The cactus – the plant of the future for a healthy diet, obesity management and diabetes

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Unique colorful cactus crops grown in Ramat Hanegev in southern Israel

Preface:

Opuntia ficus-indica, more known as the cactus, is a typical Cactaceae breed in arid and semi-arid desert climates, believed to have originated from Mexico in mid America[1]. As a source of food, the cactus is divided into branches, vegetables named Nopal, and fruit known as the Prickly pear or Tuna. The prickly pear is available in different colors (Purple\Red, Orange\Yellow and White).The names of the different parts of the cactus originate from the Mexican-Spanish language but have become an integral part of the English vocabulary[2]. In the same context, the use of the nopal and prickly pear are so deeply inherent in the mid and South American cuisines, especially in Mexico, but also in U.S southern states, that their cooking techniques gained names of their own – i.e., cubes cut from fresh Cacti branches aged three to four weeks are referred to as "Nopalitos"[3].

The possible uses for prickly pear and nopal as a source of food are vast, for example – they can be combined in a salad both as fruit or vegetable, as a basic ingredient for gravy, for making soup, different stews, snacks, drinks and deserts and therefore it constitutes a main ingredient in the Mexican and South American diet. Moreover, the nopal is a great source of food for livestock and thus supports the local agriculture[3].

According to various recent estimates, the cactus as a whole is expected to become a basic ingredient in the manufacturing of processed food in a variety of food industries across the globe. As novel and diverse food processing methods have recently become available for use, it allows it to be consumed fresh, frozen, pickled, cooked, dried as a powder, and lately – as preserved food supplement through a groundbreaking freeze-drying technology – with the same advantages of the fresh fruit and vegetable with lower volumes and longer shelf-life.

On the nutritional level, the prickly pear and nopal constitute a great source for fiber[4], vitamins, minerals, amino acids and proteins[5], alongside different antioxidants[6] – and therefore have a great potential to be a part of an everyday balanced diet. Due to the high content of protein and fiber, low fat content and immunity improvement qualities, a lot of evidence has recently been added up to attribute the cactus super-food qualities, especially to the purple\red prickly pear thanks to its high concentration of pigment.

In traditional cultures, the cactus gained a place of honor for having many different medicinal properties attributed to it, including pharmacological qualities which include – anti-oxidative effects, anti-carcinogenic effects, analgesic effects, peptic ulcer relief, anti-viral effects, diuretic effects, management of obesity and many more[7]. Recently the cactus seems to have regained its status as its medicinal properties have been researched in hundreds of studies including the possible

effects in curing diabetes, as well as it effects on blood cholesterol, which was even funded by the American Heart Association (AHA)[8] and have been found to be helpful. Moreover, the UNs' Food and Agriculture Organization (FAO) has been stated to declare the cactus as the crop of the future[9].

In this literature review we attempt to portray the medicinal and nutritional qualities of the cactus – branches and fruit, its' possible part in a daily balanced diet, its' role as an organic food, its' agricultural processing methods, the availability of Cacti products, its' possible contribution to coping with morbidity and much more.

The cactus' contribution for coping with morbidity:

The cactus' health benefits have been attributed to it for years due to accumulated experience, even prior to evidence established through conventional medical research and the understanding of the different mechanisms of action behind it. In the last couple of decades, with the ongoing public demand for natural medicine, many researchers have started to study the characteristics of the cactus in order to validate its abilities as a therapeutic agent, alongside its physiological effects and the pharmacological mechanisms behind it. The studies performed in that field produced hundreds of scientific publications from studies made in-vivo and in-vitro[8], the importance of which will be reviewed in this article.

The cactus' contribution to obesity management and hyperlipidemia –

Clinical trials performed in human beings in the last few years indicate some of the fiber present in the cactus, with Litramine IQP G-002AS being the main fiber, as

