Purslane Effect on GLP-1 and GLP-1 receptor in type 2 diabetes

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Abstract:
Background: The aim of this study was to examine the effect of purslane seeds in glucagon-like peptide-1 concentration and glucagon-like peptide-1 receptor in women with diabetes.
Methods: This was a quasi-experimental study. The population was consisted of the city of Sari where diabetic women with diabetes II who had no history of using purslane seeds. All individuals used the same dose of metformin under the specialist supervision. Among these individuals, 16 were assigned at random to Purslane group and control group. The purslane group consumed 2.5 grams Purslane with lunch and along with 5 grams of purslane (Portulaca oleracea seeds 7.5 g daily) with dinner meals twice daily for 8 weeks. Blood sample was taken before and after 8 weeks, after 12 hours of fasting to 5 ml of the left brachial vein.
Results: After 8 weeks using purslane seeds in the experimental group, a significant increase was seen in glucagon-like peptide-1 concentrations ($p<0.007$), but there was no significant difference in the concentration of glucagon-like peptide-1 receptor ($p <0.455$). No significant relationship was found between changes in glucagon-like peptide-1 and its receptor.
Conclusion: The use of purslane seeds improved Type II diabetes; therefore it can be effective in improving the health of women with diabetes.

Keywords: Purslane; Anti-diabetic factors; Type II diabetic women

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1. Introduction

Diabetes is the most common endocrine diseases with a prevalence of more than 150 million people worldwide and nearly 3 million people in Iran (1). Chronic complications of diabetes are associated with high levels of blood glucose (2). Increased blood glucose causes glucose non-enzymatic binding to proteins inside and outside the cell. People who have long-standing diabetes suffer from renal failure, eye damage, central nervous system failure and cardiovascular failure (3). Diabetes irreversible complications arise from non-enzymatic glycation end products that with changing in biomolecular composition such as albumin, collagen and hemoglobin are provided for complications such as atherosclerosis, nephropathy and retinopathy (4). Preventing non-enzymatic binding of glucose to proteins may reduce the complications of diabetes mellitus (5).

Accordingly, research on the factors that modulate the rate of non-enzymatic glycosylation of proteins gets important. For years, the researchers have focused on finding compounds that inhibit non-enzymatic glycosylation of proteins and has no side effects to worry about. Since the plants have a long history in the treatment of diabetes, one can use plants to prevent and control diabetes, especially in people who have high levels of blood sugar and glucose intolerance (6). As the prevention and continuing control principle is important in diabetes, the treatment is aimed to providing health care and preventing acute and delayed symptoms and dangerous effects. Various methods have been suggested to reduce these complications, but lifestyle changes including proper diet, exercise and blood sugar lowering drugs should be considered in diabetes management (7). Although oral hypoglycemic drugs and insulin are the cornerstone of diabetes treatment, the drug effect, lack of sufficient capacity to prevent and control disease symptoms and reduced efficacy over time encourages researchers to investigate new methods and discover better ways to control the disease and its complications (8).

Among the factors affecting the performance of insulin in patients with type II diabetes, we can refer to endocrine hormones like Glucagon-like peptide-1 (GLP-1). GLP-1 is a physiological mediator that regulates available energy and intake energy; and it is insulin based hormone that triggers the release of insulin from the pancreas and it has the ability to transport glucose from the beta cells of the pancreas that is effective in the treatment of type II diabetes. In the central nervous system, Glucagon-like peptide-1 is considered as a eating stopple (9). Glucagon-like Peptides-1 bind to the receptor protein binary BG titled receptor peptides like glucagon (GLP-1R) in the beta cells and regulates biosynthesis and release of insulin; then it is a target key in managing in type two diabetes BG protein-coupled receptor (GPCR) that is pleiotropically coupled to multiple signaling effectors and with actions including regulation of insulin biosynthesis and secretion, is one of the key targets in the management of type II diabetes mellitus (DM) (10). From the beginning of human civilization, plants were used in medicinal therapies. The development of pharmaceutical industry in the early twentieth century largely caused the loss of credibility and value of herbal medicines- probably due to poor information about herbal medications- compared to new synthetic drugs among physicians. However, in recent years a new interest has arisen for natural herbal products and drugs (2).

