

Evaluation of the therapeutic effect on consumption of *Opuntia ficus-indica* Haw (Cactaceae)

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Abstract

Opuntia ficus-indica Haw (Cactaceae) is a xerophilous plant, developing in arid and semi-arid climates popularly known as prickly pear, fig tree or nopal. This study aimed to determine the beneficial effects of phytochemicals present in *Opuntia ficus-indica*. To this end, a literature review was carried out in the Google Scholar® and PubMed databases using the health descriptors: *Opuntia ficus-indica*, prickly pear and nopal, until 2020. As an inclusion criterion, the articles were analyzed based on the quality of the hypothesis / objective description; quality of the description of the outcome to be studied; characterization of the included sample; quality of the description and discussion of the main photochemical compounds found in *Opuntia ficus-indica* related to the benefits for human health; quality of the description of the study's main findings. Cladodes are the most used part of the plant, where most of the important beneficial properties that are used for human health and disease prevention are concentrated. In view of what is available in the literature, it is concluded that it is a plant that has not been explored much, therefore, more studies are needed for new discoveries to be made about the biological activities of the plant under study.

Keywords: *Opuntia ficus-indica*. Phytochemical Compounds. Antioxidants. Medicinal Plant.

Introduction

Opuntia ficus-indica Haw (Cactaceae), a plant introduced in Brazil around 1,880 in the northeastern region of the country in arid and semi-arid soil, being classified as forage palm and morphological characteristic as absence of thorns. It has adapted with excellence in Brazilian soil where its large-scale cultivation has been derived mainly for animal feeding due to the great nutritional power that this plant has where it aroused great

interest from farmers and ranchers in the region, starting from the condition of scarcity or even the absence of other food sources^[1].

Through the nutritional properties already proven and used by man for centuries in his diet with success and excellence, the need arises to further explore this plant in order to discover and isolate new substances classified as phytochemicals with pharmacological properties for the treatment of several diseases due to the great potential that it has demonstrated over time^[2].

Its phytochemical properties, being in great abundance the antioxidants present and various parts of the plant have been showing benefits in the control of several diseases such as: cardiovascular diseases, diabetes, obesity, metabolic syndromes, cancer and many other diseases, as it plays a very important role in the control inflammation and oxidative stress that cells suffer over time, helping to prevent and delay the onset of such diseases^[1].

Materials and Methods

This is a bibliographic search, including indexed articles, published since 2013, written in English that studied *Opuntia ficus-indica*, a type of cactus typical of Mexico and that gained popularity in other countries due to its important photochemical properties. Only food but also for human health, contributing to the improvement of several pathologies due to its high concentration of fibers and antioxidant compounds distributed throughout the plant.

The search strategy for articles included research in electronic databases such as the National Library of Medicine (PUBMED), Scientific Electronic Library Online (SCIELO) and Scholar Google®.

As an inclusion criterion, articles were analyzed based on the quality of hypothesis / objective description; quality of the description of the outcome to be studied; characterization of the included sample; quality of the description and discussion of the main photochemical compounds found in *Opuntia ficus-indica* related to the benefits for human health; quality of the description of the study's main findings.

Results and Discussion

Taxonomic characteristics and origin of the plant

Opuntia ficus-indica is a xerophilic plant (adapted to the drier environments), belonging to the Plantae Kingdom to the Tracheobionta Sub-kingdom to the Dicotyledonea Class to the Dialipetalas Subclass to the Caryophyllales Order to the Cactaceae Family and the *Opuntia* genus. It can be popularly known as prickly pear, fig tree, pear cactus, hedgehog, nopal or nopalera, depending on its geographical location, which includes about 1,500 species of cactus. This plant has a tropical and subtropical predominance, with development in arid and semi-arid climates, with characteristic geographical distribution in countries like Mexico where it was classified as one of the oldest plants to be cultivated and which contributed significantly to the agricultural economy of the Aztec empire in the pre-times -Hispanic, and gained popularity in other territories such as Latin America, especially in Brazil in the middle of the 18th century, introduced by the Portuguese and in South Africa and Mediterranean countries, aiming at the beginning to be used for economic purposes^[3,4].

Botanical characterization, morphology and physiology of *Opuntia ficus-indica*

The species of *Opuntia ficus-indica* demonstrates a shrub, creeping or vertical plant, which reaches approximately 1.8 m in height and with an approximate length of 60-70 cm and an average thickness of 2-3 cm. The aerial part is called cladodes of fleshy and succulent appearance (water storage in the organs) and with a rare presence of thorns^[5].

The flowers of *Opuntia ficus-indica* are located in the cladodes mainly in the apical part of the plant, with yellow or orange coloration that vary 7-8 cm in diameter ^[5]. The *Opuntia ficus-indica* fruit presents a cylindrical shape, with a sweet and juicy characteristic. Its length can vary from 4.8-10 cm, its width from 4-8 cm with an approximate weight of 100 and 200 g^[5].

Phytochemical and nutritional components

The *Opuntia ficus-indica* plant has become known and appreciated worldwide for presenting some important phytochemical characteristics, as it is being used for human nutrition due to its high nutritional value in the form of teas, juices, jellies, gels, liquid sweeteners, edible oils, sauces among others, and production of cosmetics and mainly by modern medicine as an herbal remedy, to treat various health problems linked to its therapeutic effects^[6].

