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Phytochemical Screening of Fruits of *Opuntia Elatior* mill.

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ABSTRACT

The phytochemical analysis was carried out for standardization of fruits of *Opuntia elatior* Mill. The fruits were preliminary evaluated by estimation of proximate analysis. Presence of betacyanin was confirmed by spectrophotometric and high performance liquid chromatography coupled with mass spectroscopy techniques. The average weight of fruit was 24.568 ± 7.134 g/unit and the percentage of peel and seed was very low compared to the edible portion. Phytochemical analysis indicated the presence of color pigment betacyanin as an active principle and sugar content in high amount and low acidity of fruit which make it very sweet and delicious. The total betacyanin content (47.10 mg/100 ml) equivalent to betanin obtained from fruits of *Opuntia elatior* Mill. was higher as compared to *Opuntia ficus-indica* and *Opuntia undulata* Griff. while lower as compared to *Opuntia stricta* Haw.

Keyword: Opuntia; Prickly pear; Betacyanin; Betalain

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INTRODUCTION

Phytopharmaceutical products have served as a major source of drugs for centuries and today about half of the pharmaceuticals in use are derived from natural products. The use of phytopharmaceutical substances, particularly isolated from plants, to control diseases is an old practice that has led to the discovery of more than half of all modern pharmaceuticals as complimentary or alternative medicine either to prevent or ameliorate many diseases has been noted in recent years¹. The presence of potentially active nutrients and their multifunctional properties make *Opuntia spp.* fruits and cladodes perfect candidates for the production of phytopharmaceutical products. Although traditionally appreciated for its pharmacological properties by the Native Americans, cactus pear is still hardly recognized because of insufficient scientific information². However, recent studies on *Opuntia spp.* have demonstrated prickly pear fruit and vegetative cladodes to be excellent candidates for the development of phytopharmaceutical products.

Opuntia is a large genus of succulent shrubs, native of the new world, now widely grown in the warmer parts of the world on account of their unique appearance and attractive flowers. They are commonly known as Prickly pears because of their edible fruits. The cactus *Opuntia* (subfamily: *Opuntiodae*, family: Cactaceae) is a xerophytic plant producing about 200 – 300 species and is mainly growing in arid and semiarid zones. In local parlance cactus is called prickly pear, slipper thorn, tuna (English) and has different vernacular names in India like Hathlo thor, chorhthlo (Gujarati), Haththathoira, Nagphana, Nagphani (Hindi), Snuhi, Vajrakantaka, Bahushala (Sanskrit), fico d'india (Spain), Nagadali, Nagakkali, Chapati balli (Tamil), Nagamulla, Nagajemudu (Telugu), Nagphani, Thuar (Urdu). It was found that cacti in India did not all belong to one species as a *O. dillenii*, but three to four species distributed over different regions in India. *O. dillenii* Haw. is found mainly in the southern parts of the India while *O. vulgaris* Mill (Syn *O. monocantha* Haw.) is distributed mainly in the northern parts; *O. elatior* Mill. is found in western India^{3,4}.

The plant is bitter, hot; laxative, stomachic, carminative, diuretic, antipyretic, alexiteric; cures biliousness, burning, leucoderma, “vata”, urinary complaints, tumors, ascites, loss of consciousness, piles, inflammations, vesicular calculi, anaemia, ulcers, cures bronchitis of children, ophthalmia, liver complaints lumbago and enlargement of the spleen. The leaves are very tasty, stomachic; cure inflammations, ascites, tumours and pains. The leaves mashed up and applied as a poultice are said to allay heat and inflammation. The hot leaf applied to boils hastens

suppuration; the leaf made into a pulp is applied to the eyes in cases of ophthalmia. In South Africa and in Australia a decoction of the leaf has been used as a diabetes remedy. A wineglassful of a strong decoction, to which sodium bicarbonate is often added, is taken thrice daily. It must be freshly prepared each day. It is reported from Australia to relieve the symptoms and to lower the blood sugar level in diabetes. A second method of preparation is to cover the minced leaf with sodium bicarbonate over night. A black treacly liquid exudes, which is used as a diabetes remedy. The flowers cure bronchitis and asthma. The fruit is considered a refrigerant, and is said to be useful in gonorrhoea. The baked fruit is given in whooping cough and syrup of the fruit is given to increase the secretion of bile and control spasmodic cough and expectoration³⁻⁶.

The literature study reveals that still today there is no record of phytochemical composition of *Opuntia elatior* Mill. fruits in support of nutritional and medicinal use. In light of this, the present screening was carried out to ascertain the chemical composition of fruits of *Opuntia elatior* Mill.