possible agents for obesity management. For instance, a double blinded randomized controlled trial performed in Germany in 2013 by Barbara Grube et al including 125 people suffering from obesity found that the intervention group who consumed fiber from the cactus showed a statistically significant average loss of weight of 2.5 kg more than the control group during the 12 weeks of trial ($P<0.001$). Some of the subjects in the study lost more than 5 percent of their body weight, probably due to an intestinal fat absorption delay mechanism, as well as an improvement in fat percentage, Body Mass Index levels and abdominal circumference – all of which with no reported side effects[10]. Similar data was found in three other clinical trials, performed in human beings and mice, which tested the safety of that same fiber and its ability to promote weight loss compared to placebo, all with statistical significance as well[11]. Another double blinded randomized controlled trial performed in Germany in 2012 including 20 subjects, supported the hypothesis claiming the cactus' mechanism of action in helping with obesity is through a delay in intestinal fat absorption after its data indicated that subjects in the intervention group excreted extra 9mg of fat in their feces in average compared to the subjects in the control group with proven statistical significance[12]. A meta-analysis published in the journal "Nutrition" reviewed 5 clinical trials performed in human beings in order to evaluate the influence of consumption of cactus as a food supplement on cardiovascular risk index showed it to be helpful with improving Body Mass Index values in the intervention group compared to the control group, in addition to a decrease in blood triglycerides levels and systolic blood pressure values together with an improvement in blood HDL levels – all with statistical significance. In that same meta-analysis a loss of weight was shown in the intervention group compared to the control group – but with no statistical significance this time[13]. Furthermore, the cactus mechanism of action in improving blood LDL levels was tested in a guinea pig model and showed that a pectin rich diet produced from prickly-pair fruit was able to lower LDL level by 33 percent in the intervention group compared to the control group ($P<0.001$) through suppression of Apolipoprotein B receptor activity, which is responsible for carrying LDL molecules in the bloodstream[14].

Balancing blood glucose level and coping with diabetes –

Over the years, many studies were conducted in order to evaluate the association between cactus consumption in its various forms and blood glucose levels, and hence its ability to help cope with diabetes. The primary research work to establish that claim was first tended to in animal models. For instance, studies performed in the beginning of the 1980s in Mexico with three different animal models including mice, rabbits and dogs confirmed the cactus' branches (Nopal) essence ability to decrease blood glucose levels in healthy subjects[15+16]. Similar data was shown in a research conducted in healthy mice in 2003 by Alarcon-Aguilar et al fed with a diet rich a polysaccharide that was isolated from a cactus, when in addition – a partial

success in lowering blood glucose levels in mice suffering from artificially induced diabetes alongside healthy mice[17]. Other studies performed in laboratory animals with artificially induced diabetes showed encouraging results as well. For example, a research performed in 1996 by Trejo-Gonzalez et al found that cactus essence from the Opuntia Foligunosa strain was able to decrease blood glucose levels to normal levels in diabetic mice without using insulin after 7 weeks study[18]. Another study performed in pigs by Laurenz et al in 2003 found that ingestion of 250 and 500 mg of cactus essence per kg of weight respectively managed to decrease blood glucose levels in healthy and diabetic pigs, with higher dosage providing better results as the maximal effect was achieved four hours after consumption[19]. After successful results in various animal models, the path for assessing the same hypotheses in clinical trials with human beings was paved. Several clinical trials in Non Insulin Dependent Diabetes Mellitus (NIDDM) patients were performed, with a meta-analysis reviewing a few studies pointed out that intervention with Cacti products has managed to decrease blood glucose by 10-30mg/dl compared to the control group proving Cacti products metabolic influence[20]. In a study performed in 1988[21] and two other studies performed in 1989[22] and 1990[23] Frati-Munary-AC et al showed that consumption of broiled cactus branches (Nopal) successfully decreased blood glucose levels in diabetic patients and proved a dose-response relation as greater consumption improved blood glucose results. For example, one of the studies showed a statistically significant decrease of 45-64.5mg/dl in blood glucose levels in diabetic patients who ate 500 grams of broiled cactus branches 3 hours after consumption – compared to the control group drinking 400ml of water[21]. Since similar studies using non broiled Cacti products showed inferior results, demanded impractical dosages and even showed no significant benefit, it has been estimated that the broiling process is of importance in the cactus' mechanism of action, most probably through improvement of insulin sensitivity. Current studies continue trying to evaluate the cactus' influence on stabilizing blood glucose in type 2 diabetic patients, and so in 2014 Patricia Lopez-Romero et al examined the influence of a 300 gram consumption of steamed cactus branches as a part of a protein or carbohydrate rich meal on postprandial blood glucose level in diabetic patients, and found a statically significant 14mg/dl decrease in blood glucose levels in the intervention group compared to the control ($P<0.05$)[23].

Furthermore, it seems that the consumption of cactus, beyond assisting diabetic patients, is able to help regulate blood glucose levels in healthy subjects, especially athletes. For example, Van Proeyen et al demonstrated in a double blinded controlled trial, published in the International Journal of Sport Nutrition Exercise and Metabolism in 2012, that consumption of capsules made of prickly pear shells and cactus branches (Nopal) in a dosage of 1 gram decreased blood glucose levels following an Occult Glucose Tolerance Test (OGTT) by 26% in subjects who

performed cardio workout compared to the control group ($P<0.05$), through an increase of blood insulin levels which helped regulate blood glucose levels[24].

