The effects of Purslane (Portulaca oleracea L.) on serum level of lipids, lipoproteins and paraoxanase 1(PON1) activity in hypercholesterolemia patients

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Abstract: Some unverified reports around the world demonstrated that Purslane has therapeutic effects on some conditions. The aim of this study was to compare the effects of Purslane and Lovastatin therapy in decreasing serum lipids, lipoproteins, and paraoxanase1 (PON1) activity. In this clinical trial study, 93 patients with LDL-C more than 120 mg/dl who referred to the internal clinic of Kashani hospital in Sahrekord, Iran were selected and divided into two groups: Purslane (42 patients) and Lovastatin (51 patients). Fasting venous blood samples obtained before and 45 days after taking Purslane or Lovastatin, levels of all variables in the samples were measured. Our results showed that after receiving Purslane or Lovastatin serum level of cholesterol, LDL-C and OxLDL decreased. PON1 activity, ApoA1 and HDL-C increased but Triglyceride and body mass index (BMI) decreased Only in Purslane group. ApoB decreased only after taking Lovastatin. In conclusion, Purslane reduces some cardiovascular risk factors and increases PON1 activities better than Lovastatin.

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1. Introduction

Portulaca oleracea L. (Common Purslane, also known as Khurfeh in Iran) grows in most parts of the world and cultures in most countries. There are Water, pectin, protein, Carbohydrates, fatty acids, particularly unsaturated fatty acid ω3, antioxidant substances and Several mineral elements, including: iron, copper, manganese, potassium, calcium and phosphorus in different parts of this plant (Mohamed and Hussein, 1994).

This plant is an edible succulent 'weed' which is widely distributed in Iran. Fresh Purslane has a slightly sour and salty taste and is eaten by most of the southern aborigines of Iran. It is used as salad or is cooked and used as a soup. Its leaves, stems, flowers, and seeds are all used in Iranian folk medicine. Some unverified reports around the world demonstrated that Purslane has therapeutic effects in some conditions (Oh et al., 2000). Purslane has been traditionally used for treatment against parasites, and digestive disorders. It is also used to treat infections or bleeding of the genito-urinary tract. The fresh one may also be applied topically to relieve sore and insect or snakebite (Bensky, 2004).

Purslane contains many biologically active compounds and nutrients, including phenolic alkaloid pigments (Yang et al., 2009), flavonoids, glutathione and alpha-tocopherol (Simopoulos et al., 1992). Reddish Betacyanins and yellow Betaxanthins are also found in Purslane (Wang and Yang, 2010). Most of these compounds are very potent antioxidants and have been found to have anti mutagenic, anti-inflammatory and anti-fungal activities in laboratory studies (Xu et al., 2006).

Purslane contains more Omega-3 fatty acids than any other leafy vegetable plants and it contains extraordinary amounts of eicosapentaenoci acid (EPA). The leaves of Fresh Purslane are rich in alpha-Linolenic acid (Wang and Yang, 2010). It also contains polyphenols, vitamins (A,B,C,and carotenoids) as well as dietary minerals, such as calcium, iron, potassium , magnesium and selenium (Barbosa-Filho et al., 2008).

Cardiovascular risk factors can reduce by these antioxidants, Omega-3 fatty acids and some of vitamins or minerals.

It has been proposed that oxLDL plays an important role in the development of therosclerosis and is well recognized that HDL plays a protective role against atherogenesis and coronary heart disease (Knoflach et al., 2009; Vekic et al., 2007). HDL has also been a carrier of enzymes that destroys the lipid hydroperoxides that oxidize LDL phospholipids. Human paraoxonase-1 (PON1) is a calcium-dependent esterase associated with HDL particles (Vekic et al., 2007) and the antioxidant activity of HDL is largely due to the activity of PON1. Previous studies indicated that PON1 plays a protective role against the oxidative modification of plasma lipoproteins and has been shown to hydrolyze lipid peroxides in human atherosclerotic lesions (Fortunato et al., 2003).

The aim of this study was to compare the effects of Purslane and Lovastatin therapy in decreasing serum lipids, ApoA1 and ApoB containing lipoproteins, oxLDL level and PON1 activity in the two groups of patients with hypercholesterolemia from Iran.

2. Material and Methods

In this clinical trial study, 93 patients with LDL-C over than 120 mg/dl who referred to the internal clinic of Kashani hospital in Sahrekord, Iran were enrolled.