MATERIALS AND METHODS

Collection and authentication of plant

The fruits of *Opuntia elatior* Mill. were collected from road side weed near Atkot, Ta: Jasdan, Dist: Rajkot, Gujarat, India at Latitude (22° 1' 48" N), Longitude (71° 12' 0" E) and Elevation 193 M (633 ft) and authenticated by Dr. H. B. Singh, Scientist and Head, Raw Materials Herbarium and Museum, National Institute of Science and Communication and Information Resources, New Delhi (NISCAIR) and were preserved in the herbarium (specimen voucher No.: rbpmpc/museum/herbarium/07-08/01) in the museum of Dept. of Pharmacognosy, Smt. R. B. Patel Mahila Pharmacy College, Atkot.

Chemicals & Reagents

Acetic acid, acetonitrile, anhydrous citric acid, anthrone reagent, benzene, chloroform, concentrated sulfuric acid, deionized water, distilled water, Folin-Ciocalteu's reagent, glucose, hydrochloric acid, methanol, nylon fibers, petroleum ether (60-80°C), sodium carbonate, sodium hydroxides, toluidine blue were procured from S.D Fine Chemicals Mumbai, India. Gallic acid and other marker compounds were procured from Sigma Aldrich, Mumbai, India.

Proximate analysis

The average weight, percentage of peel, pulp and seeds of fruits of *Opuntia elatior* Mill. were determined by weighing before and after peeled out, while seeds were weighed after homogenization. Mature fruits of *Opuntia elatior* Mill. were collected and immediately taken to

the laboratory. Spines and glochides were removed from fruits by heating on the burner and then washed with water. The peel of the fruits was removed manually and pulps were subjected to homogenization for 5 minute using boss portable blender (Boss appliances, Daman). After homogenization, fruits juice was filtered through muslin cloth and filtered juice (OFJ) was used for various estimations.

The pH of OFJ was determined using pH meter (Digital pH meter model-EQ-610, Equip-Tronics, India) (7). Moisture content, total solids content and ash values were determined as per (8) and (9). Density and viscosity of OFJ were determined by density bottle at room temperature against water as reference compound and spindle S61 of Brookfield viscometer (Model DV-II+ Pro viscometer) at 100 rpm, respectively (10). All the analysis was performed in five replicates.

Phytochemical studies

Qualitative Analysis

Chemical test and TLC profile

OFJ was subjected to various qualitative chemical tests to determine the presence of alkaloids, carbohydrate, fats and fixed oil, flavonoids, glycosides, phenolics, steroids and terpenoids, wax, saponin and betalains phytoconstituents ^{11, 12}. The OFJ was subjected to thin layer chromatography studies using silica gel 60 F 254 precoated plates (Alugram® SIL G/UV254, Macherey – Nagel, Germany) to confirm presence of carbohydrates with reference to standard using solvent system chloroform:methanol (6:4) ¹² and betalains using solvent system *n*-Butanol:Acetic acid:Water (BAW) (4:1:5) and 1 % Aqueous Hydrochloric acid ¹³. The R_f values and color of spot were observed and compared.

Spectrophotometric analysis

Betalain from the fruits of *Opuntia elatior* Mill. was extracted using methanol, deionized water and methanol containing 1% conc. hydrochloric acid (HCl), with a ratio mass fruit (g)/solvent (ml) 1:5. Freshly cut fruit pulp was homogenized in these solvents for 1 min and centrifuged at 3000 rpm at 15 °C for 10 min in a CompuFuge cooling centrifuge (Remi Instrument, Mumbai). Supernatants were filtered through a glass filter G4 (Borosil Glass Works Ltd., Mumbai), and the filtrate obtained were analyzed using spectrophotometer. The spectrum (400 to 650 nm) of methanol, deionized water and methanol HCl extracts was recorded on double beam UV-visible spectrophotometer (Thermo Spectronic, Cambridge, UK) equipped with VisionPro software V 4.10, spectral bandwidth of 2.0 nm, wavelength accuracy of ± 0.5 nm and a pair of 1 cm matched quartz cells. The identification of betalain was confirmed by λ_{max} of absorption spectra ^{14, 15}.

High Performance Liquid Chromatography (HPLC)

Identification of betalains by HPLC-DAD analysis was performed in a Shimadzu HPLC-PDA system comprising of two LC-20 AD liquid pumps, automatic rinsing kit for LC-20 AD, Gradient mixer, 7725i manual injector, fixed –loop manual kit, 25 µl syringe, injector adapter, SPD-M20A photo diode array detector, and LC solution Multi PDA workstation software. Analyses were performed using an analytical scale of 25 cm x 4.6 mm i.d. and a C18 column with a particle size of 5 µm (Merck), operating at a temperature of 25 °C. The program consisted of a 30 min linear gradient elution from solvent A (1% acetic acid in water) to 12 % solvent B (1% acetic acid in acetonitrile) with a flow of 1 ml/min. In each analysis, 20 µl of the methanolic extract was directly injected onto the chromatographic column. The betaxanthin and betacyanin composition of methanolic extract were confirmed by their visible spectral characteristics in comparison to literature and retention times of chromatographic peaks ¹⁴.

