

UCLA
Nutrition Bytes

Title

Medicinal Use Of The Latin Food Staple Nopales: The Prickly Pear Cactus

Permalink

<https://escholarship.org/uc/item/2x53d917>

Journal

Nutrition Bytes, 4(2)

ISSN

1548-4327

Author

Gutierrez, Miguel Angel

Publication Date

1998

Peer reviewed

Introduction

Traditional Latin American practice has utilized medicinal plants to control a variety of human illnesses. The nopal has been regarded as a medicinal plant since the times of the indigenous empires of the Americas, particularly among the native Nahuatl population of Mexico¹. Ancestral knowledge has culminated in utilizing nopales to treat Diabetes Mellitus as well as to regulate cholesterol levels. The hypoglycemic effect of *Opuntia* has been validated in various experimental and clinical investigations. Chemical studies attempting to isolate, purify, and identify the substances responsible for the hypoglycemic activity of the prickly pear cactus are being conducted and developed². The mechanism, however, remains to be elucidated. Dietary fibers have been shown to decrease plasma cholesterol concentrations in humans and several animal species, therefore, having a protective effect on heart disease³. Soluble fibers, including prickly pear pectin, demonstrate effects on cholesterol absorption and hepatic cholesterol homeostasis.

Background

The prickly pear cactus is known as nopal in Mexico and belongs to the genus *Opuntia*, the most abundant plants of the arid regions of the Western Hemisphere⁵. *Opuntia* can be found as far north as the provinces of Canada to as far south as the Strait of Magellan. *Opuntias* naturally separate into two distinctive groups. The first have stems made up of rounded or cylindrical joints known in Mexico as chollas. The second have stems that are large flattened joints known in Mexico as nopales. Their green stems and fruits have been a source of nourishment for the Indians of the Americas well before the colonial period, deep within Pre-Columbian times. In Mexico, the *opuntias* are an important and common green vegetable that is prepared in many different ways. Nopales can be flavored with green chilies and a touch of vinegar, rolled in a flour tortilla. A refreshing salad is commonly made from nopales, tomatoes, and onions topped with a vinegar and mustard dressing. Other recipes include nopalitos con queso (a mixture of nopales, onions, and chilies, stir fried and sprinkled with cheese) and revoltijos (potatoes, shrimp, and nopal strips cooked in mole rojo; a red chili sauce) in many parts of Mexico during Lent⁵.

Prickly Pear Cactus On Cholesterol

Study 1

In 1992, a study by Fernandez et. al, demonstrated that the intake of prickly pear pectin decreased plasma LDL concentrations by increasing the hepatic apolipoprotein B/E receptor expression and increasing receptor mediated LDL turnover in guinea pigs that were fed a high cholesterol diet³. The guinea pigs were given a diet containing lard and cholesterol (LC Diet) or a diet in which cellulose was partially replaced by prickly pear pectin (LC-P diet). The guinea pigs on the LC-P diet demonstrated a decrease in plasma LDL cholesterol concentrations by 33% ($p < 0.001$), whereas plasma VLDL and HDL cholesterol levels were unchanged. This resulted in an overall decrease of 28% ($p < 0.01$) in total cholesterol for the LC-P diet group. Hepatic apolipoprotein B/E receptor expression was 60% higher in guinea pigs on the LC-P diet ($p < 0.01$) whereas the affinity constant K_d was equal in both groups. The size of the Apolipoprotein LDL pool and total LDL fractional catabolic rate exhibited a significant negative correlation ($r = -0.52$, $p < 0.01$).