Purslane is from Common Portulacaceae family. It is annual herbaceous plant with fleshy stem and cross leaves that is cultivated in most countries (11). This plant is native to Iran and its cultivation history goes back more than 2000 years. It is an important vegetable crop in southern regions of the country and is known to Perpyn. This plant is used in many countries for a variety of purposes, including human nutrition, and pharmaceutical processing industries (12). Purslane protein has been reported 44.25 g in 100 g of dried leaves (13). Active ingredients of this plant are oxalic acid, Kinamik acid, caffeic acid, maleic acid, citric acid, coumarin, flavonoids, alanine, tannin, alpha-linolenic acid and Glikozooid Mnitropiny. It is determined that the most important chemical in the plant is alkaloid (14). Purslane is a rich source of antioxidants such as A, B1, B2, C, E, beta-carotene and other essential amino acids. This plant is also rich source of minerals such as calcium, iron, phosphorus, copper and potassium (15, 16). Among food resources, Purslane contains a significant amount of essential linoleic acid (omega-3). Linoleic acid (omega-3) is an essential fatty acid that the body can not synthesize it, and always is taken into the body with food (7, 17). It is noteworthy to note that no evidence of significant toxicity has been reported in association with this plant (18).

Several studies are mentioned purslane as a factor in lowering blood sugar. For example, in the study of Gong et al (2009), the effect of Purslane polysaccharides on alloxan-induced diabetic rats was examined and a significant reduction in Fasting Blood Glucose (FBG), triglycerides, total cholesterol and High-density-Lipoprotein (HDL) levels were observed in diabetic rats (6). In this regard, Abdullah Hussain et al (2010) confirmed anti-diabetic and anti-obesity effects of purslane consumption in mice. purslane was significantly effective in prevention the increase of body weight, blood glucose, triglycerides, total cholesterol, LDL-C and HDL-C (1). El Side et al (2011) evaluated the purslane seeds consumption in people with Type II diabetes. They reported significant reduction in serum triglycerides, total cholesterol, LDL, alanine, liver aspartate, glutamine gamma transporters, fasting and after a meal glucose, insulin, body weight and BMI, and increased HDL and albumin (19). Therefore, because there were no comprehensive studies in Iran and other countries in relation to the effect of purslane on intestinal peptides (GLP-1 and GLP-1R) and diabetes, the present study was conducted examining 8 weeks purslane seeds consumption on GLP-1 and GLP-1R of women with Type II diabetes to answer the question whether purslane consumption by diabetic patients can affect on GLP-1 and GLP-1R.

2. Material and Methods

Sixteen patients were randomly selected from diabetic women registered in Sari hospital. The inclusion criteria for participants in this study were lack of acute and chronic diabetes complications and lack of regular exercise .Blood glucose level in selected people was greater than 200 mg per deciliter mg/dl; and for controlling blood glucose, they use metformin with the equal dose. After selecting participants, the goals and actions that would be undertaken during the course was explained in a meeting and the participants signed a written consent form. Using a double-blind project, the participants randomly assigned to 2 groups, purslane (8 patients) and placebo. Purslane consumer groups consumed purslane seeds 2.5 g daily with lunch and 5 g with dinner for 8 weeks. The placebo group similarly received placebo pills (the flavored maltodextrin). Purslane seed was purchased from a grocery in the city of Tehran; it was confirmed and recognized by agricultural expert. In addition, all subjects were under medical supervision to record and remove nuisance effects. To investigate the purslane effect on GLP-1 and GLP-1R, blood samples were taken from the elbow vein of all subjects, 24 hours before and after 8 weeks purslane consumption.

In order to analyze the data, the Kolmogorov - Smirnov test and Levin test were used for testing normal distribution and homogeneity of variance, respectively. Then according to the aim of the study, factor variance analysis (2 x 4) and the post hoc Tukey test were used to determine the between-group difference and time. Pearson's correlation coefficient was used for determining the relationship between changes in GLP-1 and GLP-1R. All statistical calculations were performed on a significant level (p <0/05) and using SPSS 16 version.

3. Results

The mean age of the participants was 52.33 years (± 4.08). Table 1 shows the general characteristics of subjects in each group. The data shows that at the beginning of research, there was no significant difference between the values for age, height and body weight between the groups. Then the groups were homogeneous. The results of the analysis of data on GLP-1 concentrations before and after consumption of purslane showed significant difference between the groups (P<0/007), while GLP -1 concentrations in the control group did not change significantly (P<628). Therefore it became clear that 8 weeks purslane consumption has significant effect on GLP-1 concentrations in type II diabetic women. Also GLP-1R levels in type II diabetic women before and after consumption of purslane seeds showed no significant difference (P <0/455). In examining the relationship between GLP-1 and GLP-1R Changes in type II diabetes women, there were not seen any significant relationship between changes in before and after purslane consumption (p = 0/666).

