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Review Article

Medical Treatment with Cactus Plant

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Abstract

Cactus posses a ridiculous varietal quality; many genotypes presence, and are differentiated with flowering duration, flower color, fruit and pulp colour, fruit shape, fruit by orga-noleptic uniqueness, and the antioxidant property. Cactus exerts as antioxidative shows numerous positive medical benefits. Different cactus varieties especially Opuntia consists of several antioxidants e.g. cysteine, taurine, carotenoid, ascorbic acid, reduced glutathione, and flavonoids in the fruits and vegetative parts. Neutralizing reactive oxidative species having singlet oxygen, hydrogen peroxide due to colourless phenolics and betalains. Their high levels of certain chemical compounds can make this fruit an added nutritional value, such as taurine, calcium, magnesium, phenolic compounds and beta-lains. The antioxidants such as polyphenolics are cardio protective, anticancer, antiviral or anti-allergenic properties. These polyphenolics of cactus increases the intracellular calcium ions in endoplasmic reticulum this perturb the expression of interleukin 2 which is associated with human T cells. The phytosterols of fruit and stem extract is used in this. Beta-sitosterol is the component of stem extract which exhibits anti-inflammatory effect. By the help of the fruit and stem extracts the gastric lesions in mice were reduced remarkably. The reduction in cholesterol in humans and modification in low density lipoprotein (LDL) is caused by the intake of the cactus pear extract. When the lyophilized cladode extract of Opuntia ficus indica (1 g/kg) was given to rats for 30 days it was seen that rat had reduced cholesterol level, LDL, triglyceride plasma levels. Opuntia ficus indica is rich in Polyphenols, vitamins, polyunsaturated fatty acid and amino acid. The Polyphenols which have antioxidant and anti-inflammatory properties are found in abundant amount in Opuntia ficus-indica. Alkaloids, indicaxanthin and neobetanin are also present in cactus. The cladode extract has polysaccharide which has antidiabetic and antiglycation effects. The cactus fruits, seed and the fruit peel contain oleic acid, linolenic acid, palmetic acid. The omega 6 linoleic acid is the precursor of arachidonic acid and it exerts hypercholestrolemic effect. This also inhibits colon cancer. Cactus can be used as a coagulant. In the Opuntia cactus, inner pads are taken out and then they are dried and grinded into fine powder of size 53-106 m. For coagulation the 50 mg/l aluminium sulphate is used along with 2.5 mg/l of cactus polyelectrolytes. If 300 mg/l of cactus juice is added to the coagulation process the removal of turbidity of waste water from industries is enhanced to 15.1%. Interest in health care among consumers is increasing steadily and has expanded to dietary intake, and as a result, the food industry has started to produce new food types based on “nopalitos”to reflect this change in consumerism. However, the chemical composition of cladodes is modified by maturity stage, harvest season, environmental conditions, postharvest treatment, and type of species. In some wild species such as O. Robusta (Tapon) and Blanco, 17.4 to 19% proteins can be reached. O. leucotricha (Duraznillo) yield high-quality cladodes, since the pericarp can be easily removed and will neither fall apart during boiling nor release mucilage. It is well known that Opuntia cladodes are a good source of dietary fibers, which may help in reducing body weight by binding to dietary fat and increasing its excretion. This may explain why cladodes are considered as hypolipidemic. Opuntiacladodes contain higher calcium (Ca) contents relative to vegetables, fruits, and nuts.

Keywords: glutathione; lipoprotein; opuntiacladodes; taurine; quercetin; kaempferol; isorhamnetin