Liquid Chromatography – Mass Spectroscopy (LC-MS)

HPLC – DAD was coupled with mass spectrometer (TSQ Quantum Ultra, Thermo Scientific, USA) equipped with an electrospray ionization source and LC-quan software (2.5.6.1) operating in the positive ionization mode. Nitrogen gas was used as the dry gas at a flow rate of 12 L/min with nebulizing (40 psi). The spectra was taken to promote [M+H]⁺ ion production (electrospray voltage 4 kV), and nebulizer temperature was set at 200 °C. The program consisted of a 30 min linear gradient elution from solvent A (1% acetic acid in water) to 12 % solvent B (1% acetic acid in acetonitrile) with a flow of 1 ml/min. The injection volume for fruit extract sample was 20 µl. The identification of betanin was confirmed by mass spectrometry¹⁴.

Quantitative analysis

Total sugar content

The total sugar content was determined by the anthrone reagent method (16). The OFJ (1 ml) was transferred to volumetric flask, and diluted to 10.0 ml with distilled water, having strength 100µl/ml, labeled as stock solution. Stock solution (0.1 ml) was transferred into 10 ml volumetric flask, and diluted to 10 ml with distilled water, having strength 10µl/ml. The anthrone reagent was prepared right before analysis by dissolving 0.2 g of anthrone (0.2%) in 100 ml of concentrated sulfuric acid, protected from light and used within 12 h. Anthrone reagent (4.0 ml) was added cautiously to each tube containing 1.0 ml of standard solutions of glucose (10 – 100 µg/ml) and test solution (10µl/ml). Tubes were then placed for 10 min at 5 °C. Subsequently, tubes were boiled 5 min on constant boiling water bath. After heating, the tubes were allowed to cool at room temperature for 15 min. The absorbance of the colored solution was measured at

620 nm against reagent blank. Readings were taken in triplicate. Spectrophotometric response was compared to a standard calibration curve of glucose, and total sugar content was expressed as g/100 ml of glucose.

Total phenolic content

The amount of total phenolics in the OFJ was determined according to a modification of the Folin-Ciocalteu method¹⁷. A 1.0 ml of OFJ was extracted in 10.0 ml methanol:water (50:50 v/v), having strength 100 µl/ml was introduced into test tube and mixed with 1.0 ml of 50% Folin-Ciocalteu's reagent. The mixture was allowed to stand for a 2 to 5 min, followed by the addition of 2.0 ml of 20% Na₂CO₃. After 10 min incubation at room temperature, the mixture was centrifuged for 8 min (150 g) and the absorbance of the supernatant was measured at 750 nm on a UV-visible spectrophotometer against reagent blank. Readings were taken in triplicate. Spectrophotometric response was compared to a standard calibration curve of gallic acid, and the total phenolic content was expressed as gallic acid equivalents in mg/100 ml.

Titrateable acidity

The titrateable acidity was determined by titration with 0.1N sodium hydroxide (NaOH) to pH 8.1 according to AOAC¹⁸. The glass electrode of calibrated pH meter was immersed in 100 ml of OFJ in beaker. Initial pH values before titration with 0.1N NaOH was noted down. After moderate stirring, alkali was added quite rapidly until pH 6. Then alkali was added slowly to pH 7. As pH 7 was reached, titration was finished by adding 0.1N NaOH 4 drops at time, and total volume and pH reading were recorded after each addition. Titration was continued with ≥4 drops beyond pH 8.1, and data was interpolated for titration corresponding to pH 8.1. Readings were taken in triplicate. The titrateable acidity was expresses in g of anhydrous citric acid/100 ml.

Total betacyanin content

Quantification of total betalain content was carried out according to Cai & Corke (19) and Stintzing et al.²⁰ nine times from pigment extracted in deionised water without pH adaptation applying the molar extinction coefficients of betacyanin ($\epsilon = 60,000$ L/mol cm in H₂O; $\lambda = 538$ nm; MW=550 g/mol). The pigment extract was diluted with deionized water to obtain absorption values of $0.9 \leq A \leq 1.1$. The total betacyanin content was calculated using the equation: Betacyanin Contents [mg/l] = $[(A \times DF \times MW \times 1000) / (\epsilon \times L)]$, where A is the absorption at 538 nm for betacyanins. DF is the dilution factor and L the pathlength of the 1-cm cuvette. For MW and ϵ , the molecular weights and extinction coefficients of the representative compounds betanin were considered.

