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ORIGINAL ARTICLE

Effects of consuming purslane seed powder on indicators of metabolic syndrome in women: a randomized clinical trial

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Summary. *Introduction:* The aim of this study was to investigate the effect of purslane seed powder on indicators of metabolic syndrome in women with this syndrome. *Materials & Methods:* In this study, 64 middle-aged women (30-59 years old) with metabolic syndrome were randomly divided into two groups. The intervention group received 10 grams purslane seed powder combined with 150cc low fat yogurt daily for 12 weeks. The control group received only 150cc low fat yogurt daily for 12 weeks. At the first and at the end of the study, the height, weight, BMI, waist and biochemical indices such as LDL, HDL, TG, FBS and the blood pressure of all of participants were measured. *Findings:* The average age of the participants was 42.8 year. After consuming the purslane, there was significant decrease in weight (-1.07 versus 0.06 kg, p<0.001), BMI (-0.47 versus 0.009 kg/m2, p<0.001) and waist circumference (-2.06 versus -0.125 cm, p=0.001). Although there was decrease in serum levels of LDL (p<0.001) and TC (p=0.004), there was no meaningful change in serum levels of HDL and triglyceride. Also, consuming the purslane for 12 weeks meaningfully decreased the fasting blood glucose (-8.50 mg/dl, p=0.001), but it did not have any significant effect on systolic (-5.46 versus -2.81 mmHg, p=0.108) and diastolic blood pressure (-0.781 versus -1.40 mmHg, p=0.589). *Conclusion:* Consuming purslane for 12 weeks by women with metabolic syndrome decreased the anthropometric indices (BMI, waist & weight) and serum levels of LDL, TC & FBS.

Key words: metabolic syndrome, purslane, women

Introduction

Metabolic syndrome is a series of risk factors that increase the risk of cardiovascular diseases; type 2 diabetes and mortality resulted from cardiovascular diseases (1). There are different definitions for metabolic syndrome provided by Modified ATPIII and IDF. In these definitions, the indices of serum triglyceride, HDL cholesterol, abdominal obesity, high blood pressure and fasting blood sugar are used**.** In IDF definition, the abdominal obesity is the main criteria that together with two other criteria, they represent metabolic syndrome. In these criteria the abdominal obesity rating is 94cm in men and 80cm in women. Despite the Modified ATPIII criteria in which the abdominal obesity rating is the waist 102cm in men and 88cm in women, other criteria are the same in two definitions (2, 3). The studies indicated that the concurrency in the development of these metabolic factors is more harmful than each of them alone. According to Framingham study, the metabolic syndrome predicts nearly 25% of the new cardiovascular diseases (4). In recent years, the incidence of metabolic syndrome has increased in many countries. Its incidence has been estimated 10-25% in adults around the world (5). In Iran, based on Tehran lipid and glucose study (TLGS), 42% of women and 24% of men suffer from this syndrome (6).

Using medicinal plants has a long history in controlling chronic diseases. One of the most important

medicinal plants is purslane. It is a good source of active biologic compounds including omega-3, βcarotene (7), amino acids, βtocopherol, ascorbic acid, glutathione(8) and phenolic compounds (9). The recent studies indicate that purslane has more nutritional properties compared with other vegetables. Specifically, this plant has more linolenic acid than other examined plants. This fatty acid is the precursor of essential long chain omega-3 fatty acids which are found mainly in sea animals (10). These fatty acids have benefits such as the inhibition of cancer, cardiovascular diseases, high blood pressure and immune system disorders (11). Due to the nutritional and anti-oxidant properties of purslane it is described as power food in future (12). WHO reported purslane as the most consumed medicinal plants. It is titled as Global Panacea which means a comprehensive elixir or panacea (13). This Plant is anti-bacterial, anti-viral, anti-diabetes, and strengthens the immune system. For this reason, in Chinese literature it is a plant for long life(14).

Based on our knowledge, till now, there has not been any study to investigate the effect of purslane on metabolic syndrome. The previous studies have surveyed the hypocholesterolemic (15,16) and hypoglycemic (17) effects of purslane in animal sample. Few studies also examined the effect of purslane on diabetes type 2 patients (18,19). According to the effects of purslane on diabetic and dyslipidemia patients, this study was conducted to examine the effect of purslane seed powder on metabolic syndrome.