Introduction

Opuntia cactus was introduced in Morocco in the early 17th century from Spain (Schielief et al., 2000). With the exception of the Sahara and mountainous areas, Opuntia are widely represented in the Moroccan rural landscape, into plantations more or less regular, around villages or plant closing limiting parcels of crops or orchards (Arba *et al.,* 2000; Bouzoubaaˆ *et al.,* 2014). The culture of Opuntia exists almost in all regions of the country with relatively variable area; it occupies an estimated area with about 54,530 ha, representing 11.07% of the total area of the fruit trees (Boujghagh and Chajia, 2001). Its geo-graphical distribution is quite large since it found both in coastal areas from Sidi Ifni in the South to Tangier in the North, as in several continental regions (Boujghagh and Chajia, 2001). The best plantations are located in coastal areas and more specifically in the coastal strip of more than 10 km wide undergoing maritime influence, the plant benefits the night and morning fog, very frequently in this area throughout year (Boujghagh and Chajia, 2001; Bouzoubaa *et al.,* 2014). In Morocco, at

the Tiznit province, the culture of Opuntia occu-pies the largest area with about 17,600 ha mainly in the regions of Sidi Ifni and Ait Baamrane accounting for 65% of it (Dehbi and Radwan, 2000). Tensift and the Central regions are among the areas where regular plantations have been installed as part of national operation against erosion. In the region of Moulay Idriss, near Meknes, a cactus plantation for the production of fruits has been a steady expansion. In Beni Smir, near Oued Zem, a cactus collection was established in 1944 on an area of 500 ha (Habibi, 2004).

The cactus has been largely ignored by scientists until the beginning of 1980; this renewed interest is partly attributed to the multi functionality of prickly pear fruit. Recent studies have revealed their high levels of certain chemical compounds, which can make this fruit an added nutritional value, such as taurine, calcium, magnesium, phenolic compounds and beta-lains (Piga, 2004; Zine *et al.,* 2013).Cactus also knows a renewed interest in several countries due to its ecological role, environmental and socio-economic: the fight against erosion and desertification, and fruit produc-tion fodder (Bouzoubaa *et al.,* 2014). In Morocco, the new strategy of agricultural development concretized by the Green Morocco Plan (PMV) is a real opportunity for the development of different sectors related to cactus, knowing that the PMV provides the consecration of a million hectares fruit species requiring little water, such as olive, carob or cactus (Bouzoubaa *et al.,* 2014). The area reserved for the latter in each region will experience a remark-able increase, especially in the Guelmim-Smara and Rhamna regions with additional 70,000 and 50,000 ha respectively. Moroccan cactus has a very high genetic variability, several cultivars exist (Bouzoubaa *et al.,* 2014), and are distinguished by the flowering period (early, late), the flower color (yellow, orange and pink), fruit color and pulp (green, yellow, orange, red and purple), fruit shape (oval, round or oblong), the orga-noleptic characteristics of fruit (Boujghagh Chajia, 2001), and the antioxidant content (Kuti, 2004; Tesoriere *et al.,* 2005). Mexico has a cultural wealth and flower diversity that has fascinated explorers and researchers (Heinrich *et al.,* 2014). Because of its abundance and diversity since pre-Hispanic times, one of the plant species of greatest social and economic relevance is cactus pear (Opuntia spp), in the regions where it is distributed (Realini *et al.,* 2015). Although the center of origin of the species is still a subject of research (Majure *et al.,* 2012), its domestication process is concentrated in the central part of Mexico (Griffith, 2014). Currently, because of its long history of use, O. ficus-indica (L.) Miller is one of the most important species at the global level (Irvin, 2012). FAO (2006), as a result of various studies, has highlighted the importance of this species as a natural resource and as a potential source of income, employment and nutrients; likewise, considering the recrudescence of desertification and the decline of water resources, it is gaining increasingly more importance as an effective element in the food production system (Stintzing and Carle, 2005). However, despite its nutraceutical potential and its wealth in nutrients, it is still not considered an important source of food, due particularly to its localized production and its high perishability (Patel, 2015); therefore, its use is restricted mainly to its center of origin.