The cactus' mechanism of action was later proved in a following double blinded controlled trial performed in 2013, which examined the effect of the essence produced from prickly pear shells on blood glucose and insulin levels in subjects undergoing an OGTT following a cardio workout compared to subjects consuming the amino acid Leucine or placebo. It was found that subjects who consumed the prickly pear shell essence had their blood insulin levels increased by 35% and blood glucose levels decreased by 7% in average 90 minutes following the OGTT compared to subjects consuming Leucine ($P<0.05$). Moreover, subjects who consumed a combination of Leucine and prickly pear shell essence were found to have optimal results[25].

Later on in 2016, an in-vitro study that lead by a group of Korean researchers and published in the scientific journal Nutrients revealed the mechanism behind the cactus' ability to regulate blood glucose levels. As it seems, the components found in the cactus are able to increase the presence of Glut4 channels in the cells' membrane. These channels are responsible for inserting glucose from the blood stream into muscle and intestines cells through an intra-cellular signal transduction system, based on the action of protein kinase molecules called AMPK and MAPK p38[26].

The nopals' contribution:

The cactus' branches, known as the nopal, constitute the main part of the plant, and are known to have similar culinary characteristics to those of asparagus or green pepper, and are used as vegetables. On the components level, they comprise of 80-95% of water, alongside a low carbohydrate content of about 3-7%, with about 1-2% of fiber and around 0.5-1% of protein[27], 0% or mostly 3% fat in specific strains – with most of it constituting from Omega 3 fatty acids, essential for the human body.

In actual numbers, the soft cactus' branches contain about 6.1 grams of protein for every 100 grams of fresh vegetable, while the stiff branches contain about 1-2 grams of protein for every 100 grams. After being dried, the amount of protein is doubled into 12.2 gram per 100 grams. Furthermore, the nopal contains at least 8 vital amino acids which cannot be produced by the human body, and therefore provide a great vegetarian source of protein.

At least 10 percent of the cactus' branches water contents is present in the form of a sticky juicy fluid called Mucilage (Mucilaginous polysaccharide)[28], containing a polysaccharide known to support the action of immune system which also available

in herbs known to have medical benefits such as Aloe vera, Echinacea, Astragalus and eastern mushrooms.

The dietary fibers available in the nopal are known to be resistant to different digestive enzymes including Cellulose, Hemicellulose, Pectin, Lignin and others and are able to helpful with digestive system disorders, obesity management, metabolic syndrome in general and specifically diabetes[28], as mentioned before in this article.

Moreover, the nopal contains the pigment β-Carotene which is usually found in orange vegetables, iron, vitamin C, a certain amount of vitamin B – especially a small dose of Thiamine, with some evidence regarding the presence of Riboflavin, Niacin and around 260 micrograms of vitamin A. Additional components known to be found in the branches are phytochemicals, phenols and flavonoids, yet their quantities have not been properly evaluated.

The nopal also offers a rich mineral content including magnesium – known to prevent muscle spasms, silica, sodium, small doses of iron, aluminum, and manganese in forms of carbonate, sulfate and phosphate. For instance, the nopals' calcium content, which constitutes 15% of the daily recommended intake of calcium in an average serving of 86 grams, and therefore provides an excellent source of calcium for populations with low availability of dairy products, vegans and for people who are sensitive to dairy products[29+30]. Furthermore, the various minerals available in the nopal can provide a great alternative for supplements needed for different diseases, especially in the elderly community.

As if that was not enough, a new study recently published by X.Vecino et al (2016) showed that Mucilage liquid extracted from the nopal and processed into calcium alginate beads can be efficiently used to purify water from poisonous arsenic compared to other materials currently used in water purification process[31].

Nopal as a vegetable used in Salads

The cactus' fruit contribution (Tuna\Prickly pear):

The cactus' fruit, also known as the prickly pear, Tuna, the Indian fig and the thorny pear, is a fruit that can be used for various purposes such as for making soft drinks, different syrups, candy, gelatin, gravy, popsicles, and even wine and other alcoholic drinks[3]. Yet, unlike the cactus' branches having vegetable characteristics including high protein content even in their fresh form, the digested part of the fruit when eaten raw contains mainly water and water soluble carbohydrates as it seed content is not processed in this manner.