Cladodes are the most widely used part of the plant, where most of the important beneficial properties that are used to promote human health and disease prevention are concentrated. However, these phytochemical properties, which are so important and abundant in the plant and undergo changes due to the stage of maturity, time of harvest, environmental conditions, post-harvest treatment such as storage, are factors that must be taken into account when trying to isolate a certain phytochemical compound, these conditions also apply to the composition of the fibers in the cladode, as it gets older it increases the content of insoluble fibers in relation to the soluble fibers, a crucial factor related to therapeutic efficacy in controlling body weight as well as reducing cholesterol and blood glucose^[3,4].

The phytochemicals present in the plant are distributed and concentrated in different places in the plant, and their consumption can mitigate several diseases^[7].

In the fruit we can find proteins, carbohydrates, fibers that improve the sensitivity to peripheral insulin, with hypoglycemic properties, they also have vitamin C, organic acids (citric and malic), flavonoids (isoramnetin, rutinosis, isoramnetin and quercetin derivatives) and betalains, amino acids, and antioxidant compounds (phenols, flavonoids, betaxanthin and betacyanin) associated with the prevention of inflammation, cardiovascular dysregulation and degenerative diseases, as they assist cells in preventing or suppressing such oxidative damage in DNA^[7].

The flowers contain flavonoids (carotenoids, quercetin, canferol and luteolin), fatty acids and minerals (potassium), indicated for the treatment of amoebic dysentery, used as diuretics because they improve kidney function, due to the high potassium content⁸. Bark and seeds we can find abundantly lipids enriched with fat-soluble essential fatty acids, flavonoids and antioxidant tannins^[8].

In the Cladodes (segments of the stem), the edible part of the plant contains, carbohydrates, vitamins, amino acids, mineral salts (Potassium, Magnesium) where its consumption improves bone mineral density, organic

acids (malic and citric acid) antioxidants, phenolic compounds or phytochemicals (flavonoids, isoramnetine and quercetin), source of soluble dietary fibers (mucilage, gum, pectin and hemicellulose) and insoluble (cellulose and hemicellulose), which help to reduce body weight by binding to dietary fats, making it difficult to absorb and facilitating their absorption its excretion via the feces. Potential free radical scavenger, which can lower cholesterol levels in the case of hyperlipidemia contributing to the risk control of atherosclerosis, as well as helping to increase HDL cholesterol levels with a decrease in LDL cholesterol and triglycerides^[8-11].

Antioxidants contribute to the fight against inflammation of the respiratory and digestive system, blepharitis, conjunctivitis, psoriasis, eczema, edema, muscle and rheumatic pain, acting on healing because it mainly influences the increase in collagen synthesis in the injured tissue, stomach ulcers, fighting fatigue, low blood pressure and liver problem^[3,12-16].

Medical importance

Phenolic or phytochemical compounds obtained through the consumption of the plant are of great interest to medicine, as they are largely responsible for the prevention of various diseases. Phytochemicals are secondary metabolites produced by the plant in a natural way, responsible for preventing the plant from UV rays, attracting pollinators helping in the reproduction and dispersion of the species, growth of the plant, antimicrobial, antifungal, antioxidant and against free radicals^[12].

When using products containing *Opuntia ficus-indica* in the form of a medicine or food containing phytochemicals, they are absorbed by the small intestine, reaching target sites in the body and contributing beneficially to certain diseases^[12].

Due to the use of *Opuntia ficus-indica* since ancient times by popular and traditional medicine mainly by the most needy people, it is a simple, economical and easily accessible alternative, and with satisfactory and growing results over time, mainly with technological evolution which has been contributing to the isolation and identification of chemical compounds with greater success and efficiency, it becomes a plant of great interest also for developed countries, where they invest in the discovery of new innovative and natural pharmacological properties, mainly because it is a plant that have high annual productivity, and develops with excellence in hostile soil, great adaptability to the climate favoring the economy of places where agricultural productivity is poor. These compounds are intended to contribute beneficially in a natural and sustainable way to assist or replace older drugs that have deleterious side effects for human health, offering an alternative and safe way for new future treatments and the provision of the general population for treatment of various diseases^[5,17].

This study aimed to determine the beneficial effects of the photochemical compounds present in *Opuntia ficus-indica* in the prevention of diseases providing health promotion.

Conclusion

Currently, the search for new medicines of natural origin has been growing in a considerable proportion throughout the world, being a healthier alternative and mainly of easy access and low cost.

The growing discovery of new plant phytochemicals associated with therapeutic efficacy and safety opens up a very advantageous option for the development of new drugs due to their benefits proven by popular experiences but there is little scientific evidence.

The *Opuntia ficus-indica* plant has aroused great interest in the scientific community, as it presents several phytochemical compounds of great relevance to modern medicine, as it has been showing significant efficacy in the treatment of various diseases. However, scientific research on this plant can prove a high nutritional power, which guarantees its benefits for human consumption, and recommends its consumption.

It is worth mentioning that research on this plant must be increasingly intensified for future full proofs of the advantages and disadvantages of its consumption, since as already mentioned, most of the evidence of therapeutic effects in the treatment of certain diseases is still empirical, where people consume the plant believed in certain benefits that are popularly used and often substitute pharmacological therapy to use the plant in the form of teas or extracts as an effective alternative in the treatment of their pathologies I believe in the cure, which can cause serious damage to health. Due to such circumstances, it becomes extremely important to effectively discover the main phytochemicals that can actually exert such therapeutic effects and with that the society can be enjoying with total safety and mainly from natural sources.

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