Concerning Opuntia, three studies were registered where bibliometric techniques were used. In one of them, carried out by Inglese and Liguri (2010) aspects of biology and ecophysiology were addressed; another one deals with the effect of cactus pear in relation to body weight and cardiovascular risks (Onakpoya *et al.,* 2015); and the third contemplates studies about cactus pear used as fodder and its validation in animals (Grünwaldt *et al.,* 2015).Cactus has a great economical value as it is the no maintenance wild/ornamental plant of the family Cactaceae. It is also referred to as 'new world' plants (Shetty *et al.,* 2012). It is extensively cultivated for its various uses such as fodder and food (tastier fruit is used as a vegetable). It is also considered as an energy source as it contains 14% glucose (Salim *et al.,* 2009). It grows in hot, arid and semi-arid regions. Its morphology, physiology and anatomy are such that it conserves water. It is used as an energy source and also for ecosystem remediation (Small and Catling, 2004). Cactus is fleshy and pulpy due to its amazing capacity to retain huge amounts of water into it; therefore, this plant is capable to flourish in deserts. Physiologically it exhibits CAM metabolism, which has a mechanism to tolerate the environmental stress, mostly the unavailability of water (Anderson, 2001; Bensadón *et al.,* 2010). Morphologically, the stem of cacti is modified and become fleshy, flat and cylindrical or globular and forms cladode. The pollination and the seed dispersal take place with the help bats, birds and insects (Godýnez-Alvarez *et al.,* 2002; 2004). Storage of cactus fruit can be enhanced by reducing the microbial content and by packing the peeled fruits in the special films for 8 days at 41ºC (Shetty *et al.,* 2012). Escontria chiotillafruit 'jotilla' has a sweet-sour taste which becomes extremely tasty when frozen with sugar; also, a proximal analysis determines its suitability for marmalades and jams as well as dressing products (Yañez-Lopez *et al.,* 2005). Indole butyric acid (IBA) and Gibrellic acid (GA) are sprayed onto the flowers to produce seedless by inducing emasculation. Ethephon is generally used in 500 to 250 ppm concentration for the ripening of cactus fruit before 9 days of natural ripening (Esparza *et al.,* 2004). Fruits have vitamins, amino acid and minerals. The usual edible part of the fruit is 54.18% (Bekir, 2004). Cactus contains betalains pigment which gives colour and used in making ice creams and yoghurts (Stintzing and Carle, 2005).

The prickly pears are the best crops found widely and they are also grown at the borders of the field to protect many other crops (Mondragón-Jacobo and Pérez-González, 2001). Before it is fed to cattle the spines are burnt and then used in feeding cattle in drought prone areas. Though it is low in protein content, but it is used in semi-arid regions to feed dairy cattle fodder. It imparts good flavour to milk and imparts good colour to butter (Salim *et al.,* 2009). If this is replaced with corn and Tifton hay with forage cactus (Opuntia ficus-indica).The cactus pear extract when administrated intra-peritoneal in mice failed to show toxic effect on mice but it had the chemo preventive effect comparable to the synthetic chemo preventive agent, i.e., Retinoid N-(4-Hydroxyphrenyl) retinamide (4-HPR) which is used in ovarian cancer (Zou *et al.,* 2005; Camacho-Chab *et al.,* 2016). The antioxidative present in the cactus exerts many beneficial health effects (Leenen *et al.,* 2000; Martinez and Moreno, 2000; Tesoriere *et al.,* 2004; 2005; Fernández-López *et al.,* 2010). The fruits and vegetative parts of different varieties of cactus, largely Opuntia contains many antioxidants e.g. Ascorbic acid, carotenoid, reduced glutathione, cysteine, taurine, and flavonoids such as quercetin, kaempferol and isorhamnetin (Tesoriere *et al.,* 2005). The colorless phenolics and betalains have the beneficial activity of neutralizing reactive oxidative species such as singlet oxygen, hydrogen peroxide or may cause suppression of xanthine oxidase system (Park *et al.,* 2001; Psomiadou and Tsimidou, 2001; Tesoriere *et al.,* 2003; Dok-Go *et al.,* 2003; Gentile *et al.,* 2004; Siriwardhana and Jeon, 2004; Tesoriere *et al.,* 2004; 2005; Stintzing *et al.,* 2005; Moussa-Ayoub *et al.,* 2011; Jorge *et al.,* 2013; Khatabi *et al.,* 2016). The antioxidants such as polyphenolics are cardio protective, anticancer, antiviral or anti-allergenic properties (Tapiero *et al.,* 2002; Chougui *et al.,* 2013). These polyphenolics of cactus increases the intracellular calcium ions in endoplasmic reticulum this perturb the expression of interleukin 2 which is associated with human T cells (Aires *et al.,* 2004; Gallegos-Infante *et al.,* 2009; Rebah and Siddeeg, 2017). The phytosterols of fruit and stem extract is used in this. Beta-sitosterol is the component of stem extract which exhibits anti-inflammatory effect. By the help of the fruit and stem extracts the gastric lesions in mice were reduced remarkably (Park *et al.,* 2001).