The different cactus fruit (Purple Red, Orange Yellow, White):

The cactus' fruit having different colors posses slightly different qualities, whereas the main characteristic determining their color is the ratio of different Betalain pigment contents which are attributed with anti-oxidative qualities, mainly Indixanthin and Betanin that are also found in Beak.

For instance, the yellow fruit contains about 10mg of Betalains in a 100g fruit, 89% of which are Indixanthin. The purple fruit on the other hand contains about 8.5mg of Betalains for every 100g of fruit, when 65% of which are Betanin, while the white fruit contains about 6.5mg of Betalains for every 100g of fruit constituted almost solely by Indixanthin. From that we are able to conclude that Indixanthin is responsible for the white pigment whereas Betanin is responsible for the red pigment[32], with the purple red fruit having the best anti-oxidative effects of all three fruit colors.

Different studies performed also indicated the purple red fruit's advantages over the other fruit strains, which eventually lead it to be the most investigated one. One of those studies performed in a rabbit animal model by Marina Perfumi and Rosalia Tacconi from The University of Camerino in Italy that was later published in the International Journal of Pharmacognosy, found that consumption of the purple red prickly pear essence in a 5mg/kg dosage decreased their intestinal glucose absorption in a level equal to using 100mg/kg dosage of the sodium channel blocker medicine Tolbutamide, preventing increased blood glucose levels after ingestion of sugar[33].

Another research performed by Zhao LY et al from The Agricultural University of Henan, China, found that a polysaccharide isolated from the purple red prickly pear fruit given to diabetic mice for three weeks has managed to substantially diminish their food consumption, blood glucose levels, total blood cholesterol and triglyceride

levels while also improving their liver function, liver glycogen content and increase their HDL cholesterol levels while gaining weight[34].

Freeze dried purple red prickly pear powder – 20 grams of powder are the equivalent of 3 prickly pears weighing 240 grams. The powder preserves the qualities of fresh fruit and is meant for daily use.

The cactus' seeds contribution:

In addition to the health benefits of the cactus' fruit and branches, the vast majority of scientific evidence indicates that the cactus' seeds found in the prickly pear in a soft or hard form, withhold a great nutritional and medicinal potential, whereas unlike the prickly pear consisting mostly of water and carbohydrates, the seeds' content is rich with protein with up to 4.7 gram of the protein content in a 100 grams of prickly pear being attributed to the seeds alone. The proteins found in the prickly pears' seeds include the amino acids Lysine, Methionine and Tryptophan, which are uncommon in different types of grain. Since the seeds are not digested when eating the fresh prickly pear, their benefits can be utilized only through grinding it, as performed in the process of making "cactus cheese" and cactus oil[35].

For example, a study performed in 2014 by Berraaouan A et al in lab rat model to assess the effects of cactus oil made of cactus seeds in decreasing blood glucose levels and intestinal glucose absorption compared to 2mg/kg dosage of Glibenclamide, an anti-diabetic medicine, or water, found the oil to have anti-diabetic qualities as consumption of 2ml/kg of oil decreased the rats blood glucose level by 40.33% and 16.01% in healthy rats and diabetic rats respectively. In addition, the cactus oil decreased the rats' intestinal glucose absorption by 25.42% in average, healthy and diabetic, with no known side effects caused by the oil[36].

Furthermore, a consecutive study performed one year later 2015 Berraaouan A et al in order to evaluate the anti-oxidative qualities of cactus oil made of cactus seeds and its anti-diabetic effect in a mice lab model, found that the oil was able to decrease the damage caused by free radicals like DPPH and lower the mice morbidity rates due to hyperglycemia using 0.2ml/kg dosage of oil with statistical significance ($p<0.001$). In addition, the oil was proved to morphologically protect the mice's insulin producing cells (Pancreatic Langerhans islets)[37].

The cactus – an organic crop grown with no pesticides:

The cactus, unlike different agricultural products demanding chemical pesticides for the survival of their crops, is resistant to common pasts attacking most agricultural crops and therefore is grown with no pesticides. For example, the Mediterranean Drosophila known be common in Middle Eastern agricultural lands, does not infect the prickly pear, making custom phosphoric pesticides used for defending fruit unnecessary. Similarly, Aphids and Whiteflies find no interest in the prickly pear or nopal.