Materials and Methods

Participants: This is a randomized clinical study performed on 64 women with metabolic syndrome at the age of 30-59 years old referring to 22 Bahman health center in Bam city. This study was conducted during July to December 2016. Based on sample size equation proposed for clinical trial studies, the sample size was achieved 28 individuals(124.62 ± 36)(6). Including the loss of 10%, 32 individuals were selected as study sample in each group. The diagnosis of metabolic syndrome was done based on IDF criteria (20): abdominal obesity more than 80cm, BP≥130/85, TG>150, HDL<50 and FBS>100, or consuming drugs to treat the last 4 indicators. In addition to having metabolic syndrome, the inclusion criteria were no pregnancy and lactation, no change in the type and amount of drug were considered during 3 months. People with chronic diseases (hepatic, cardiovascular, thyroid, autoimmune, renal and pulmonary diseases) and people with allergy to purslane did not enter the study. The people were authorized to leave the study whenever they wanted. All people fulfilled the informed consent form. The study protocol was approved by ethic committee of international campus school of Shahid Sadoughi University in Yazd (111126/1/17/β).

Study Design

The individuals were randomly divided into two groups. The intervention group received 10 grams purslane seed powder with 150cc low fat yogurt daily. The control group received only 150cc low fat yogurt daily for 12 weeks. The participants were asked not to change their common food or physical activity during the study. Also, they were asked to inform the researcher about the probable change in dose or type of their drugs. The powder was packed in 5 gram packs. At each visit, the amount of powder to be consumed in three weeks was given to the participants. Dietary intake of the individuals was controlled by 24 hour recalls at the beginning and the end of study. The individuals' adherence was examined by consumption check list and weekly telephone interview. The amount of physical activity was measured before and after the study using international physical activity questionnaire (IPAQ).

Biochemistry analysis

At the beginning and at the end of the study, fasting blood samples (5 ml) were collected from individuals. Venous blood samples were taken according to standard protocols and biochemical variables were measured by Pars Azmoon kits with the photometric method and by Auto-analyzer BT 1500 (made in ITALY).

Blood Pressure measurement

Blood pressure was measured after 15 minutes of rest in a sitting position and with standard mercury manometers(ALP K2,JAPAN) . Overall for every one

blood pressure measured 2 times: At first and the end of intervention.

Anthropometric Measurements

Individuals' weight was measured without clothes and shoes by Seca scale(Made in GERMANY with 100 gr accuracy) . The individuals' height was measured in upright position without shoes while shoulders were in normal position by Seca stadiometer(Made in GERMANY with 0.5 Cm accuracy) . The BMI was calculated by dividing weight in kg by height in square meter. The waist circumference was measured by tape between the last rib and the iliac crest bumps.

Statistical analysis:

In order to ensure compliance of variables with normal distribution, the Kolmogorov-Smirnov test was used. The logarithm of abnormal data was calculated for non-normal variables. The normal quantitative data were compared between two groups by independent T test analysis. The normal-distributed quantitative data in each group were compared by paired T test. The demographic properties were compared between two groups by using Chi-square test. All the statistical analyses were at significant level of 95%.

Results

The general characteristics of the participants are in Table 1. The mean of age of the participants was 42.8 years old. All the participants were female. The dietary intake of participants was examined before and after the study. There was no meaningful difference in receiving macronutrients between the groups. Also, due to our request from individuals not to change their physical activity during the study, the level of physical activity during the study was stable and there was no meaningful difference between two groups (76.15 versus 76.14 MET – h/d, p=0.953). The effects of intervention on anthropometric indices are summarized in Table 2. The average of weight in intervention group at the beginning of the study was 73.84±11.65 Kg. The 12-week intervention caused meaningful decrease in the weight of intervention group in comparison with control group (-1.07 versus 0.06 kg, p<0.001). Also, consuming purslane caused significant decrease in BMI (-0.470 versus 0.009 kg/m^2, p=0.001) and waist compared to control group (-2.06 versus -0.125 cm, p=0.001).The effect of purslane on metabolic profile of individuals with metabolic syndrome is shown in Table 2. After 12 weeks of intervention, there was significant decrease in fasting plasma glucose level in comparison to control group (-8.50 versus 0.000 mg/dl, p=0.001).

