Anthocyanins, and its antioxidant properties in selected fruits

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ABSTRACT

Anthocyanins are natural pigments which are responsible for the blue, purple, violet and red colours in fruits, flowers, stem and leaves. They belong to major flavanoid classes such as flavones, isoflavones, flavonones and anthocyanins which have strong antioxidant activity. The anthocyanins have a long history as part of the human diet. In the present scenario, there is a rising demand for natural sources of food colorants with nutraceutical benefits. Sources including anthocyanins are becoming increasingly important for this reason. So, the present study was aimed to evaluate the Anthocyanin content, total phenols and to analyze antioxidant activity in selected fruits like- Solanum nigrum, Kirganelia reticulata, Basella alba, Syzygium cuminum and Opuntia dilleni. Among the samples Kirganelia reticulata was found to have higher concentration of anthocyanin. Antioxidant assays were done in enzymatic and non enzymatic methods. In non-enzymatic assays like DPPH and Ascorbic acid, the activities were shown to be higher in Kirganelia reticulata. In enzymatic assays like Super oxide dismutase, Catalase and Peroxidase, Basella alba showed higher activity. In Kirganelia reticulata Glucose -6- Phosphate dehydrogenase activity was found to be higher and in Solanum nigrum Ascorbate oxidase was found to have higher activity. On HPTLC analysis of the selected fruits Rutin was identified as the major compound.

Key words: Anthocyanins, Antioxidants, DPPH, Super oxide dismutase, Rutin

INTRODUCTION

Anthocyanins, natural pigments which are responsible for the blue, purple, violet and red colour of fruits belongs to one of the major flavanoid classes. They are probably the most important group of visible plant pigments besides chlorophyll and are mainly the glycosides of polyhydroxy and polymethoxy derivatives of 2-phenylbenzopyrylum or flavylum salts. It is estimated that more than 400 anthocyanins have been found in nature (Jin et al., 2008).

Anthocyanins are becoming increasingly important not only as a plant pigment but also as food colorants and antioxidants. An antioxidant is a compound that inhibits or delays the oxidation of substrate even if the compound is present in a significantly lower concentration than the oxidized substrate and can be recycled in the cells or irreversibly damaged (Halliwell et al.,2007). This antioxidant property of the pigment arise from their high reactivity as hydrogen or electron donors and from the ability of the polyphenol derived radicals to stabilize and delocalize the unpaired electrons and from their ability to chelate transition metal ion (Rice- Evans et al.,1997).

These pigments are reported to have many therapeutic properties including vasoprotective and anti-inflammatory properties, anti cancer, chemo protective and anti-oxidative properties, reversing age related deficits (Joseph et al.,1997) and useful in controlling oxidative stress during pregnancies complicated by intrauterine growth retardation (pawlowicz et al.,2000). It has also been suggested that anthocyanins has got the ability to stabilize DNA triple helical complexes (Mas et al., 2000) and can also protect the chloroplast against high light intensities (Pietrini et al., 2002).

Among the plant materials fruits, vegetables and spices are reported to be rich in compounds with antioxidant and anti-inflammatory properties, anti cancer, chemo protective and anti-oxidative properties, reversing age related deficits (Joseph et al.,1997) and useful in controlling oxidative stress during pregnancies complicated by intrauterine growth retardation (pawlowicz et al.,2000). It has also been suggested that anthocyanins has got the ability to stabilize DNA triple helical complexes (Mas et al., 2000) and can also protect the chloroplast against high light intensities (Pietrini et al., 2002).

The absorbance of the samples (A) was calculated as follows:

\[ A = \frac{(\text{Absorbance} \times \lambda \times \text{vis.-max} - A750) \times p^4}{\text{MW} \times DF \times 1000 / \epsilon \times 1} \]

Where, Molecular weight of anthocyanin (cyd-3-glu) = 449, Extinction coefficient (\(\epsilon\)) = 29,600,DF = diluted factor

MATERIALS AND METHODS

1. Sample collection

Samples were collected from places in and around Coimbatore district, Tamilnadu and were stored at -20°C. The fruits from the plants Solanum nigrum, Kirganelia reticulata, Basella alba, Syzygium cuminum, and Opuntia dilleni were taken for anthocyanin extraction and analysis.