The reduction in cholesterol in humans and modification in low density lipoprotein (LDL) is caused by the intake of the cactus pear extract (Stintzing *et al.,* 2001; Stintzing and Carle, 2006). When the lyophilized cladode extract of Opuntia ficus indica (1 g/kg) was given to rats for 30 days it was seen that rat had reduced cholesterol level, LDL, triglyceride plasma levels (*et al.,* 2003). According to El-Mostafa et al. (2014) *Opuntia ficus* indica is rich in Polyphenols, vitamins, polyunsaturated fatty acid and amino acid. The Polyphenols which have antioxidant and anti-inflammatory properties are

found in abundant amount in Opuntia ficus-indica (Butera *et al.,* 2002; Kuti, 2004). Alkaloids, indicaxanthin and neobetanin are also present in cactus (Valente *et al*., 2007). The cladode extract has polysaccharide which has antidiabetic and antiglycation effects (Yang *et al.,* 2008). Flower contains gallic acid and 6-isorhamnetin 3-O-robinobioside in the concentration of to 4900 and 4269 mg/100 g of dry weight respectively (Ahmed *et al.,* 2005; De Leo *et al.,* 2010; Ammar et al., 2012). Gallic acid is known to DNAdamage (Ginestra et al., 2009) and also buffer free radical (Yen *et al.,* 2002). The tumoral cells from lung and prostate cancer can kill by cytotoxic activity of Gallic acid (You and park, 2010). Many phenolic compounds are in the concentration of less than 10 mg/g. The seed of cactus also contains phenolic com pounds like sin apoyl diglucoside, feruloyl derivatives, tannins etc. atconcentrations 48 to 89 mg/100 g (Chougui *et al.,* 2013). The seed of cactus also contain s phenolic compounds like sin apoyl diglucoside, feruloyl derivatives, tannins etc. at concentrations 48 to 89 mg/100 g (Chougui *et al.,* 2013).

The cactus fruits, seed and the fruit peel contains oleic acid, linolenic acid, palmetic acid (Ramadan, 2003; Ennouri, 2005). The omega 6 linoleic acid is the precursor of arachidonic acid and it exerts hypercholestrolemic effect. This also inhibits colon cancer (Soel *et al.,* 2007). Cactus can be used as a coagulant (Sellami *et al.,* 2014). In the Opuntia cactus, inner pads are taken out and then they are dried and grinded into fine powder of size 53-106 m (Jadhav and Mahajan, 2014). For coagulation the 50 mg/l aluminium sulphate is used along with 2.5 mg/l of cactus polyelectrolytes (Ikeda et al., 2002). If 300 mg/l of cactus juice is added to the coagulation process the removal of turbidity of waste water from industries is enhanced to 15.1% (Adjeroud *et al.,* 2015). The cactus also has some enzymes which may help in the conversion of dyes which come from the textile industries. The cactus reduces the BOD, COD, turbidity, salinity of water. It also decreases the number of heavy metals in the water (Carvalho Dos Santos and Lenzi, 2000). Certain chemical reactions may occur between the chemicals and hence certain health problems (Gebresamuel and Gebre-Mariam, 2012). The physical method of absorption technique is a very expensive method and after the treatment the carbon is needed to be restored (Ginos *et al.,* 2006). The chemical components of cactus are very useful and they are not harmful (Gebresamu el and Gebre-Mariam, 2012). T the polysaccharide is the major mucilage component (Garvie, 2006; Sellami *et al*., 2014) and Ca and Mg ions are the gelatin components of mucilage (Sepúlveda *et al.,* 2007). The mucilage has a good water holding capacity (Trachtenberg and Mayer, 2003). The carbohydrate present are l-arainose, dgalactose, l-rhamnose, d-xylose and galacturonic acid (Vijayaraghavan *et al.,* 2011; Swathi *et al.,* 2014). Plants in the genus Opuntia are members of the Cactaceae family that is widely distributed in arid and semi-arid regions throughout the world (Butera *et al.,* 2002). Among the members of this family, Opuntia ficus indica is the largest genus and most widespread species that has been successively cultivated in semi-arid regions of the world for commercial processing (Coria-Cayupán *et al.,* 2011; Moussa-Ayoub *et al.,* 2011). The cactus plant originated from tropical America and its fruits are widely consumed as a delicacy in northern Mexico, South-western United States, Mediterranean countries and South Africa (Guzmán-Maldonado *et al.,* 2011; Piga *et al.,* 2003). Cactus plants can grow under harsh conditions and have low water exigency and a high water-use efficiency ratio, which makes it suitable for extensive production as underlined by the Food and Agriculture Organization. The annual production of cactus fruit is in the range of 50 tons/hectare under optimum conditions (Ramadan and Morsel, 2003).