Table 1. Mean and standard deviation of the physiological characteristics of subjects in each group (p <0/05, n=8)

Group	Age (year)	Height (cm)	Weight (kg)
Placebo	50.17±5.34	160.67±6.4	75.67±9.44
Purslane	52.33±4.08	159.17±6.65	73.50±6.65

4. Discussion

Plants in traditional medicine are used to treat a wide variety of diseases such as inflammatory diseases, diabetes mellitus etc. (20). Studies on purslane have been approved its anti-diabetic effects in the animal and human subjects; But a study to examine the effects of purslane consumption on GLP-1 and GLP-1R is not available. The findings showed that eight weeks consumption of purslane seeds are likely to increase significantly GLP-1 (p=0.007, t = 4.06); and despite the increase in GLP-1R, this increase was not significant (p = 0.455, t = 0.798).

The results have indicated that purslane reduces markers of oxidative stress and prevent lipid peroxidation. This is due to large amounts of antioxidants such as vitamins A, B, C, E and beta-carotene (21). Studies have shown that Polysaccharides, flavonoids, Oligo proteins, polypeptides, steroids and alkaloids present in medicinal plants such as purslane can properly justify blood sugar and fat reducing Property and effect of some plants in the treatment of diabetes and prevention of biochemical changes (22, 23).

The results of this study showed that purslane consumption may increase the amount of GLP-1- as an affecting marker on pancreatic beta cells and insulin; these findings are consistent with results of some researcher’s studies. Fayong Gong (6) demonstrated that the use of purslane in alloxan-induced diabetic rats increases pancreatic island cell function and insulin secretion stimulation. Purslane mechanism can be in connection with increasing insulin secretion by closing of the channel gate ATP-K +, membrane depolarization and Ca2 + entry stimulation as the first key step in insulin secretion (6). Although the subjects were laboratory animals, and they are quite different from the present study subjects, it can be valuable to identify effective mechanisms in this field. In a recent study on obese by

Abdalla Hussein (1), it is found that 8-week consumption of purslane Atanolik extract with high-fat meal significantly prevents the increase in body weight, blood glucose, triglycerides, total cholesterol, LDL-C and HDL-C. Since Atanolik purslane extract contains Omega 3 fatty acids and polyphenols, purslane can reduce the liver fat by affecting on liver and increasing energy consumption (1). In another study, El-Sayed and colleagues showed that purslane seeds consumption in patients with type II diabetes compared with patients who use metformin resulted in a significant reduction in serum triglycerides, total cholesterol, LDL, alanine, liver aspartate, gamma glutamine transporters, fasting and postprandial glucose, insulin, body weight, Body Mass Index (BMI), and raising HDL and albumin. Although similar effects were observed with metformin in purslane group, increased HDL (C) was not observed (19).

Among the affecting mechanisms, we can refer to high levels of purslane melatonin that have been reported to be more than other plants and fruits. Melatonin has critical functions such as anti-inflammatory effects and directing free radicals. Melatonin of purslane extract can be anti-obesity and anti-diabetic. Cholesterol and LDL-C increasing by high-fat foods is reduced by melatonin control (24). Purslane has also a high concentration of omega-3 fatty acids (25) that can be effective through mechanisms such as avoiding carbohydrate intake, intestinal absorption of glucose, and stimulation insulin secretion from pancreatic beta cells, modulating hepatic glucose release, activation of the insulin receptor, glucose consumption in insulin-sensitive tissues and modulating hepatic glucose utilization (1). Some studies reported lowering properties in blood sugar levels in laboratory animals by polysaccharides derived from PO. Sun et al showed that Fiber composition may improve glucose metabolism. The mechanism of this effect is related to the increased sensitivity of tissues to insulin (26). Fiber may affect the release of gastrointestinal hormones, adjust pancreas secretes and digestive process, and modify the rate and method of absorption and metabolism of carbohydrates, proteins and elements balance (27).

The purslane plant has fiber compound and anti-diabetic properties. Then it seems quite reasonable to reduce cholesterol levels. Probably, existing Fibre in Purslane binding to cholesterol in the diet and prevent the absorption of cholesterol from the digestive tract and thereby reduce cholesterol (28). Purslane plant has anti-diabetic properties, alters the activity of glutathione reductase, and causes a significant reduction in lipid peroxidation associated with increased activity of Catalase (CAT) and Superoxide dismutases (29). Polysaccharides, flavonoids, glycoproteins, polypeptides, steroids and alkaloids present in medicinal plants such as purslane can show good properties of fat and sugar reduction. This study indicates that Purslane seeds can play an important role in healing diabetic women. This is probably due to the presence of antioxidant substances, alkaloids, fiber, melatonin and ample amounts of omega-3 found in purslane and their mechanisms of inhibition of cholesterol synthesis. However, further studies are needed to understand the involved mechanisms.

5. Conclusion

In summary, purslane seeds increased the GLP-1 in women with type II diabetes. However, this increase was not significant in GLP-1R check. Women with type II diabetes are recommended to take advantages of eating eating purslane seeds.

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Conflict of Interest:

There is no conflict of interest to be declared.

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