In addition to the mentioned above, the cactus' ability to absorb different minerals and nitrogen directly from the land relatively to other crops allows growing it with no use of fertilizers. As it seems, the optimal conditions for growing the cactus is simply through providing sufficient amounts of re-used purified water. Moreover, the use of crushed leftover Cacti crop alongside chopped wild grass on agricultural soil provides a great option for organic fertilizing, especially due to the high contents of nitrogen, phosphor and potassium found in it.

The cactus as part of a daily diet:

Based on cumulative experience and assessment of nutrients found in the cactus, the recommended daily amount of prickly pear and nopal for an optimal diet as part of a healthy diet plan is around 200-300 grams per day, which is available in several ways such as:

1. Drinking crushed whole prickly pears (shell included) shake alongside meals.
2. Drinking crushed prickly pear shake alongside cooked prickly pear shells.
3. Eating 4 prickly pears.
4. Eating sufficient amount of nopales – which can be sliced or diced in salads, cooked, used in pies, alongside different dishes, etc.

Extra serving and processing options:

- Sliced nopal – for pickles, or fried alongside meat of omelet.

- Cooked nopal with beans, wheat grains or chickpeas – which can be used as a substitute for a daily serving of protein.
- Enriching pastries (industrial or home-made) – crushed prickly pears and nopal can replace in the process of bread making.

How will we consume cactus products in the near future?

Advanced food industries in cooperation with Orlys' Cactus Farm have recently started developing processed products using prickly pears and nopales, including pasteurized cactus juice.

Two other advanced products expected to soon be available for purchase are:

1. Nopal powder, which could be added to stews, bake goods, salads, pastes etc. with 10 grams having equal nutritional values to 100 grams of fresh nopales.
2. Water soluble freeze dried prickly pear powder, with 20 grams having equal nutritional values to 200 grams of fresh prickly pear.

The technology behind these new products is expected to fully preserve the fresh fruits' and cactus' branches nutritional values.

Pickled nopal slices

Orly strain green nopales – can be purchased as freeze dried powder

Nutritional facts standardized for consumption of 100g of nopal[38+40]:

Principle	Nutrient Value	Percentage of RDA
Energy	16 Kcal	<1%
Carbohydrates	3.33 g	2.56%
Protein	1.32 g	2%
Total Fat	0.09 g	<1%
Cholesterol	0 mg	0%
Dietary Fiber	2.2 g	5.5%
Vitamins		
Folates	3 µg	<1%
Niacin	0.410 mg	2.5%
Pantothenic acid (Vitamin B5)	0.167 mg	3%
Pyridoxine (Vitamin B6)	0.070 mg	6%
Riboflavin	0.041 mg	3%
Thiamin	0.012 mg	1%
Vitamin C	9.3 mg	15.5%
Vitamin A	457 IU	15%
Vitamin E	0.00 mg	0%
Vitamin K	5.3 µg	4.4%
Electrolytes		
Sodium	21 mg	1.5%
Potassium	257 mg	5.4%
Minerals		

Calcium	164 mg	16%
Copper	0.052 mg	6%
Iron	0.59 mg	7%
Magnesium	52 mg	13%
Manganese	0.457 mg	20%
Phosphorus	16 mg	3%
Selenium	0.7 µg	1%
Zinc	0.21 mg	5%
Phyto-nutrients		
Carotene-ß	250 µg	
Carotene-a	48 µg	
Lutein-zeaxanthin	0 µg	

Nutritional facts standardized for consumption of 100g of prickly pear[39+40]:

Principle	Nutrient Value	Percentage of RDA
Energy	41 Kcal	<2%
Carbohydrates	9.57 g	3.19%
Protein	0.73 g	1.46%
Total Fat	0.51 g	<1%
Cholesterol	0 mg	0%
Dietary Fiber	3.6 g	14.4%
Vitamins		
Folates (Vitamin B9)	6 µg	1.5%
Niacin (Vitamin B3)	0.460 mg	2.3%
Pyridoxine (Vitamin B6)	0.060 mg	3%
Riboflavin (Vitamin B2)	0.06 mg	3.53%
Thiamin (Vitamin B1)	0.014 mg	0.93%
Vitamin C	14 mg	23.3%
Vitamin A	43 IU	0.86%
Electrolytes		
Sodium	5 mg	0.21%
Potassium	220 mg	6.29%
Minerals		
Calcium	56 mg	5.6%
Copper	0.08 mg	4%
Iron	0.3 mg	1.67%
Magnesium	85 mg	21.25%
Phosphorus	24 mg	2.4%
Selenium	0.6 µg	0.86%
Zinc	0.12 mg	0.8%
Phyto-nutrients		
Carotene-ß	25 µg	
Carotene-a	0 µg	
Lutein-zeaxanthin	0 µg	

Orlys' Cactus Farm prickly pear strains – the purple red prickly pears contain higher levels of anti-oxidants.