2. Extraction of anthocyanin pigment

0.5 gm of samples were treated with 10 ml of solvents like methanol, acidified methanol, acetone and ethanol and were macerated in a mortar and pestle separately. The mixture was centrifuged at 10,000 rpm for 10 min and supernatant was taken for analysis.

3. Analytical procedures

Flavanoid conformation test (Harbone, 1988)

3.1. FeCl3 solution

1 ml of sample extraction was added with a small amount of FeCl3 solution, and the results were observed.

3.2. Alkalic AlCl3 solution

1 ml of sample extraction was added with 5% alkalic AlCl3 solution.

4. Total phenolic assay (Ronald et al., 1998)

Total phenolic compounds in anthocyanin samples were quantified by using Folin-Ciocalteau’s method. 25 µl of Folin-Ciocalteau’s reagent (50%/v/v) was added to 10 µl of sample extract. It was incubated for 5 mins. After incubation 25 µl of 20% (w/v) sodium carbonate and water was added to a final volume of 200 µl. Blanks were prepared by replacing the reagent by water to correct for interfering compounds. After 30 mins of incubation, the absorbance was measured using spectrophotometer at 760 nm.

5. Stability at variable pH

The anthocyanin stability was tested by treating 1 ml of sample with 1 ml of pH 1.0 and 4.5 solutions. The colour change was observed (Strack, 1989).

6. Determination of total anthocyanin

The total amount of anthocyanin content was determined by using pH differential method. A spectrophotometer and 1 cm path length cuvette was used for spectral measurements at 210 and 750 nm (Fuleki & Francis, 1968).

The absorbance of the samples (A) was calculated as follows:

\[ A = (\text{Absorbance} \times \lambda \times \text{vis.-max} - A750) \times p^4 \times 1.0 - (\text{Absorbance} \times \lambda \times \text{vis.-max} - A750) \times p^4 \times 4.5 \]

Anthocyanin pigment content (mg / liter) = \(\frac{(\text{MW} \times DF \times 1000 / \epsilon \times 1)}{\text{MW} \times DF \times 1000 / \epsilon \times 1} \)
7. Antioxidant assay

The antioxidant assay was done in enzymatic and non-enzymatic assays.

Enzyme Extraction

The 1 gm of sample was homogenized with 5 ml of phosphate buffer (0.1 M pH 6.5) and centrifuged at 3,000 rpm for 15 min at 5°C. The obtained supernatant was used as an enzyme source.

7.1. Non-enzymatic assay

7.1.1. Quantification of Ascorbic acid

0.1 ml of brominated sample extract was added with 2.9 ml of distilled water. Then 1 ml of 2% DNBH reagent and 1-2 drops of thiourea was added with sample. After incubation at 37°C for 3 hours, the orange-red osazone crystals that were formed were dissolved by the addition of 7 ml of 80 % sulphuric acid. Again incubated for 5 minutes. After incubation absorbance was measured at 540nm. Vitamin C concentration was expressed in terms of mg/g of sample.

7.1.2. Assay of DPPH

Scavenging activity of anthocyanins against DPPH radicals was assayed according to the procedure previously described by Smith et al., 1987; Yamaguchi et al., 1998. Methanolic DPPH (0.1mM) was used as the reaction mixture. 50µl of the plant extract (conc. 100µg/1) along with 1 ml of 0.1mM DPPH in methanol and 450 µl of 50 mm Tris-Hcl (pH 7.4) was taken for assay. After that, the solution was incubated for 30min at 25°C in dark; the decrease in the absorbance at 517 nm was measured. Control contained methanol instead of antioxidant solution, while blanks contained methanol instead of DPPH were used for the assay. The percentage inhibition of DPPH radicals by the samples was calculated according to the following equation:

\[
\text{Percentage inhibition} = \left(1 - \frac{C - S}{C}\right) \times 100
\]

C – Net absorbance of the control
S – Net absorbance of the sample

7.2. Enzymatic assay

7.2.1. Assay of catalase activity

Catalase activity was assayed by the method of Sinha (1972). The enzyme extract (0.5 ml) was added to the reaction mixture containing 1ml of 0.01 M phosphate buffer (pH 7.0), 0.5 ml of 0.2 M H₂O₂, 0.4 ml H₂O and incubated for different time period. The reaction was terminated by the addition of 2ml of 2% acid reagent (dichromate/acetic acid mixture) which was prepared by mixing 5% potassium dichromate with glacial acetic acid (1:3 by volume). To the control, the enzyme was added after the addition of acid reagent. All the tubes were heated for 10 minutes and the absorbance was read at 610 nm. Catalase activity was expressed in terms of μmoles of H₂O₂ consumed/min/mg protein.