Element analysis

The metallic elements were analyzed by atomic absorption spectrometry (AAS) using air/acetylene flame²¹. About 30 ml of OFJ was taken in a silica crucible. It was dried and then ignited over a bunsen burner till it was charred. Then it was, transferred to muffle furnace at 500 ± 50 °C for ashing till all carbonaceous matter burned and dull grey ash resulted. It was cool and then treated with 25 ml 6N HCl to dissolve the ash. It was heated over steam bath for 15-20 min and ash solution was transferred quantitatively to 50 ml volumetric flask and desire volume was made up. The solution was filtered to remove any acid-insoluble matter using Wattsman filter paper no. 14. The sample solution obtained was used for further estimation of metal elements *viz.* copper, iron, zinc, calcium, potassium and sodium.

RESULTS AND DISCUSSION

Proximate analysis

In the present study, phytochemical screenings were carried out to establish the authenticity of the plant based on physicochemical and phytochemical data. The phytochemical analysis was carried out for standardization of fruit juice. The phytochemical analysis revealed the presence of carbohydrates, flavonoids, phenolics and betalains. Piga²² and Moßhammer *et al.*²³ reported the presence of color pigment betalains and sugar content in high amount and low acidity of fruit which make it very sweet and delicious. The fruits were preliminary evaluated by estimation of proximate analysis (Table 1). The average weight of fruit was 24.568 ± 7.134 g/unit and among percentage of peel and seed was very low compared to the edible portion. A comparatively low ash value indicates presence of less inorganic matter. The fruits are very good source of watery content as high amount of moisture content and low amount of solid content. The fruit juice can resist microbial growth as low pH and are acidic in nature. The density of fruit juice was comparatively near to the water as it is high in moisture content. Viscosity of juice was 53.62 ± 0.402 centipoise at 100 rpm.

Table 1: Proximate analysis of fruit of *Opuntia elatior* Mill.

Parameters	Mean \pm SD
Total ash	0.579 ± 0.164 % w/w
Acid insoluble ash	11.9 ± 3.4 % w/w
Water soluble ash	23.1 ± 1.43 % w/w
Moisture content	86.086 ± 1.23 % w/w
Total solids	13.913 ± 1.23 % w/w
pH	4.583 ± 0.0411
Density	1.10063816 ± 0.007565 g/cm ³
Viscosity	53.62 ± 0.402 centipoise

Phytochemical analysis

Qualitative Analysis

Chemical test and TLC profile

The Phytochemical screening was proved that the fruits consisted of carbohydrates, polyphenols, flavonoids and pigment betalains. The OFJ was subjected to identify the carbohydrates in presence of standard compounds like D-Xylose (X), L-Arabinose (A), D-Fructose (F), D-Galactose (Gal), Maltose (M), Lactose (L), Glucose (Glu) and Sucrose (S) by thin layer chromatography (TLC). The R_f values of these compounds were compared with the OFJ (Figure 1 & 2). A comparison of R_f values and spot color obtained in TLC of carbohydrates, it was concluded that the fruit juice consisted reducing hexose monosaccharides like galactose and glucose. The presence of betalains was confirmed by TLC using solvent system *n*-Butanol:Acetic acid:Water (BAW) (4:1:5) and 1 % aqueous hydrochloric acid (Figure 3). The R_f values were found very low (0.081 ± 0.004) in BAW and high in 1% Aq. HCl (0.916 ± 0.030) which indicates presence of betacyanin. The R_f values were expressed in mean \pm SD ($n = 5$). From the comparison of R_f values and spot color obtained in TLC of carbohydrates, it suggested that the fruit juice contained reducing hexose monosaccharides like galactose and glucose ²⁴. TLC of betalain indicates presence of betacyanins type of color pigments as R_f value was low in BAW and high in 1% Aq. HCl ¹³.

