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RESEARCH ARTICLE

PHYTOCHEMICAL SCREENING AND EVALUATION OFANTIOXIDANT ACTIVITY OF FRUIT EXTRACTS OFSOLANUM TORVUM SWARTZ

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ABSTRACT

Solanum torvum Swartz is one of the important medicinal plants belonging to the family Solanaceae which is used by traditional systems of medicine. Different parts of the plant are reported to possess a number of medicinal properties. The present study was aimed to screen the phytochemical constituents and to evaluate the antioxidant activity of fruit extracts of *Solanum torvum.* The results of the study revealed the presence of various phytochemicals such as tannin,quinones, flavonoids, alkaloids, cardio glycosides, phenols, steroids, coumarin and betacyanins in the fruit extracts of *Solanum torvum*. FTIR analysis was performed for the identification of various functional groups present in the fruit extracts. The functional group present in *S.torvum* are alcohol, aldehyde, carbon dioxide, isothiocyanate, alkene, tertiary alcohol and halo compound. DPPH free radical scavenging assay was studied for the evaluation of antioxidant potential. The fruit extracts of *Solanum torvum* showed 100% of scavenging activity. The presence of phenols and flavonoids in the fruit extracts are responsible for the antioxidant property. Thus the study indicates that *S. torvum* fruit is an excellent source of natural antioxidant and could be an effective nutritional food supplement, which interns will have therapeutic applications.

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INTRODUCTION

Plants have been used as medicines throughout history. Medicinal plants have been known for millennia and are highly esteemed all over the world as a rich source of therapeutic agents for the prevention of diseases and ailments (Sharma *et al*. 2008). The importance of medicinal plants and traditional health systems in solving the health care problems of the world is gaining increasing attention. Because of this resurgence of interest, the research on plants of medicinal importance is growing phenomenally at the international level, often to the detriment of natural habitats and mother populations in the countries of origin. Most of the developing countries have adopted traditional medical practice as an integral part of their culture. Historically, all medicinal preparations are derived from plants, whether in the simple form of raw plant materials or in the refined form of crude extracts, mixtures, etc (Krishnaraju *et al*., 2005). India has a rich cultural heritage of traditional medicines which chiefly comprised the two widely flourishing systems of treatments i.e. Ayurvedic and Unani systems since ancient times (Surana *et al*., 2008). Plant products have been part of phytomedicine and these can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds, etc (Cragg and David, 2001) i.e., any part of the plant may contain active components. Knowledge of the chemical constituents of plants is desirable because such information will be of value for the synthesis of complex chemical substances.

Such phytochemical screening of various plants is reported by many workers (Mojab *et al*., 2003; Parekh and Chanda, 2008; Parekh and Chanda, 2007). *Solanum torvum*Swartz is one of the important medicinal plants belonging to the family Solanaceaewhich is used by traditional systems of medicine. It is found andcultivated throughout tropical areas (Little *et al*.,1974) and also is distributed widely in Thailandwhere it is known as turkey berry or Thai eggplant(Agrawal *et al*., 2010). It is a plant which is found all over the Indian subcontinent and West Indies, Bermuda, Indonesia, Malaya, China, Philippines and tropical America (Ghani,1998).The fruits are berries that grow in clusters of tiny green spheres that look like green peas. Fruits are used as a vegetable and ingredient for cooking while different parts of the plant are widely used in folk medicine (Jaiswal, 2012). The pericarp of the fruit contains high amount of phenolic and flavonoid compounds that are the secondary metabolites of the plant. The whole plant is traditionally used as a digestant, diuretic and sedative (Kala, 2005). Fruit and leaf decoctions are used to treat liver and spleen enlargement and coughing (Siemonsma and Piluek, 1994). Many pharmacological studies have shown that this plant possesses antioxidant (Sivapriya andSrinivas, 2007; Thenmozhi and Mahadeva Rao, 2012), antiplatelet aggregation, cardiovascular(Nguelefack*et al*., 2008; Mohan *et al*., 2009), analgesic, anti-inflammation (Ndebia*et al*., 2007), antiviral (Arthan*et al*., 2002) and antimicrobial activities (Ajaiyeoba, 1999; Chah*et al*., 2000), and many more that are related with the phytochemical constituents (Agrawal *et al*., 2010). Scientists and nutritionists encouraged the use of antioxidants as food supplements in order to prevent diseases due to oxidative stress and to

maintain good health. Hence, the present study is focused to evaluate the phytochemical contents and antioxidant activity of the fruits of *S. torvum.*

MATERIALS AND METHODS

Collection of plant material: The plant S*olanum torvum*was collected from Agaramthen, Tambaram, Chennai. The plant was identified and authenticated by the taxonomist at the Department of Botany, Queen Mary's College, Chennai and the herbarium has been deposited at the college for further reference. The fresh fruits were collected, shade dried and ground into a coarse powder. The powder was stored in an airtight container and used for further analysis.