None of the patients was taking lipid-lowering drugs or any other medication known to affect lipid metabolism before beginning the study. The individuals with hypertension, diabetes mellitus, thyroid, hepatic, renal diseases and smokers were excluded from the study.

The patients filled out a consent form in and the Ethics Committee of the Shahre-kord University of Medical Sciences approved the study. The patients were divided in two groups of Purslane (N=42) and Lovastatin(N=51). In the Purslane group, almost 50 gr/day of fresh leaves and stems of Purslane were added to the patient's diet for 45 days. The second group received 20mg/day Lovastatin for the same period.

The study was approved by the Medical plants research center of Shahrekord University of Medical Science and its Ethics Committee. All patients gave their written informed consent. A consent form was read to them carefully and it was explained so that it will be fully comprehended and lastly signed by them. This study was registered in the Iranian

Registry of Clinical Trials (www.irct.ir) with registration number ID: IRCT138902063806N1.

Biochemical analysis:

A fasting blood sample was obtained from the patients before onset of receiving Purslane and Lovastatin and the second one, 45 days after the end of the treatment. Glucose, total cholesterol (TC) and triglycerides (TG) were assayed using standard enzymatic procedures. HDL-C and LDL-C were measured with direct method and ApoA1 and ApoB levels were measured by immunoturbidimeteric method. Creatinine also was measured by Jaffe method for excluding renal patients. All biochemical tests were measured in serum (BT 3000 automatic analyzer) using commercial kits by Pars Azmon Co. (Iran). Arylesterase activity was measured using phenylacetate as the substrate by the modified procedure of Kitchen et al (Kitchen et al., 1973). PON1 activity toward paraoxon was measured after the reaction of paraoxon hydrolysis into p-nitrophenol and diethylphosphate catalyzed by the enzyme (Rainwater et al., 2005). The oxLDL was measured by a sandwich ELISA method using a commercial kit (Mercodia- Sweden).

Data were analyzed using independent t-test, paired Student t-test and SPSS statistical software (ver.=11.5). P value was considered significant $P<0.05$.

3. Results

The patients fulfilled the process of the study and there were no dropouts. The average age of the patients in Purslane group was 44±9.6 and the Lovastatin group was 49±11.6 years old. No significant differences were found between the two groups tested in terms of the mean age and gender

The average Body mass index (BMI) before intervention in Purslane and Lovastatin groups were 27±3.9 and 26±4.9 Kg/m2 respectively ($p>0.05$).

There was a significant decrease in serum cholesterol, LDL-C and oxLDL in the two groups after taking both Purslane and Lovastatin but ApoB was decreased only after taking Lovastatin. PON1 activity was increased in the two groups and PON1 arylesterase activity, HDL-C and Apo A1only were increased in the Purslane group, but BMI and triglycerides were decreased in Purslane group (Table 1).

Table 1: The variables measured before and after receiving Purslane and Lovastatin in the patients studied

Groups Variable	Purslane (N=42)			Lovastatin (N=51)		
	Before Mean ±SD	After Mean ±SD	P value	Before Mean ±SD	After Mean ±SD	P value
BMI (kg/m^2)	27±3.9	25±4.1	0.032	26±4.2	26±4.4	0.65
FBS (mg/dl)	79±17.5	81±19.1	0.34	88±12.6	86±13.5	0.19
Total cholesterol (mg/dl)	215±34.5	197±31.6	0.02	235±29.4	191±31.5	0.01
Triglycerides (mg/dl)	189±75.5	169±61.6	0. 01	189±60.7	180±63.6	0.45
HDL-C (mg/dl)	38±10.5	42±10.2	0.024	39±8.9	41±9.5	0.38
LDL-C (mg/dl)	139±23.3	121±27.5	0.02	149±28.9	99±31.8	0.006
ApoA1 (mg/dl)	125±10.6	131±10.5	0.03	123±21.9	125±29.5	0.56
ApoB (mg/dl)	111±18.1	106±19.2	0.265	125±29.6	98±25.4	0.004
OxLDL (U/L)	68±19.1	61±19.9	0.011	86±14.6	73±15.4	0.007
PON1 arylesterase activity (U/L)	95±42.5	114±53.7	0.012	101±35.6	108±42.1	0.09
PON1 paraxonase activity (U/L)	198±111	276±132	0.034	205±117	265±114	0.021

4. Discussions

Many studies strongly support the hypothesis that oxidative modification of LDL plays a crucial role in the pathogenesis of atherosclerosis (Berliner JA, Heinecke W, 1996). PON1 may be a major defense barrier against lipid peroxides from oxidized LDL (Mackness et al., 1993). It needs to be known that whether factors, such as diet, medical herbs or lipid lowering compounds influence plasma PON1 activity or concentration.