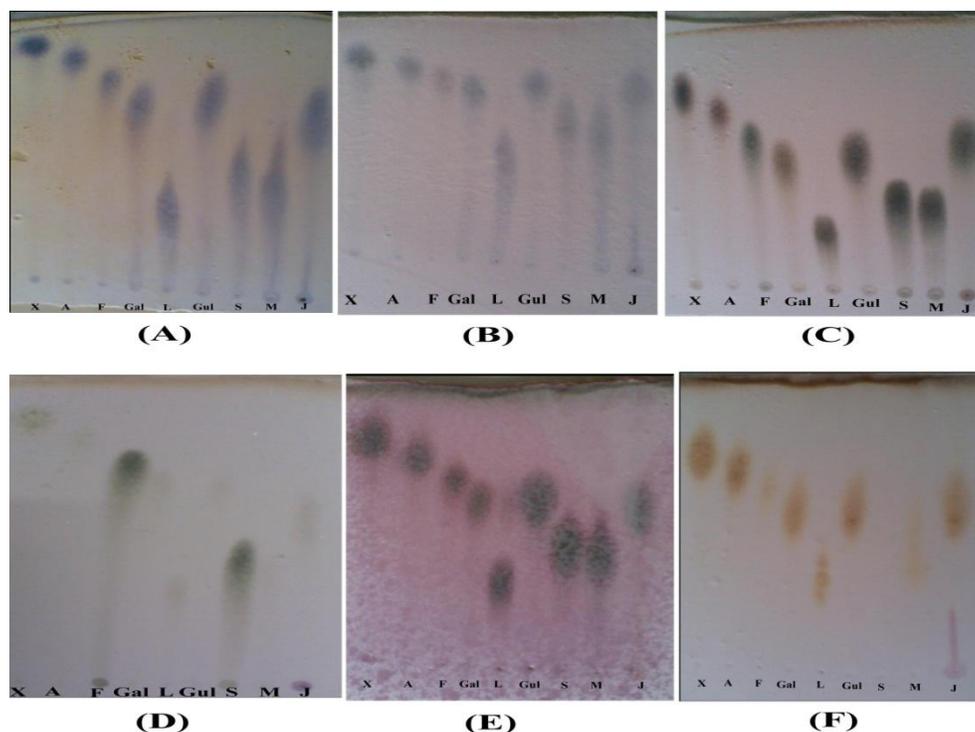


Figure 1: Identification of sugar from fruit juice using Thin Layer Chromatography

Detection reagent: α -Naphthol sulphuric acid (A), Aniline-diphenylamine-phosphoric acid (B), Phenol-sulphuric acid (C), Anthrone reagent (D), Thymol-sulphuric acid (E) and *p*-Anisidine phthalate reagent (F). TLC of OFJ was carried out in presence of standard compounds like D-Xylose (X), L-Arabinose (A), D-Fructose (F), D-Galactose (Gal), Lactose (L), Glucose (Glu), Sucrose (S) and Maltose (M).

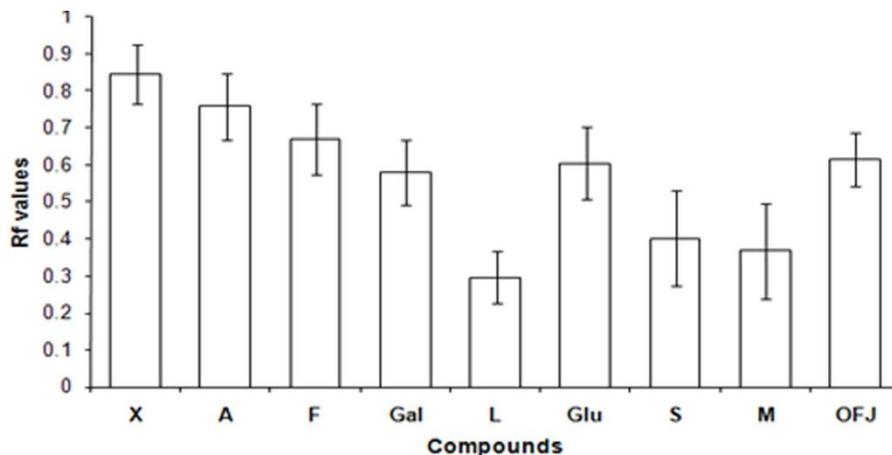


Figure 2: Comparison of R_f values of standard sugars and OFJ.

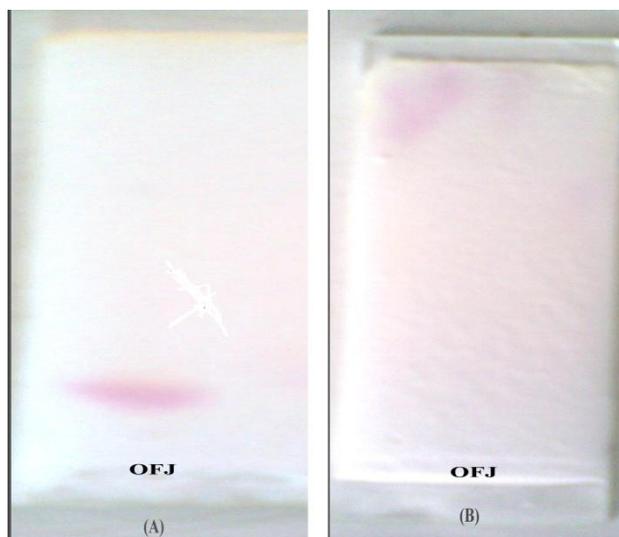


Figure 3: Photograph of thin layer chromatography (TLC) of OFJ in BAW (A) and 1% aqueous HCl (B).

Spectrophotometric analysis

Harborne ¹³ reported that visible spectrum of betacyanin in methanol-HCl give maximum absorbance in the range of 532 – 554 nm. The spectrophotometric analysis suggests that the external color of prickly pear fruits depends on the relative concentration of betacyanins (red pigments with maximum absorbance at around 535 nm) and betaxanthins (yellow pigments with maximum absorbance at around 480 nm) (14, 20, 24, 25). The absence of a peak at 484 nm

indicates that in fruits of *Opuntia elatior* Mill., betaxanthins are found in very low level and spectrophotometrically it is very difficult to distinguish them from betacyanins, which are present in a much higher concentration at 535 nm in methanol and water extracts of fruit. Figure 4 shows the visible absorption spectra (400 – 650 nm) of water, methanol and methanol containing 1% conc. HCl extracts of the fruits of *Opuntia elatior* Mill. The spectrum of water and methanol extracts shows one peaks at 535 nm, while methanol containing 1% conc. HCl shows bathochromic shift at 545 nm.