Table 1: Comparison Average and STD Age and Anthropometric indices participants before and after the intervention

Parameter		**intervention (n =32)**	**control (n =32)**	**p**
Age (year)		42.16± 5.48	43.16±8.33	0.429
Weight(kg)	baseline	73.84 ± 11.65	73.50 ± 11.27	0.905 *
	12 weeks	72.76 ± 11.96	73.56 ± 11.45	0.786 **
	Changes	-1.07±1.20	0.06±1.04	<0.001***
	P – value*	<0.001	0.737	
BMI	baseline	28.23 ± 4.43	26.30 ± 3.72	0.064*
(kg/^{2}m)	12 weeks	27.76 ± 4.54	26.30 ± 3.78	0.170**
	Changes	-0.470±0.407	0.009±0.36	<0.001***
	P – value *	<0.001	0.888	
Waist	baseline	102.53 ± 10.49	101.90 ± 10.13	0.610*
(cm)	12 weeks	100.46 ± 10.54	101.78 ± 9.94	0.809**
	Changes	-2.06±2.72	-0.125±1.23	0.001***
	P – value*	<0.001	0.572	

* Independent two sample t-test
**ANCOAVA
***Paired sample t- test

Table 2: Comparison Mean and STD Biochemical parameters and blood pressure before initiation and after the intervention

Parameter		intervention (n =32)	control (n =32)	p
FBS	baseline	129.87 ± 50.09	138.96 ± 78.60	0.583
(mg/dl)	12 weeks	121.37 ± 46.81	138.96 ± 79.70	0.286
	Changes	-8.50±12.18	0.000±4.30	0.001
	P – value*	<0.001	1	
H DL	baseline	43.75 ± 7.19	47.03 ± 7.93	0.088
(mg/d)	12 weeks	43.65 ± 6.77	47.43 ± 7.99	0.045
	Changes	-0.093±3.504	0.406±1.45	0.459
	P – value*	0.881	0.125	
TG	baseline	211.15 ± 115.65	191.31 ± 72.104	0.414
(mg/d)	12 weeks	188.40 ± 102.80	197.81 ± 69.36	0.669
	Changes	-22.75±37.123	6.500±20.41	0.108
	P – value*	0.002	0.081	
LDL	baseline	117.31 ± 46.54	117.06 ± 37.81	0.981
(mg/dl)	12 weeks	111.34 ± 44.00	119.72 ± 36.51	0.411
	Changes	-5.968±9.457	2.656±5.08	<0.001
	P – value*	0.001	0.006	
TC	baseline	196.56 ± 46	217.09 ± 49.34	0.090
(mg/dl)	12 weeks	188.03 ± 44.	219.28 ± 47.83	<0.001
	Changes	-8.53±16.34	2.187±11.59	0.004
	P – value*	0.006	0.294	
SBP	baseline	121.25 ± 16.16	117.66 ± 8.7	0.274
mmHg	12 weeks	115.78 ± 11.65	114.84 ±7.56	0.704
	changes	-5.46±7.65	-2.81±5.07	0.108
	P – value*	< 0.001	0.004	
DBP	baseline	77.03 ± 8.69	80.15 ± 6.02	0.100
mmHg	12 weeks	76.25 ± 6.60	78.75 ± 4.	0.076
	changes	-0.781±5.40	-1.40±3.64	0.589
	P – value*	0.004	<0.001	

* Independent two sample - test
**Paired – sample t- test

Table 3: Number and percent individuals suffer from metabolic syndrome parameters before initiation and after the intervention

Metabolic syndrom	Intervention(n=32)	Control(n=32)	P – Value *
baseline	32(100%)	32(100%)	1.000
12 weeks	31(96.9%)	26(81.25%)	0.019

* chi squre test

After consuming purslane, although there was decrease in serum level of triglyceride in the group receiving purslane, but the difference between two groups was not statistically significant(p=0.108). Also, in the intervention group, there was no meaningful change in serum level of HDL (-0.093 versus 0.406 mg/dl, p=0.459). Consuming purslane for 12 weeks significantly decreased serum level of LDL (-5.968 versus 2.656 mg/dl, p=0.001) and cholesterol (-8.53 versus 2.187 mg/dl, p=0.004). When we compared the

changes in two groups, there was considerable decrease in purslane group in proportionate to control group.

In both groups there was significant decrease in systolic and diastolic blood pressure, but the differences between two groups were not meaningful

Discussion

The results indicated that consuming purslane seed meaningfully decreased the weight, BMI and waist of women with metabolic syndrome. Despite the meaningful decrease in plasma triglyceride level in intervention group, the differences between two groups were not . While consuming purslane seed meaningfully decreased the serum level of LDL and TC, but it does not have any effect on serum level of HDL. At the end of the study there was meaningful decrease in systolic and diastolic blood pressure in both groups and the differences between the groups were not significant. Also, consuming purslane seed for 12 weeks decreased fasting blood glucose in intervention group.

Based on our knowledge, this is one of the primary studies that investigate the effect of consuming purslane seed on metabolic and anthropometric indices of women with metabolic syndrome.