Preparation of plant extract: About 5gm of dried fruit powder was extracted with aqueous and ethanol (75%) for 1 min using an ultra Turax mixture (13000 rpm) and soaked overnight at room temperature. The samples were then filtered through Whatman No: 1 paper in a funnel. The filtered solution was evaporated under vacuum in a rota-evator at 40°C to a constant weight and then dissolved in respective solvents. The concentrated extracts were stored in airtight container in refrigerator below 10°C.

Phytochemical analysis: The aqueous and ethanolic fruit extracts of S*olanum torvum* were subjected to different tests to identify the nature of bioactive chemical constituents present in the plant material. The crude extracts were screened qualitatively for the phytochemical constituents using the standard procedure of Trease and Evans (2005).

Fourier Transform Infrared Spectrophotometer (FTIR): FTIR is the most powerful tools for identifying the types of chemical bonds/functional groups present in the phytochemical. The wavelength of light absorbed is salient features of the chemical bonds as can be seen in the annotated spectrum. By interpreting the infrared absorption spectrum, the chemical bond in a compound can be determined. Dried powder of S*olanum torvum* fruit was used for FTIR analysis. 10mg of the dried powder was encapsulation in 100mg KBr Pellet, in order to prepare translucent sample discs. The powdered plant sample were loaded in FTIR Spectroscope (Perklinelmer Model Spectrum IPC), with a scan range from 400 to 4000$cm^{-1}$with a resolution of 4 $cm^{-1.}$ The analysis of each samples were recorded.

Free Radical Scavenging Activity: The antioxidant activity of the extracts was evaluated through the DPPH (1,1 diphenyl-2 picryl hydrazyl) radical scavenging assay as described by Lee *et al*., (2003). 100 µloffruit extract was mixed with 2.7 ml of ethanol and then 200 µl of 0.1% ethanolic DPPH was added. The suspension was incubated for 30 minutes in dark condition. Initially, absorption of blank containing the same amount of ethanol and DPPH solution was prepared and measured as a control. Subsequently, at every 5 minutes interval the absorption maximum of the solution were measured using a UV double bean Spectra scan (Chemito, India) at 517 nm. The antioxidant activity of the sample was compared with known synthetic standard of (0.16%) of butylated hydroxyl toluence (BHT). The experiment was carried out in triplicates. The capacity of scavenging free radical was calculated as scavenging activity (%) =

$$\frac{\text{(Absorbance of control) - (Absorbance of sample)}}{\text{Absorbance of control}} \times 100$$

RESULTS AND DISCUSSION

The phytochemical composition of *Solanum torvum* fruit extracts were given in Table 1. Ethanol and Aqueous solvents were used to detect the various compounds. In the ethanolic solvent various phytocompounds like Tannin, Quinones, Flavonoids, Alkaloids, Cardio glycosides, Phenols, steroids, Coumarin and Betacyaninswere present in *Solanum torvum*.

However in Aqueous extract Saponins Glycosides, Steroids and Anthocyanin were absent and other compounds were found to be present. The presence of different phytocompounds in the plant are responsible for the various pharmacological properties. The phytochemical screening results of the extract are consistent with the results reported by Harborne (1998), where the author mentioned the presence of Tannins, Alkaloids. Saponins and Terpenoids in screened medicinal plants. Chah *et al*., (2000) also pointed out that *S. torvum* as a rich source of alkaloids, flavonoids, tannins, saponins, and glycosides.

Table.1 Phytochemicals screening of seed extracts of *Solanum torvum*

S. No	Phytochemicals	Different solvents used	
		Ethanol	Aqueous
1	Tannins	+	+
2	Saponins	+	-
3	Quinones	+	+
4	Flavonoids	+	+
5	Alkaloids	+	+
6	Glycosides	-	-
7	Cardio glycosides	+	+
8	Terpenoids	-	+
9	Phenols	+	+
10	Steroids	+	-
11	Coumarins	+	+
12	Anthocyanins	-	-
13	Betacyanins	+	+