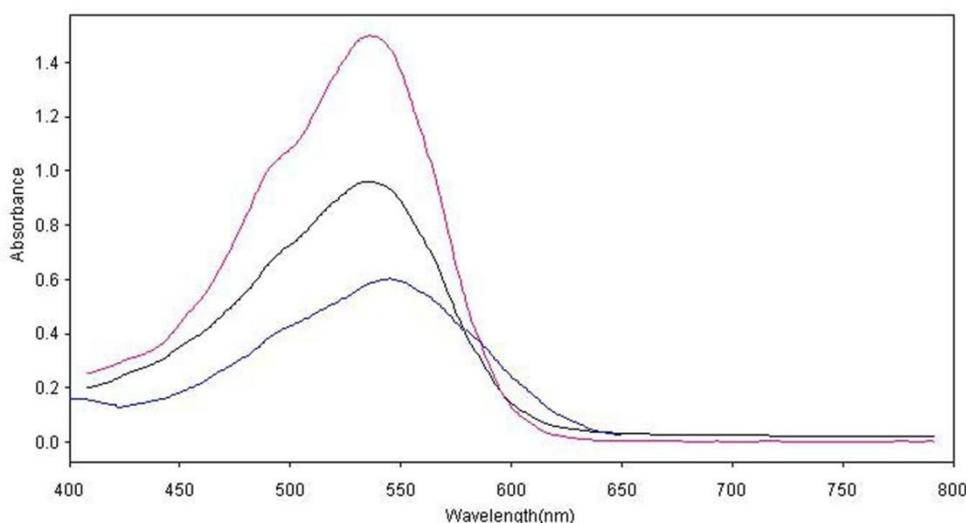


Figure 4: Visible light absorption spectra of water (red line), methanol (black line) and methanol HCl (blue line) extracts of fruits of *Opuntia elatior* Mill.

High performance liquid chromatographic (HPLC) analysis

Since betacyanins and betaxanthins possess similar spectroscopic and chromatographic properties, HPLC is an invaluable means of separating and analyzing them. Tentative identification of these betalains can be deduced from their chromatographic behavior, and corroborative data may be provided by an analysis of their absorption spectra. HPLC is an excellent means in the analysis of betalains. The most common support is C₁₈-derivatized silica providing adequate efficiency and retention of betacyanins as well as their sufficient resolution on conventional stationary phases. Because betacyanins exist in aqueous solution in different ionized forms at varying pH values, the use of typical acidic eluents with or without buffers is a useful factor governing their separation^{24, 26–29}. Fernandez-Lopez et al.³⁰ analyzed presence of betalains from the fruits of *Opuntia stricta*, *Opuntia undulata* and *Opuntia ficus-indica* and found HPLC patterns of betalains with retention time at 16.8 min (λ_{\max} 484 nm), 19.6 min, and 22.8 min (λ_{\max} 537 nm) assigned to indicaxanthin, betanin and isobetanin, respectively. Figure 5 shows the chromatographic pattern of the methanolic extracts of fruits of *Opuntia elatior* Mill.

At 484 nm, one peak can be observed eluting at 21.76 min (peak 1). When the same extract is monitored at 535 nm, a large peak with a retention time of 22.67 min (peak 2) is observed. Peak 1 showed maximum absorbance (λ_{\max}) at 484 nm and peak 2 at 535 nm. From the respective retention times in comparison to literature, the spectral properties provided by the photodiode array detector and data reported by other researchers peak 1 with retention time 21.76 min at 484 nm was identified as indicaxanthin which present in very low amount and peak 2 with retention time 22.76 min at 535 nm as betanin, present in high amount in fruits of *Opuntia elatior* Mill.