Study 2

In 1994, a study by Fernandez et. al, investigated the effects of prickly pear pectin on the rate of absorption of cholesterol and on HMG-CoA reductase and acyl CoA: cholesterol acyltransferase (ACAT), the enzymes responsible for hepatic cholesterol homeostasis. The guinea pigs were fed one of the following three diets. 1) a lard-basal diet with no added cholesterol or prickly pear pectin (LB diet). 2) the LB diet with cholesterol (LC diet). 3) the LC diet with prickly pear pectin added at the expense of cellulose (LC-P diet)³. Total plasma cholesterol was significantly lower in the LC-P than the LC group. The cholesterol lowering was specific to LDL because VLDL and HDL cholesterol plasma concentrations were unaffected. It was determined that this hypocholesterolemic effect of prickly pear pectin on total plasma cholesterol and LDL levels does not result from a reduction in cholesterol absorption, but may be due to its effects on LDL receptor expression and LDL turnover⁴. This lowers hepatic ACAT activity while not affecting hepatic HMG-CoA reductase activity, therefore having a major effect on hepatic cholesterol homeostasis.

Prickly Pear Cactus On Diabetes

Study 1

In 1995, the anti-hyperglycemic affect of 12 edible plants was studied by Roman-Ramos et al, on 27 healthy rabbits. The fasting animals were given subcutaneous glucose tolerance tests after gastric administration of water for control group, tolbutamide suspension for reference control group, or a traditional preparation of the plant for experimental group². Blood glucose levels were measured in fasting, and at 60, 120, 180, 240, and 300 minutes. Among the twelve edible plants studied was, of course, *Opuntia Streptacantha*, also known as nopal. *Opuntia* demonstrated a significant decrease in blood glucose values as demonstrated as a decrease of 17.8% ($p < 0.05$) in the area under the glucose tolerance curve and a decrease of 18% ($p < 0.05$) in the hyperglycemic peak as compared to controls. The interest of controlling diabetes mellitus with edible plants is simple, food and medication become one². Possibilities include diabetic patients reducing dosage of current hypoglycemic agents by incorporating these plants into their diet. Also, patients with mild Type 2 diabetes could possibly avoid the use of these agents and control blood glucose via diet alone.

Study 2

In 1996, a study by Trejo-Gonzales et al, demonstrated the ability to control experimentally induced diabetes in rats by utilizing purified extract from *Opuntia*, the prickly pear cactus. Diabetes was induced by intraperitoneal injection of streptozotocin (STZ). A suspension of prickly pear powder was administered daily through a gastric catheter. Throughout the experiment, the glucose levels of the nondiabetic control groups remained similar to initial levels. Insulin treated diabetic rats showed high glucose levels after 1 week, decreasing by week 2 and then stabilizing at moderately high levels. Diabetic rats receiving only *Opuntia* extract had glucose levels similar to those of insulin treated rats. Diabetic rats receiving both insulin and *Opuntia* extract were the only diseased animals with normalized glucose levels. Within 2 weeks, glucose levels in this group had declined to values found in the nondiabetic group. Insulin treatment was suspended due to hypoglycemia after week 8, and normal glucose levels were maintained during the subsequent 7 weeks with administration of *Opuntia* extract alone⁶. The important conclusion expressed in this study is that the control of diabetes by purified extract of *Opuntia* can be attained with daily oral doses in the range of 1mg/kg body weight. This appears to be a promising result which could possibly one day replace the numerous high doses of insulin injection required for similar hypoglycemic effects.

Abstract on Prickly Pear Cactus

Based on a survey of South Texas residents that revealed a significant use of herbal remedies, including *Opuntia*, Aguilar et al. have been reviewing and systematically quantifying a relationship between the prickly pear cactus and the metabolic control of people with Type 2 Diabetes Mellitus. Analysis of six medical studies from Mexico has provided sufficient evidence that ingestion of prickly pear cactus reduces serum glucose levels among diabetics between 10 to 30 mg/dl at 30 to 180 minutes post-ingestion when measured from baseline⁷. Complete full-scale review, however, is incomplete because published control group data was determined to be insufficient. The primary investigators have agreed to provide the complete data on control groups to assist completion of international review. Definite conclusions cannot be made as of yet, however, preliminary findings strongly suggest that ingestion of prickly pear cactus has a true metabolic effect for diabetic patients.