Aryl esterase activity has a direct correlation with mass of PON1 protein (Van et al., 2006) and serum paraoxanase activity seems to have inverse relationship with coronary heart disease (Mackness et al., 2003).

Based on our results, the reduction in serum total cholesterol, LDL, oxLDL, and ApoB was observed in Lovastatin group which is in agreement with several other reports (Clauss et al., 2006).

Purslane contains almost all of the nutrients and it is an excellent source of the antioxidant, vitamins, α-tocopherol, β-carotene, and L-norepinephrine (hanson et al., 2004).

Triglycerides, total cholesterol, LDL and oxLDL were decreased in the group received Purslane. Cholesterol reduction is occurring principally in LDL-C fraction but HDL-C fraction was increased which would be beneficial for reducing the risk of cardiovascular disease.

Purslane is a rich source of Omega 3 fatty acids and it has been reported that Omega 3 fatty acids reduce LDL-C (Chang et al., 2009).

High concentrations of Melatonin, a free radical scavenger, are recently identified in Purslane (Simopoulos et al., 2005; Rodriguez et al., 2004). Melatonin also reduces LDL-C in rats with high cholesterol diet. Therefore, LDL-C reduction seen in our study might be due to Melatonin.

The presence of other active compounds such as alpha-tocopherol, beta-carotene and glutathione in Purslane also may play a role in the observed hypocholestrolemic effects (Hoyos et al., 2000; Liu et al., 2000).

Following taking of Purslane OxLDL decreased. Antioxidant compounds in Purslane probably prevents the generation of lipoperoxides during the process of LDL oxidation. Purslane herb aqueous extracts can prevent oxidant-induced stress in the aging mice**.** The contents of malondialdehyde (MDA) were decreased and the activity of superoxide dismutase (SOD) was increased in the brain and liver of the tested mice (Hongxing et al., 2007). Superoxide anion, nitric oxide and hydroxyl radicals could be significantly scavenged by Purslane polysaccharides (YouGuo et al., 2009). Therefore, LDL could be protected from oxidation by Purslane polysaccharides which is led to decrease level of oxLDL.

This study also showed that Purslane reduces oxLDL level via increasing of paroxonase activity. PON1 activity can be modified by factors such as diet and lifestyle (Mackness et al., 2002). PON1 gene expression has been shown to be affected in vitro and in vivo by statins (Suehiro et al., 2000) which is consisted with Lovastatin effects in this study.

Purslane is a rich source of polyphenols. Polyphenols have antioxidant activity and also, modulates gene expression of PON1 leading to increased PON1 activity (Suehiro et al., 2000). Therefore, the increased PON1 activity was shown in our study could be due to Polyphenol contained in Purslane.

Oleic acid in olive oil is associated with increased PON1 activity (Ferretti et al., 2001). PON1 also was found to be inactivated by oxidized lipids and oxidized LDL (Rantala et al., 2002). It has been shown that anti-oxidant vitamins such as C and E may influence the PON1 activity (Van ET AL., 2005).

Purslane has plenty of antioxidant vitamins and similar to olive oil is rich of oleic acid and alpha-linolenic acid (Simopoulos et al., 1992) and thus could increase PON1 activity.

The minor decrease of ApoB density among Purslane consumers is may be because of the fact that Purslane components less often action the liver receptors of lot eliminator. In other word the effect of Purslane on the LDL-C ingredient is may be due to colestral discharging in gradients not because of lotal eliminating by Purslane receptors. So ApoB density changed a little.

Purslane could reduce some well-known cardiovascular risk factors such as cholesterol, triglyceride, LDL-C and particularly ox LDL. Reduction of ox LDL level is result of increasing paraoxanase 1 protein concentration and this enzyme activity.

Acknowledgements:

The study was approved by the Medical plants research center of Shahrekord University of Medical Science and its Ethics Committee. All patients gave their written informed consent. A consent form was read to them carefully and it was explained so that it will be fully comprehended and lastly signed by them. This study was registered in the Iranian Registry of Clinical Trials (www.irct.ir) with registration number ID: IRCT138902063806N1. Authors would like to thank the research deputy Shahrekord University of Medical Sciences for their financial support.

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