The cactus plants are characterized by a huge diversity with relation to their parts including the fruit and exhibit great variability in chemical composition (Chang *et al.,* 2008; Kuti, 2004). The skin and pulp colour, pulp texture, sugar content, and juice acidity of cactus fruits are directly related to the presence, intensity and activity of nutritional and functional compounds (Yahia and Mondragon-Jacob, 2011). The nutritional and phytochemical composition of different species of cactus fruit have been studied (Guzmán-Maldonado *et al.,* 2011; Piga *et al.,* 2003; Ramadan and Morsel, 2003; Kuti, 2004 and Lee JC and Lim, 2000). The presence of phytochemicals in cactus fruits varieties have been linked to their antioxidant, anti-inflammatory, anticancer, antiviral, analgesic, and anti-LDL cholesterol peroxidation, hypoglycemic and antimicrobial activities (Coria-Cayupán *et al.,* 2011; Moussa-Ayoub *et al.,* 2011; Chang *et al.,* 2008; Kuti, 2004 and VanderJagt. 2002). Consequently, cactus pear has become an important fruit for conservation and food security in the arid and semi-arid regions of Kenya, where the production of more succulent food plants is severely limited (Kunyanga *et al*., 2009). In Mexico, among the number of plants identified and used in folk medicine, Opuntia species (spp.) exhibit a lot of beneficial properties and high biotechno-logical potential. They grow in dry desert area where hard environmental conditions prevail, and they have been used for centuries as food resources and in folk medicine for the treatment of chronic diseases (obesity, cardiovascular and inflammatory diseases, diabetes, and gastric ulcer) and many other illnesses (Young *et al.,* 2005).The Opuntioid cacti represent the most spectacular species of succulent plants, which are characterized by a shallow root system that permits rapid water uptake; a thick, waxy cuticle that prevents excessive water loss; and crassulacean acid metabolism (CAM), an alternative photosynthetic pathway, that allows plants to uptake atmospheric CO_2 at night when water loss is minimized (Ogburn and Edwards, 2010). Opuntia spp. is one of the most diverse and widely distributed genera in America (Anderson, 2001), but the highest richness of wild species are found in Mexico, as at least 126 species with different degrees of domestication have been observed (Reyes-Agüero and JAguirre Rivera, 2011).