Despite high prevalence of metabolic syndrome in the world, still there is no specific treatment to control and manage it (5). New researches indicated that purslane contains active biologic compounds that have beneficial effects on human health (21). In this study, consuming purslane for 12 weeks had meaningful effect on plasma fasting glucose level. The findings of our study are in compliance with previous studies on animals. Nearly in all previous studies, the effect of purslane on decreasing blood sugar has been observed. Gong et al. (17) showed the effect of hypoglycemic polysaccharides in purslane in rats. Other studies indicated the improvement in insulin resistance and hyperinsulinemia in rats (22,23). There are only few studies conducted on human (24,25). Elsayed et al. (18) indicated that consuming purslane in patients with diabetes type 2 decreased the fasting blood glucose compared with Metformin. In Zakizadeh et al. study (19) on diabetic patients, despite the small decrease in fasting blood glucose, consuming 10 grams purslane seed for 5 weeks did not have any effect on serum insulin.

Our study indicated that consuming purslane significantly decreased the serum levels of total and LDL-cholesterol, however, there was no meaningful effect on other lipid profiles. In previous studies there was the effect on decreasing blood lipid. Movahedian

Table 4: Comparison Mean and STD Macronutrients , Physical activity and energy before initiation and after the intervention

Parameter		Intervention(n=32)	Control(n=32)	P - value
Daily total Energy Intake(Kcal)	before	1577.99±870.24	1974.17±760.83	0.057
	after	1705.01±726.81	1975.44±623.75	0.115
Intake lipid(gr)	before	48.76±32.79	64.49±36.81	0.076
	after	46±37.26	62.26±35.91	0.089
%Intake energy of lipid	before	27.68±9.38	29.59±9.84	0.431
	after	26.40±9.85	28.31±8.41	0.408
Intake Protein(gr)	before	67.57±34.20	82.94±39.54	0.101
	after	69.86±35.85	84.83±32.03	0.083
%Intake energy of Protein	before	17.46±7.63	16.78±5.85	0.687
	after	18.25±5.06	18.68±6.79	0.771
Intake Carbohydrate(gr)	before	223.79±80.62	266.60±107.29	0.076
	after	230.28±101.09	262.09±70.05	0.149
%Intake energy of carbohydrate	before	54.84±10.31	53.28±10.09	0.542
	after	55.15±11.09	53.09±11.79	0.474
Physical activity	before	892.53±257.30	1013.32±355.99	0.125
	after	968.68±306.08	1089.46±344.71	0.143

et al. (16) reported that purslane extract meaningfully decreased the LDL and total cholesterol of rabbits with high cholesterol diet, but it did not have any effect on serum level of HDL. The same findings were observed in rats (15). A few studies examined the effect of purslane on human lipid profile. Consuming 1 gram purslane powder daily in obese adolescents for one month improved LDL and triglyceride but it did not have any effect on serum HDL and cholesterol (6). Two other studies indicated the effect of purslane seed on decreasing the blood lipid(24,25).

After consuming purslane, there was no meaningful decrease in systolic and diastolic blood pressure. Only in Zakizadeh et al. study the significant decrease in systolic and diastolic blood pressures was reported (19), other previous studies did not report anything about the effect of purslane on blood pressure.

Some mechanisms account for the beneficial effects of purslane on glycemic situation of patients. Maybe, the effect of purslane on decreasing the blood sugar is due to its effect on insulin secretion by closing the K+/ATP channels and its effect on membrane depolarization and calcium as the first key steps in secretion insulin(26). Another study indicated that receiving purslane seed meaningfully increased the level of glucagon-like peptide 1 in patients with diabetes type 2 (24). Glucagon-like peptide 1 is a peptide that is secreted from L cells of intestine. It has several physiologic functions such as improving the function of pancreas βcells, regulating insulin secretion and inhibiting glucose release (27). Purslane seeds have high amount of flavonoid (9,28) and the beneficial effects of flavonoids on lipid profile have been indicated in some studies (29,30).

The findings of our study were interpreted while considering the possible limitations. The most important limitations was work on women that don't able extended to entire society. Based on our knowledge, this is one of the primary studies that investigates the effect of consuming purslane seed on metabolic and anthropometric indices of women with metabolic syndrome.

Conclusion

This clinical trial study indicated that consuming purslane for 12 weeks in patients with metabolic syndrome improved the anthropometric indices, fasting blood glucose, and serum levels of total and LDL- cholesterol. further research is needed to determine the suitable amount of consumption in these patients.

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