7.2.2. Assay of superoxidisedismutase activity

The assay of superoxidisedismutase was done according to the procedure of Das et al. (2000). In this method, 1.4ml aliquots of the reaction mixture (comprising 1.11 ml of 50 mM phosphate buffer of pH 7.4, 0.075 ml of 20 mM L-Methionine, 0.04ml of 1% (v/v) Triton X-100, 0.075 ml of 10 mM Hydroxylamine hydrochloride and 0.1ml of 50 mM EDTA) was added to 100 µl of the sample extract and incubated at 30°C for 5 minutes. The reaction was terminated by the addition of 2ml of 2% acid reagent (dichromate/acetic acid mixture) which was prepared by mixing 5% potassium dichromate with glacial acetic acid (1:3 by volume). The reaction mixture was incubated at 37°C for every 30 seconds for 2 minutes. The peroxidase activity was calculated using an extinction coefficient of oxidized pyrogallol (4.5 liters/mol).

7.2.4. Assay of ascorbate oxidase activity

Assay of ascorbate oxidase activity was carried out according to the procedure of Vines and Oberbacher (1965). The sample was homogenized [1: 5 (w/v)] with phosphate buffer (0.1 M pH 6.5) and centrifuged at 3,000 g for 15 min at 50°C. The supernatant obtained was used as enzyme source. To 3.0 ml of the substrate solution (8.8 mg ascorbic acid in 300 ml phosphate buffer, pH 7.0), 0.1 ml of the enzyme extract was added and the absorbance change at 265 nm was measured for every 30 seconds for a period of 5 minutes. One enzyme unit is equivalent to 0.01 O.D. changes per min.

7.2.5. Assay of Glucose-6-phosphate dehydrogenase activity

The enzyme was assayed by the method of Balinsky and Bernstein (1963). The solution containing 0.1 ml each of 0.1 M Tris-HCl buffer (pH 8.2), 0.2 mM NADP and 0.1mM MgCl₂ was taken in a cuvette along with 0.5 ml of water and suitable aliquots of enzyme extract. The reaction was initiated by the addition of 0.1 ml of 6 mM glucose-6-phosphate and O.D. increase was measured at 340 nm. The activity of the enzyme is expressed in terms of units/mg protein, in which one unit is equal to the amount of the enzyme that brought about an increase in O.D of 0.01/min.

8. Compound Identification

The separation was done by HPTLC analysis.

8.1 HPTLC analysis

Sample preparation

The sample extracts 0.1ml was dissolved with Methanol and made up to 1.5ml. This solution was centrifuged and collected the supernatant liquid. This solution was used as test solution for HPTLC analysis.

Sample and Reference standard application

5µl of each test solutions and reference standards were loaded as 8mm band length in the 5 x 10 Silica gel 60F₂₅₄ TLC plate using Hamilton syringe and CAMAG LINOMAT 5 instrument.

Spot development

The samples loaded plate was kept in TLC twin trough developing chamber (after saturated with Solvent vapor) with respective mobile phase (Flavonoid) and the plate was developed in the respective mobile phase up to 90mm.

Photo-documentation

The developed plate was dried by hot air to evaporate solvents from the plate. The plate was kept in Photo-documentation chamber (CAMAG REPROSTAR 3) and captured the images at White light, UV 254nm and UV366nm.

Derivatization

The developed plate was sprayed with respective spray reagent (Flavonoid) and dried at 120°C in hot air oven. The plate was photo-documented in UV366nm mode using Photo-documentation (CAMAG REPROSTAR 3) chamber.

Scanning

Finally, the plate was fixed in scanner stage and scanning was done at 366nm. The Peak table, Peak display and Peak densitogram were noted.

8.2. Analysis details

Mobile phase

Ethyl acetate-Methanol-Water (10 : 1.35 : 1)

Spray reagent

1% ethanolic Aluminium chloride reagent and dried at 120°C 10 min.