There are evidences that during the process of Opuntia domestication, the continuous and systematic gather of cladodes and fruit favored the development of exceptional features, with the purpose to adapt plants to successfully live in human-made environment and maximize yield or any given selected feature (Casas and Barrera, 2002). It has been proposed that O. ficus-indicais a spineless cultivar derived from O. megacantha, a native species from central Mexico (Griffith, 2004; Labra *et al.,* 2003). Bayesian phylogenetic analysis of nrITS DNA sequences indicates that the center of domestication for this species is located in central Mexico (Arakaki *et al.,* 2011). The easy of clonal Opuntia propagation probably explains why it is easily distributed worldwide. Evidence exists for the use of Opuntia as human food since at least 9000 years ago or even as early as 12,000 years ago (Griffith, 2004). The plants are also recorded in cultivation in Tlaxcala, Mexico, in 1519.O. ficus-indica fruits and shoots were also reportedly consumed by the Maya of southeastern Mexico (Griffith, 2004). Actually, O. ficus-indica is as important as corn and tequila agave in the agricultural economy of modern Mexico and represents important food and feed resources. Its economic importance has gradually increased around the world as a health-promoting food (Anaya-Perez, 2001). O. ficus-indica is grown for the large, sweet fruits (often called “tunas”), which are available in local and commercial markets worldwide (Inglese et al., 2002). In addition, the young cladodes (stem segments) of O. ficus-indica are harvested as a vegetable crop (often called nopalitos). Other uses have been reported, including as a binding and waterproofing agent in adobe and its medicinal properties (Saenz-Hernandez *et al.,* 2002).O. ficus-indica, along with other Opuntia and Nopalea species, has been grown from pre-Columbian times as a host plant for cochineal insects (Dactylopiuscoccus) for the production of valuable, vivid red and purple dyes (Anderson, 2001; Nobel *et al.,* 2002). Interest in health care among consumers is increasing steadily and has expanded to dietary intake, and as a result, the food industry has started to produce new food types based on“nopalitos”to reflect this change in consumerism (Saenz-Hernandez *et al.,* 2002).However, the chemical composition of cladodes is modified by maturity stage, harvest season, environmental conditions, postharvest treatment, and type of species (Guevara-Figueroa *et al.,* 2010; Hernandez-Urbiola *et al.,* 2011). In some wild species such as O. Robusta (Tapon) and Blanco, 17.4 to 19% proteins can be reached (Guevara-Figueroa *et al.,* 2010). O. leucotricha (Duraznillo)

yield high-quality cladodes, since the pericarp can be easily removed and will neither fall apart during boiling nor release mucilage (Stintzing and Carle, 2005). t is well known that Opuntia cladodes are a good source of dietary fibers (Beatriz Pena-Valdivia et al., 2012), which may help in reducing body weight by binding to dietary fat and increasing its excretion (Uebelhack *et al.,* 2014). This may explain why cladodes are considered as hypolipidemic. Opuntiacladodes contain higher calcium (Ca) contents relative to vegetables, fruits, and nuts (Hernandez-Urbiola *et al.,* 2011; Ramirez-Moreno *et al.,* 2011 and Astello-Garcia *et al.,* 2015).

Aguilera-Barreiro et al. (2013) reported that consumption of cactus improves the bone mineral density in women with low bone mass. The beneficial properties of Opuntia spp. are related to their content in chemical compounds as minerals, polyphe-nols, vitamins, polyunsaturated fatty acids, and amino acids, as recently reviewed by El-Mostafa et al. (2014). O.ficus-indica is the most domesticated and studied species, and several reports describe the main compounds found in cladodes, flowers, and fruits (Stintzing and Carle, 2005; El-Mostafa *et al.,* 2014 and Stintzing *et al.,* 2015).Flowers and peels could exhibit a higher phenolic content than fruits and pads with about 45.7g/100g FW, so it is recommended to exploit these materials to obtain biocom-pounds with antioxidant characteristics (El-Mostafa *et al.,* 2014 and Moussa-Ayoub *et al.,* 2014). The phenolic profile in Opuntia is complex with more than 30 compounds identified in cladodes of different species (Stintzing and Carle, 2005; Guevara-Figueroa *et al.,* 2010; Astello-Garcia *et al.,* 2015 and Stintzing *et al.,* 2015), more than 20 in seeds, and 44 compounds in juices (Chougui *et al.,* 2013 and Mata *et al.,* 2016).