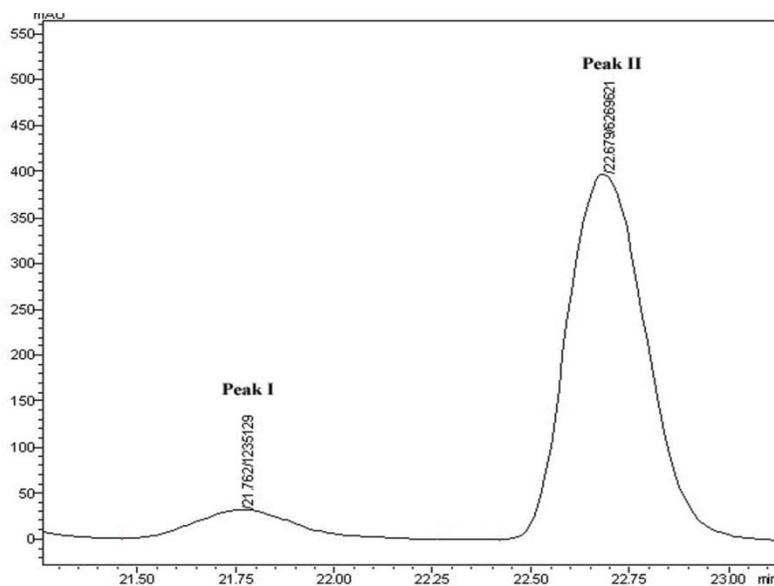


Figure 5: HPLC chromatogram of methanolic extract of fruits of *Opuntia elatior* Mill.

Liquid chromatography – mass spectroscopic (LC-MS) analysis

MS provides molecular weight and structural information of the chromatographic bands so that fully-resolved peaks are not required, thus shortening chromatographic runs and reducing sample preparation while ensuring high sensitivity and selectivity. This technique is commonly used in investigations on betalain pigments^{24, 26 – 29}. Ferndndez-Lopez *et al.*³⁰ screened the presence of betalain pigments in fruits of *Opuntia stricta*, *Opuntia undulata* and *Opuntia ficus-indica*. Furthermore, Yahia & Castellanos-Santiago¹⁵ identified betalains from the fruits of 10 Mexican prickly pear cultivars by HPLC and ESI-MS. The presence of betanin was confirmed by its identical spectral properties (maximum absorbance at 535 nm), and the presence of their protonated molecular ions $[M+H]^+$ with m/z 551 (Figure 6A), while the prominent secondary ion at m/z 390 was due to the presence of protonated aglycones $[\text{betanidine} + H]^+$ (Figure. 6B). From the respective molecular mass in comparison to literature and data reported by other researchers, it was identified as betanin.