RESULTS AND DISCUSSION

1. Flavonoid Confirmation Test

Flavonoids are phenolic compounds, which are very effective antioxidant (Maslarova, 2001). In flavonoid confirmation test of sample aliquots with FeCl₃, the change of color to brown was observed and with alkalic AlCl₃, no colour change was observed confirming the presence of flavonoids. It has been already reported the presence of flavonoids in Opuntia dilleni (Kuti et al., 2003), Syzygium cumini (Banerjee et al., 2004), Solanum nigrum and Basella alba (Surveswaran et al., 2006).

2. Total Phenol Assay

Polyphenols are the large groups of phytochemicals that are gaining acceptance as being responsible for the health benefits associated with fruits and vegetables. Because of their chemical structure, plant polyphenols can scavenge free radicals and inactive other oxidants, and also interact with a number of biological relevance (Vinson et al., 1998). Table 1 shows the total phenol content (TPC) of the five samples in different solvents.

<table>
<thead>
<tr>
<th>Solvent</th>
<th>Basella</th>
<th>Kigirumella</th>
<th>Solanum</th>
<th>Opuntia</th>
<th>Syzygium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>27</td>
<td>19</td>
<td>17</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Methanol</td>
<td>3</td>
<td>15</td>
<td>29</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Acidified methanol</td>
<td>2</td>
<td>19</td>
<td>40</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>Ethanol</td>
<td>2</td>
<td>17</td>
<td>17</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

The total content of the phenols in acetone extract from Basella alba was 27mg/ml which was found to be higher when compared with other extracts. Jinyuan Lin (2006) suggests that the total phenolic and flavonoid content varies in fruits and vegetables.

3. P4 Stability Test

Anthocyanins were stable at low pH and were unstable as the pH increases (Guisti et al., 2003). When the aliquots of the sample were treated with pH 1.0 buffer no colour change was observed. When pH 4.5 buffer was added decolourization was observed.

4. Total Anthocyanin Content

Four different solvent systems were used for extraction of anthocyanin was used including...
aceton, methanol, acified methanol and ethanol. The highest anthocyanin content found in *Kirganelia reticulata* and there was a decrease in Syzygium cuminum, Basella alba, *Solanum nigrum* and *Opuntia dilleni* (Table-2). Acified methanol and acetone extraction resulted in significantly higher values for the total anthocyanin content than the methanol and ethanol extract. Several authors reported aqueous aceton was better than various alcoholic solvents for fruit pro-cyanidin, anthocyanin and other phenols (Gracia-Viguera et al., 1998). Lu and Fao (2001) observed significant anthocyanin interaction with aqueous aceton to form pyrano anthocyanidins which significantly lowered quantities of detectable anthocyanins. However, since acified methanol preserves the extracted anthocyanins in their original form better for longer duration (Joseph et al., 2004). It should be the solvent of choice for quantification and analysis of anthocyanins.

### Table –2.Total Anthocyanin content in different solvent system of selected fruits

<table>
<thead>
<tr>
<th>Solvents</th>
<th>Syzygium cuminum</th>
<th>Solanum nigrum</th>
<th>Kirganelia reticulata</th>
<th>Solanum Kirganelia</th>
<th>Syzigium Opuntia</th>
<th>Opuntia dilleni</th>
<th>Basella alba</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>334.104</td>
<td>413.50</td>
<td>368.75</td>
<td>207.51</td>
<td>357.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methanol</td>
<td>204.06</td>
<td>389.68</td>
<td>375.12</td>
<td>134.70</td>
<td>243.774</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acified methanol</td>
<td>190.36</td>
<td>413.80</td>
<td>397.72</td>
<td>142.587</td>
<td>267.428</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethanol</td>
<td>163.59</td>
<td>397.12</td>
<td>343.57</td>
<td>137.639</td>
<td>207.055</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The catalase and peroxidase activity were observed to be maximum in Basella alba when compared with other selected fruits. The activity of these enzymes is to degrade H$_2$O$_2$ to non toxic form. So, in our results the activity of both the enzyme was higher in Basella alba which detoxify more H$_2$O$_2$ molecule. It was reported that in plants the antioxidant enzymes namely catalase and peroxidase have been shown to increase when subjected to stress condition (Hertwig et al., 1999 & Nouchi 1993).