Nutritional facts standardized for consumption of 100g of the purple red prickly pear powder made by Orlys' Cactus Farm, as tested by ALS Laboratories (Formerly known as Campbell Brothers):

Principle	Nutrient Value	Percentage of RDA
Energy	319 Kcal	19.50%
Carbohydrates	74.6 g	36.59%
Protein	5.7 g	9%
Total Fat	4 g	
Cholesterol	0 mg	0%
Omega 3	0.18 g	11.25%
Omega 6	1.45 g	9%
Dietary Fiber	28.1 g	70.25%
Vitamins		
Folates	46.8 µg	15%
Niacin	3.6 mg	21.95%
Pantothenic acid (Vitamin B5)	***	
Pyridoxine (Vitamin B6)	0.47 mg	40%

Riboflavin	0.47 mg	39%
Thiamin	0.11 mg	9%
Vitamin C	110 mg	183.33%
Vitamin A	25896 IU	849%
Alpha-tocopherol (Vitamin E)	69 µg	460%
Vitamin K	***	
Electrolytes		
Sodium	39 mg	2.79%
Potassium	1710 mg	35.93%
Minerals		
Calcium	436.3 mg	43%
Copper	0.052 mg	6%
Iron	2.3 mg	27%
Magnesium	662.3 mg	166%
Manganese	0.457 mg	20%
Phosphorus	187 mg	35%
Selenium	11.5 µg	8%
Zinc	0.93 mg	22%
Phyto-nutrients		
Carotene-ß	3.01 µg	
Carotene-a	0.16 µg	
Indicaxanthin	2.61 µg	
Phytofluene	0.03 µg	
Betanin	5.12 mg	

*****. Nutrient data marked with asterisks have not been tested, even though there is high probability for their existence.**

Nutritional advice for diabetic patients – Courtesy of Batya Elimelech, Chief Nutritionist at Israels' Diabetes Association:

1. Despite the praises given to the cactus' fruit and branches in this literature review – we would like to stress out the fact that the use of different supplements or consumption of specific food, excellent as it can be, could never replace the treatment of diabetes including a proper healthy diet, physical exercise and following your drug regimen as established by your attending physician.

2. On the nutritional level – as can be seen in the nutritional facts table above, there is a vast difference between consuming nopal and prickly pear, as the prickly pear contain triple amounts of carbohydrates compared to the nopal. Therefore, we would naturally recommend favoring the consumption of fresh nopal or its essence over the prickly pear.
3. The recommended daily amount of prickly pear and nopal as mentioned in the previous chapter is equivalent to about 20-30 grams of carbohydrates, which in its turn is equivalent to 1.5-2 serving of fruit. Consumption of fruit in that amount is compatible with recommended amount of fruit consumption for the general population and for the balanced diabetic patient. In the case of case of the average diabetic patient – it is mandatory to individually evaluate the blood glucose balance level alongside extra parameters and combine the consumption of cactus as part a balanced menu, so it would be divided throughout the day.

Sliced fresh nopal, goes great with homemade cooking

Summary:

The information reviewed in this article indicates that the cactus, as shown in studies in Vitro and in Vivo as well as in clinical randomized control trials in human, may assist as part of a healthy balanced diet with coping with diabetes, management of obesity, cure hyperlipidemia, relieve pain, help with peptic ulcers and even hangover phenomenon, as well as having antibiotic, antiviral and anticarcinogenic effects. Whilst doing so, the cactus possesses great nutritional qualities by being rich with fiber, different antioxidants and carotenoids as well as the ability to fulfill almost every nutritional need for the human body when consumed correctly and in the right amounts.

The cactus can be eaten fresh or cooked, branches (Nopal) or fruit (prickly pear), in salads or as a jam, as gravy or as a supplement, and recently – through a state of the art technology, be consumed as condensed powder with extra long shelf-life which preserve its nutritional and medicinal properties to be equivalent to those of a fresh cactus. Therefore, the cactus is available for consumption in many ways.

Processed cactus products – made of prickly pear and nopal, Integrates in all fields of industrial food.

A drink made of purple red prickly pears.

"Orly Strains", developed by Professor Itamar Glazer and Noam Bloom since 1975 (patented)

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