Prickly Pear Cactus Supplementation

In our country today, one can find supplementation for just about everything. Many of these supplements are based on studies with promising results whose exact mechanism of action is usually unknown. Vaxa International is a homeopathic nutraceutical that carries a product by the name of Diabin+ which is a "Scientifically Advanced Pancreatic Nutraceutical Dietary Supplement". It has been designed to provide general nutritional support for those individuals having difficulty in maintaining appropriate blood sugar levels by aiding the body in rebuilding pancreatic b-cells, controlling insulin output and utilization, and

decreasing the plasma and urinary glucose levels. These capsules contain a cocktail of ingredients, all of which have demonstrated the ability to benefit some aspect of Diabetes Mellitus, however most in an unknown method of action. Among this conglomeration of ingredients, one will find none other than Opuntia, the prickly pear cactus.

Conclusion

In Latin American folk medicine, curanderos have continued to utilize herbs and medicinal plants to maintain the well-being of their community. These traditions have endured many generations, and have been incorporated into daily life and beliefs. As we progress in this age of technology, we are continuously reminded about our history and the reasons why beliefs and traditions have remained throughout the ages. We continue to validate traditions that were once well established, but now via scientific and research methodology. The nopal has not only become a food staple, but has been utilized as a mode of controlling disease, such as, diabetes and hypercholesterolemia. The interest with alternative treatments stems from the limitations of current diabetic treatments. Management of Diabetes Mellitus consists of controlling glucose intake in the diet and utilizing pharmacological therapies which attempt to stabilize the glucose levels. The use of oral drugs is restricted due to side effects and interactions with other medications or due to the fact that they become less effective with prolonged use. The problem with insulin injection is that while it does lower blood glucose, it does not maintain physiological normal levels. The prickly pear cactus (Opuntia) appears to be one of the most promising sources of "plant-derived Diabetes Mellitus-active suppressants"⁶. The results of these studies indicate the importance and the need to advance into the investigation of Opuntia into human clinical trials. In addition, the nopal has demonstrated its use in altering and managing cholesterol levels. With the widespread incidence of heart disease, the importance of continued investigation into this mechanism of action will provide insight on how to combat and overcome this major cause of the death.

REFERENCES

1. Ibanez-Camacho, R. and Roman-Ramos, R. Efecto hipoglucemiante del nopal. Archivos de Investigacion Medica (MEX). 10 (1979). 223-230.
2. Roman-Ramos, R., Flores-Saenz, J.L., Alarcon-Aguilar, F.J. Anti-hyperglycemic effect of some edible plants. Journal of Ethnopharmacology. 48 (1995) 25-32.
3. Fernandez, M.L., Lin, E.C.K., Trejo, A., McNamara, D.J. Prickly pear (Opuntia sp.) pectin reverses low density lipoprotein receptor suppression induced by a hyper-cholesterolemic diet in guinea pigs. Journal of Nutrition. v122. n12. (Dec, 1992): 2230.
4. Fernandez, M.L., Lin, E.C.K., Trejo, A., McNamara, D.J. Prickly Pear (Opuntia sp.) pectin alters hepatic cholesterol metabolism without affecting cholesterol absorption in guinea pigs fed a hypercholesterolemic diet. (Biochemical and Molecular Roles of Nutrients). Journal of Nutrition. v124, n6 (June, 1994):817-823.
5. Ciesla, Bill. Opuntia: points about the prickly pear. Americas (English Edition). v40, n4 (July-Aug, 1988):10.
6. Trejo-Gonzalez, A. Gabriel-Ortiz, G., Puebla-Perez, A.M., Huizar-Contrera, M.D., Munguia-Mazariegos, M., Mejia-Arreguin, S., Calva, E. A purified extract from prickly pear cactus (Opuntia fuliginosa) controls experimentally induced diabetes in rats. Journal of Ethnopharmacology. 55 (1996) 27-33
7. Aguilar, C., Ramirez, C., Castededa-Andrade, I., Frati-Munari, A.C., Medina, R., Mulrow, C., Pugh, J. Opuntia (prickly pear cactus) and metabolic control among patients with diabetes mellitus (abstract). Annu Meet Int Soc Technol Assess Health Care, 1996, 12:14.
8. <http://www.vaxa.com/669.html>.