplements on the lipid profile, glucose, and WHR in obese inactive women was investigated. Fifty-two obese women with a BMI of over 30 participated in this study in four groups. The exercise was considered for 12 weeks, 3 sessions per week, with the intensity of 80-85% heart rate. The results showed that the effect of time and group was significant on LDL and glucose. HDL and total cholesterol in the supplement-exercise group, WHR and triglyceride in the supplement group were significantly different comparing with the pre-test.

Lipid profile

In All three groups, exercise, supplement and supplementary exercise groups had a significant decrease in LDL. The only significant effect in increasing HDL in the exercise-supplement group was. Cholesterol decreased significantly in supplement and exercise-supplement groups (table 2). There was a significant decreasing in triglyceride levels in the supplementation group (table 2).

Studies have investigated the effects of drinking green tea containing Catechin on body composition and fat distribution in obese and overweight adults during physical activity, and reported that the group receiving Catechin drink had a significant reduction in the concentration of free fatty acids and TG serum; abdominal and total fat decreased significantly. However, there was no change in total cholesterol and lipoprotein levels. Researchers believed that adding Thioflavin to the green tea extract is the cause of this result [20].

In contrast, another study proved that drinking of beverages containing catechin for 12 weeks showed significant reduction of body and subcutaneous fat in healthy Japanese men but it did not affect the blood lipid profile [21]. They also indicated that the amount of Cateschin was not enough for preventing mussel formation. In another study (2007), he concluded that Catechin can lower LDL [22].

The effect of different exercise program on lipid profile has been reported in different studies [10, 18, 23]. Recently, the effect of aerobic exercises, along with supplement, especially green tea on lipid profile has been studied [24, 25].

Considering the studies, it seems that aerobic exercise along with taking Malva Sylvestris supplements can has synergetic effects on lipid profile.

Glucose

Every three groups of intervention, exercise, supplement and supplement-exercise showed significant decrease in the amount of glucose serum. The changes of control group were significantly different comparing other groups changes.

The effects of various exercise programs on blood glucose have been reported in different studies. Recently, the positive effects of aerobic exercise on blood glucose while taking the supplements such as Urtica [26], L-carnitine [27], and Cinnamon [28] have been reported in several studies. Of course, some studies have also reported that exercises are ineffective considering blood glucose [29], the volume and intensity of exercises, as well as adherence to exercises must be considered in these cases.

Waist-hip ratio (WHR)

The Waist-hip ratio or waist-to-hip ratio (WHR) is the dimensionless ratio of the circumference of the waist to that of the hips. This is calculated as waist measurement divided by hip measurement. The World Health Organization (WHO) considers waist measurement about 94-101.9 cm for men and 80-87.9cm for the women and also which is more than 0.8 among women and 0.9 among the men as the equivalent for body mass index (BMI) in overweight about [23-25, 30-32].

The adipose tissue, especially in the abdominal areas, causes the secretion of hormones that stimulate the growth of adipose tissue cells as well as appetite. Therefore, obesity, especially abdominal obesity, cause more obesity. So, obesity around the abdomen and waist is more dangerous. According to studies, waist measure more than 80 centimeters for women and 94 centimeters for men can increase the risk of heart attack [33]. Hadaegh et al. (2006) found that the waist measure more than 94.5 for Iranian men and women increases the risk of death from heart disease. So that, the risk of atherosclerosis is higher among ones with normal height to weight ratio and bigger waist. If the measure of waist is over 102 cm in men and is over 88 cm in women, the risk of stroke is four times more, comparing the normal waist measure [33]. Talaei et al (2008) investigated that there is a relationship between the waist measures over than 89 and 91 for men and women respectively and the risk of metabolic syndrome.

Since the measure of waist and abdomen can be smaller or bigger considering genetic bases, it's not a proper criteria for determining abdominal obesity; therefore, in recent years, the waist to height ratio (Waist to Height Ratio = WHTR) or Waist to Hip (WHR) is also used [34-36]. In some studies, men and women with more than 0.5% WHTR are considered as the ones with abdominal obesity. Hadaegh et al. mentioned 0.55 and 0.62 as risk ration for both men and women [33].

According to researches, if the waist to hip ratio (WHR) in men is higher than 0.97 and in women is higher than 0.84, the risk of stroke is about 8 times more comparing to men and women with ratios of less than 0.92 and 0.78. As Hadaegh et al. said, if this ratio is greater than 95% for men and 90% for women, the risk of death from heart disease will increase [33].

Conclusion

It can be said that Malva Sylvestris supplement, by itself, had significant effect on the decrease of blood Glucose, triglyceride, cholesterol, LDL and WHR.in this study, the exercise just had effect on LDL and blood glucose.

Supplement and exercise together affect significantly on blood glucose, LDL and HDL. Their interactive effect was about the increase of HDL. They didn't have any effect on HDL alone.

Considering the previous studies and the effects of different exercise with proper time and intensity on positive changes of glucose and lipid profile indexes and also the effect of Malva Sylvestris supplement on some of these indexes by itself, it is recommended to use both of these intervention inactive obese women.

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