The superoxide dismutase activity was also observed to maximum in Basella alba (71.8 Units gram tissue) and minimum in Opuntia dilleni (45.2 Units gram tissue ) Rani et al., (2004) reported that the Super oxide dismutase activity was maximum in fruits this may be due to the total phenol content in the fruits which is correlating with our results also. So, as the SOD activity is higher which means they can scaveng more superoxide ion.

The ascorbate oxidase activity was higher in *Solanum nigrum* (34 U/g) which means they have higher capacity to degrade ascorbate than other fruit samples. Also, the activity of glucose-6-phosphate dehydrogenase was higher in the same fruit sample. It is interesting to note that the high activity of glucose-6-phosphate dehydrogenase noted in fruits is also associated with very high activity of ascorbate oxidase compared to other fruits under study. Since NADPH is an ultimate reducing equivalent utilized by dehydroascorbate reductase to maintain the balance between dehydroascorbate and ascorbate through GSH-GSSG system, the increase in ascorbate oxidase activity in orange has been compensated with increase in glucose-6-phosphate dehydrogenase activity in the same which is correlating with our results (Rani et al., 2004).

6. **Compound identification**

**HPTLC analysis for flavanoid profile**

Detection, bright orange colour zones were present in the samples and various RF values in the chromatogram and white light after derivatization. Peak table 4 which belongs to the flavanoid class compound present in the given sample. From the standard flavanoid it was confirmed that Rutin was present in sample *Solanum nigrum* with other flavanoids.

From peak table 4 given above and form the graph the peak, the RF value, height, area and substance were determined. Track 3 (*Kirganelia reticulata*), has rutin with an RF value of 0.34. The RF value of 0.34 correlate with the standard rutin. Track 4 (*Opuntia dilleni*) has 1 compound with RF value 0.42. Track 5 (Basella alba) has 3 flavanoids with an RF value of 0.21, 0.34 & 0.43, this also contain rutin. Track R,C,K,Q were used to detect the presence of Rutin, Coumarin, Kaemferol and Quercitin. By HPTLC analysis, quantitation was carried out at UV of 366nmn, the concentration of rutin was more in *Kirganelia reticulata & Basella alba* than in *Solanum nigrum*.

### Table – 4. Peak table for chromatogram

<table>
<thead>
<tr>
<th>Track</th>
<th>Peak</th>
<th>$R_f$</th>
<th>Height</th>
<th>Area</th>
<th>Assigned substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.3</td>
<td>154</td>
<td>6899</td>
<td>Flavonoid 2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0.19</td>
<td>102.4</td>
<td>1496.7</td>
<td>Flavonoid 1</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0.34</td>
<td>68.8</td>
<td>1633.3</td>
<td>unknown</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.43</td>
<td>28.5</td>
<td>850</td>
<td>unknown</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.42</td>
<td>39.9</td>
<td>993.5</td>
<td>unknown</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0.21</td>
<td>43.4</td>
<td>805.5</td>
<td>unknown</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>0.32</td>
<td>204</td>
<td>3785.3</td>
<td>Flavonoid 2</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>0.43</td>
<td>217.6</td>
<td>3564.2</td>
<td>Flavonoid 4</td>
</tr>
<tr>
<td>R</td>
<td>1</td>
<td>0.34</td>
<td>216.4</td>
<td>4024.3</td>
<td>Rutin</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>0.74</td>
<td>186.3</td>
<td>4570</td>
<td>Coumarin</td>
</tr>
<tr>
<td>K</td>
<td>1</td>
<td>0.75</td>
<td>151.2</td>
<td>3208.3</td>
<td>Kaemferol</td>
</tr>
<tr>
<td>Q</td>
<td>1</td>
<td>0.69</td>
<td>141.6</td>
<td>6391.6</td>
<td>Quercitin</td>
</tr>
</tbody>
</table>

Ascorbate has been found in the chloroplast, cyslot, vacuole and extracellular compartments of plant cells and shown to function as a reductant for many free radicals (Foyer 1993). An increased ascorbic content was found in *Kirganelia reticulata* (12mg) as compare to *Sycium cuminum* (10mg), Basella alba (7mg) *Solanum nigrum* (4.3mg) and *opuntia dilleni* (2.2mg). So, from the above results *Kirganelia reticulata* was found to contain high ascorbic acid content and can act as a good antioxidant.