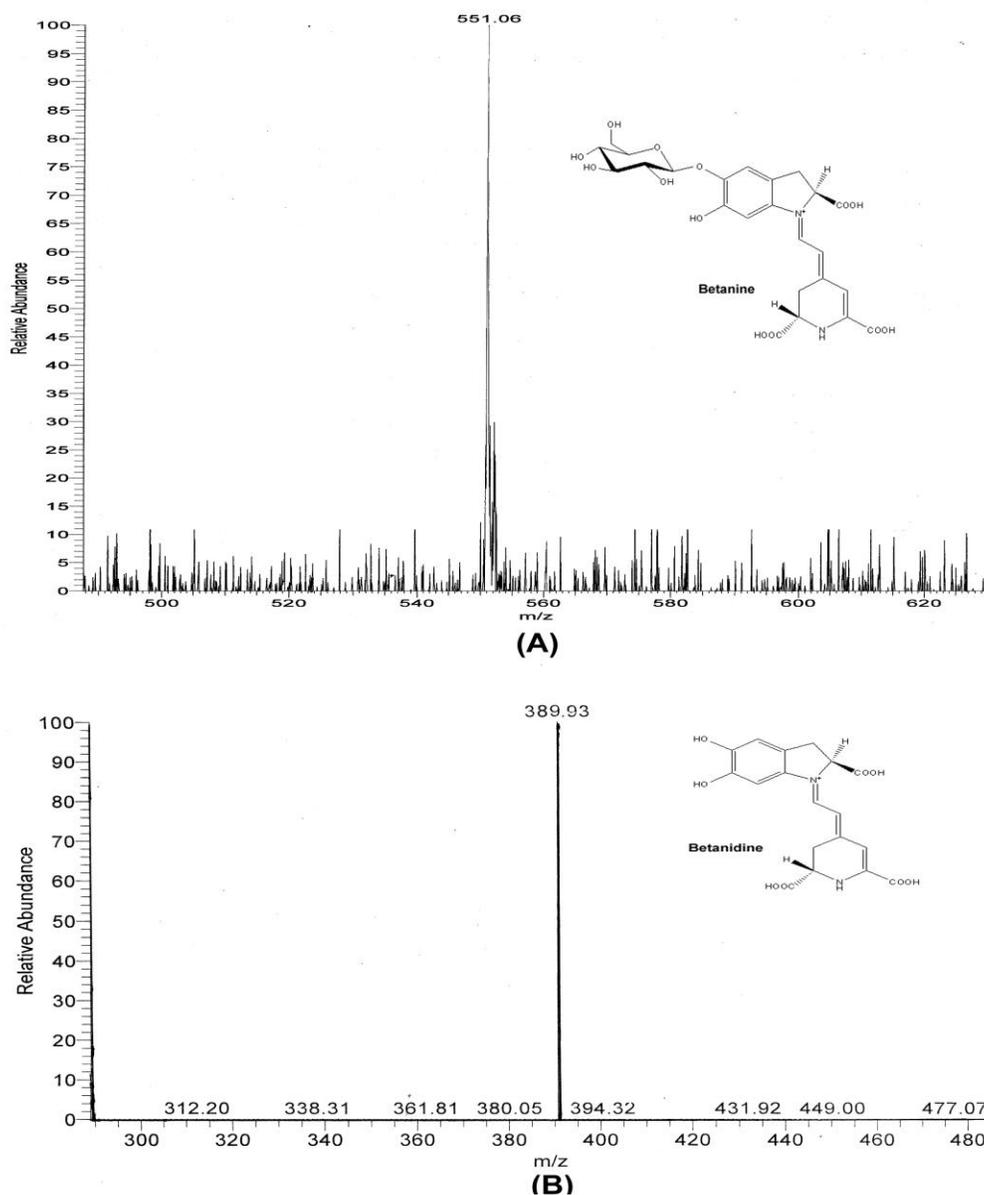


Figure 6: Positive ion spray mass spectra corresponding to betanin, parent ion scan of m/z 551 (A); daughter ion scan of m/z 389 (B).

Quantitative analysis

The results of quantitative analysis of fruits of *Opuntia elatior* Mill. were summarized in table 2. The preliminary analysis suggests that the external color of prickly pear fruits depends on the relative concentration of betacyanins (red pigments with maximum absorbance at 535 nm). Fruits of *Opuntia elatior* Mill. contained higher amount of potassium followed by calcium and others are in range of reported literature of other *Opuntia* species. Total sugars range from 12 – 17 °Brix and are mainly of the reducing type with glucose being the predominant sugar and fructose being the second sugar imparting the fruit pulp its sweet taste. Directly absorbable high

glucose concentrations in cactus fruits represented as instantly available energy source for brain and nerve cells while being sweeter may enhance the fruit's flavor. Some authors have also reported the occurrence of galactose and maltose. The total sugar content (11.41 g/100 ml) equivalent to glucose obtained in fruits of *Opuntia elatior* Mill. was low with respect to other *Opuntia* species^{2, 22, 31}. The fruits belonging to species *Opuntia ficus-indica* and *Opuntia dillenii* contained 117 ± 10 and 45.2 ± 7.4 mg/100 g of total phenolics respectively³². Su Feng Chang et al.³³ reported total phenolics (91.5 ± 1.5) and flavonoids (29.2 ± 1.5) along with gallic acid (4 ± 0.6), catechin (22.7 ± 0.7) and epicatechin (10.9 ± 0.2) as mg/100 g fresh sample of *Opuntia dillenii* Haw fruits. The total phenolic content (49.82 mg/100 ml) equivalent to gallic acid obtained in fruits of *Opuntia elatior* Mill. was in range of other species. Citric acid is the major organic acid in cactus pear followed by malic acid, quinic, shikimic and oxalic acids. However, isocitric, fumaric, glycolic, and succinic acids were only found in traces^{23, 31}. The titratable acidity (0.94%) equivalent to citric acid serves as a low acid food in fruits of *Opuntia elatior* Mill. The most convenient way to quantify betalains is spectrophotometric method. First, Nelsson³⁴ established a method to quantify pigments in beetroot. The total content of betacyanin was determined using the formula reported by^{30,35,36} The total betacyanin content (47.10 mg/100 ml) equivalent to betanin obtained from fruits of *Opuntia elatior* Mill. was higher compared to *Opuntia ficus-indica* and *Opuntia undulata* Griff. while lower compared to *Opuntia stricta* Haw. The mineral composition is characterized by high amounts of potassium followed by calcium while other minerals are in the normal range of fruits with respect to reported literature of other *Opuntia* species.

Table 2: Quantitative analysis of fruits of *Opuntia elatior* Mill.

Chemical composition	Mean \pm SD
Total sugar equivalent to glucose	11.417 ± 0.0567 g/100ml
Total phenolic equivalent to gallic acid	49.823 ± 21.294 mg/100ml
Titratable acidity equivalent to citric acid	0.942 ± 0.019 g/100ml
Total betacyanins equivalent to betanin	47.101 ± 2.149 mg/100 ml
Elements (mg/100g)	
Potassium (K)	131.80
Calcium (Ca)	50.24
Sodium (Na)	3.40
Zinc (Zn)	0.51
Iron (Fe)	0.32
Copper (Cu)	0.16

CONCLUSION

The present work shows the phytochemical compositions of fruits of *Opuntia elatior* Mill. The

preliminary analysis suggests that the external color of prickly pear fruits depends on the relative concentration of betacyanins which has antioxidant potential. The low acidic in nature and moderate sugar content make the fruit very delicious while mineral compositions and phenolic content support its nutritional importance.

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