Betalains are excellent radical scavengers with an antiox-idant activity 3-4 times higher than ascorbic acid, rutin, and catechin (Cai *et al.,* 2005), twice higher than that measured for pear, apple, tomato, banana, and white grape, and from the same order as pink grapefruit, red grape, and orange (Strack *et al.,* 2003). The monophenol nature of betanin and reducing intermediates during the oxidation process may confer to the molecule a higher H-atom or electron donation potential. In the case of betaxanthins, the antioxidant power has been linked to the presence of one or two phenolic hydroxy groups in their structure. Betacyanins also have a potential to inhibit NO or nitrogen radical species due to the presence of a catechol group in betanidin structure (Gandía-Herrero *et al.,* 2009 and Taira *et al.,* 2015).Epidemiological and clinical studies have consistently shown that high fruit and vegetable consumption is associated with a reduced risk of several chronic diseases such as coronary heart disease, cancer, ageing, atherosclerosis neurodegenerative diseases (such as Parkinson˝s and Alzheimer˝s disease), and inflammation (Iriti and Faoro, 2006). There are mucilaginous cells in both, that store mucilage (Espino-Diaz *et al.,* 2010). Mucilage is distributed in the cladodes and fruits (peel and pulp) of Opuntia spp. Although cactus pear fruits and stems were traditionally utilized for medicinal and cosmetic purposes, as forage, building material, and as a source for natural colours (Stintzing and Carle, 2005) their use is mainly restricted to fresh fruit consumption in their countries of origin but are also exported to the European fresh fruit market (Galati *et al.,* 2005; Guzman-Maldonado *et al.,* 2010). Generally, cladodes are rich in pectin, mucilage, and minerals, whereas the fruits are good sources of vitamins, amino acids, and betalains (Stintzing and Carle, 2005; Tesoriere et al., 2005). Worth to say, that Opuntia spp. has been extensively studied for their biological effects, such as their therapeutic properties against arthritis and cancer (Lee *et al.,* 2002). Viscosity is being studied, with results that may enable them to compete in markets where locust bean gum, guar and other gums are used as thickening agents (Medina-Torres *et al.,* 2000; 2003; Goycoolea *et al.,* 2000; Sepulveda *et al.,* 2003b). A major review of these compounds has been published by Saenz (2004). According to Nelson (2001), adding insoluble fibre to foods is a way of reducing their calorie content. A significant number of scientific investigations have been performed on extraction and analysis of polysaccharides from cladodes (Majdoub *et al.,* 2001), fruit pulp (Matsuhir *et al.,* 2006), and fruit peel/skin (Habibi *et al.,* 2004a, 2004b) of O. ficus indica, particularly from mucilage, and their biophysical properties.

These compounds are valued for their contribution to a healthy diet and also as ingredients for designing new foods (Saenz, 2004). They enhance health, help to prevent or treat disease and/or improve physical or mental performance with the addition of one or more functional ingredients or using appropriate biotechnologies (Sloan, 2000). Of the functional compound available, dietary fibre is one of the most widely studied. It has helped to establish nutritional value and the relationships between fibre and health (for example, Cholesterol control and/or prevention of diseases such as diabetes and obesity). Cladodes are an important source of fibre, calcium and mucilage, all of which are valuable in a healthy diet (Saenz *et al.,* 2004). Once extracted from the pulp, these compounds can be used as food thickening agents (Saenz *et al.,* 2004a; Sepulveda *et al.,* 2003b). Two enzyme combinations (Rohapect B1L and Fructozym BE) showed the best result for the production of mucilage-free purple pitaya juice comparing with single enzyme use (Herbach *et al.,* 2007). A significant number of scientific investigations have been performed on extraction and analysis of polysaccharides from cladodes (Majdoub *et al.,* 2001), fruit pulp (Matsuhir *et al.,* 2006), and fruit peel/skin (Habibi *et al.,* 2004a, 2004b) of O. *ficus indica*, particularly from mucilage, and their biophysical properties.

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