### Enzymatic antioxidants

The inevitable generation of Reactive Oxygen Species in biological systems and oxidative damage is counterpoised by an array of enzymatic defense system. The levels of antioxidant enzymes assessed in five different fruits are collectively represented in table 3.
Fig – 3

1- Kirganelia reticulata, 2- Syzygium cuminum, 3- Solanum nigrum, 4- Opuntia dilleni, 5- Basella alba
R- Rutin, C- Coumarin, K- Kaemferol, Q- Quercetin

Fig – 4

1- Kirganelia reticulata, 2- Syzygium cuminum, 3- Solanum nigrum, 4- Opuntia dilleni, 5- Basella alba
R- Rutin, C- Coumarin, K- Kaemferol, Q- Quercetin

Fig – 5. After derivatization

1- Kirganelia reticulata, 2- Syzygium cuminum, 3- Solanum nigrum, 4- Opuntia dilleni, 5- Basella alba
R- Rutin, C- Coumarin, K- Kaemferol, Q- Quercetin

Fig – 6

Track 1 - Baseline display (Scanned at 366nm)

Track 1 – Peak densitogram display

Fig – 7

Track 2 - Baseline display (Scanned at 366nm)

Sample 1 – Kirganelia reticulata

1- Kirganelia reticulata, 2- Syzygium cuminum, 3- Solanum nigrum, 4- Opuntia dilleni, 5- Basella alba
R- Rutin, C- Coumarin, K- Kaemferol, Q- Quercetin
Sample 2 - *Syzygium cuminum*

Track 2 - Peak densitogram display

Chromatogram

After derivation at white light in samples (1- *Kirganelia reticulate*, 2- *Syzygium cuminum*, 3- *Solanum nigrum*, 4- *Opuntia dilleni*, 5- *Basella alba*), only one flavanoid was identified and it was Rutin. In sample 2 no flavanoid bands were observed which indicates the absence of flavanoid in the sample. In sample 3, three bands were observed the 2nd band was similar to Rutin. In sample 4 only one unknown band was observed & in sample 5 three bands were observed and second was similar to standard Rutin (Fig 2-5) and also other compounds with Rf value of 0.19 and 0.43 were also observed.

From the results (fig 6-14) it was found that *Kirganelia reticulata*, *Solanum nigrum* and *Basella alba* contains Rutin, which was similar to Rutin standard. No flavanoid bands were found in *Syzygium cuminum* under HPTLC analysis.
Eunhalee et al., 2003 reported the constituents of stems & fruits of *Opuntia dilleni* contain 8 flavanoids, similar to our result the unknown flavanoid may be the above compounds isolated from the fruits of *Opuntia dilleni*. Ahamed et al., has also reported the presence of Kemferol in the alcohol extract of the flowers of *Opuntia dilleni*. Nelson et al., 2009 reported the presence of anthocyanin, rutenoids in *Solanum betaceum* which correlates to our results.
that the content of anthocyanin and its antioxidant activity differs significantly between the selected species. These fruits could also be exploited for commercial purification of specific antioxidants, since they are available in abundance. From HPTLC analysis it was identified that rutin was present in most of the selected fruits. During HPTLC analysis, presence of unidentified compounds was also noted. So there is a need to find out unidentified compounds.

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CONCLUSION

Many plant phenolic compounds exhibiting antioxidant properties have been studied and proposed for production against oxidation. Extracts from plants which contribute health benefits to consumers, arising from protection from free radical – mediated deteriorations had stronger antioxidant activity than that of synthetic antioxidants. Anthocyanins represent a class of important antioxidants, as they are so common in human foods. The present study clearly points out the phenolic content, total anthocyanin content and its antioxidant potential of the selected fruits emphasizing the importance of incorporating these fruits as a regular component in diet. The data presented in this study demonstrates

Track 8– Peak densitogram display

Track 9 – Quercetin

CONCLUSION

Many plant phenolic compounds exhibiting antioxidant properties have been studied and proposed for production against oxidation. Extracts from plants which contribute health benefits to consumers, arising from protection from free radical – mediated deteriorations had stronger antioxidant activity than that of synthetic antioxidants. Anthocyanins represent a class of important antioxidants, as they are so common in human foods. The present study clearly points out the phenolic content, total anthocyanin content and its antioxidant potential of the selected fruits emphasizing the importance of incorporating these fruits as a regular component in diet. The data presented in this study demonstrates