'+' Present, '-' Absent

Anubha Arora, (2013) observed that the curative properties of medicinal plants are due to the presence of various secondary metabolites such as Alkaloids, Flavonoids, Glycosides, Phenols. Saponins, Steroids etc. These compounds served as natural antibiotics, which help the body to fight infections and microbial invasion (Santhi *et al*, 2011).Generally, plant extracts are rich in antimicrobial compounds. The antioxidant and nephroprotective properties of *S.torvum* flavonoids (Haenen *et al*. 1993), and their ability to chelate free iron, are involved in the reduction of DOX39-induced toxicity (Vaclavıkova *et al*. 2008). The nephro-protective action of phenolic compounds extracted from different parts of *S. torvum* was also mentioned by Loganayaki*et al*.(2010). Alkaloids are one of the largest groups of phytochemicals that have led to the invention of powerful pain killer medications (Kam and Liew,2002). Phenolic compounds are one of the most common and widespread secondary metabolite in plants. In the present study,the preliminary screening tests revealed the presence of various secondary metabolites in the fruit extracts of S*olanum torvum* which showed that the plant species have high medicinal values.

FT-IR Analysis: The FT-IR spectrum was used to identify the functional group of the active compounds based on the peak value in the region of infrared radiation**.** Fig. 1 shows the FTIR spectra of *S.torvum* fruit extracts. The peak at 3183.57 cm revealed the presence the alcohols (O-H stretch). The peak at 2515.00 cm refers to the presence of aldehyde(C-H stretch). The peak of 2360.71,2032.86,2000.71,1460.71 and 1190.71 cm indicate the presence of carbon dioxide, isothiocyanate, alkene, alkene and tertiary alcohol respectively.The functional group present in *S.torvum* are alcohol, aldehyde, carbon dioxide, isothiocyanate, alkene, tertiary alcohol and halo compound (Table 2). The presence of various functional group of phytochemicals could be responsible for the various medicinal properties of *S. torvum*. Similar research was carried out in FTIR spectral analysis of *Ampelocissus latifolia* extract and reported that the presence of functional groups such as metal carbonyl compounds, alkanes, amides and aliphatic fluoro compounds were responsible for potential medicinal properties (Parag *et al*., 2013). The results of the present study enlightens the fact that the plant is medicinally important and can be further taken for study for locating bioactive compounds to find its significance in the pharmaceutical industries. Scavenging activity for free radicals of DPPH has widely used to evaluate the antioxidant activity of natural products from plants.

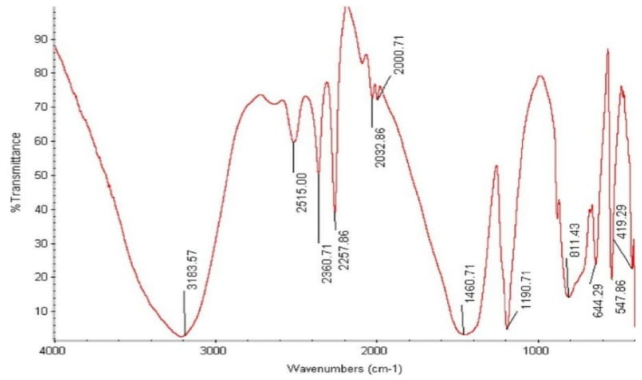

Figure 1. FT-IR Analysis of Solanum torvum

Table 2. FT-IR Analysis of *Solanum torvum*

S. No	Absorption Peak	Bond	Type of bond	Appearance
1	3183.57	O-H	Alcohol	Broad
2	2515.00	C-H	Aldehyde	Medium
3	2360.71	O=C=O	Carbon dioxide	Strong
4	2032.86	N=C=S	Isothiocyanate	Strong
5	2000.71	C=C=C	Alkene	Medium
6	1460.71	C-H	Alkene	Medium
7	1190.71	C-O	Tertiary alcohol	Strong
8	811.43	C=C	Alkene	Medium
9	644.29	C=C	Alkene	Strong
10	547.86	C-Br	Halo compound	Strong
11	419.29	C-1	Halo compound	Strong

Table 3. DPPH free radical scavenging activity of *Solanum torvum*

Concentration (mg/ml)	Percentage inhibition
20	33.33
40	55.55
60	77.77
80	88.88
100	100
IC_{50}	37.81

In this study the fruit extracts of *Solanum torvum* showed 100% of scavenging activity (Table 3). The results revealed that the activity was increased by increasing the concentration of the extract. The presence of phenols and flavonoids in the fruit extracts are responsible for its high radical scavenging activity. An IC_{50} value is the concentration of the sample required to scavenge 50% of the free radicals present in the system. In the present study the IC_{50} value was found to be 37.81mg/ml. Medicinal plants containing active chemical constituents with high antioxidant property play an important role in the prevention of various degenerative diseases (Selvam *et al*., 2013).Natural antioxidants from plants are potent and safe due to their harmless nature, many wild herbs have been investigated for their antioxidant properties (Lee *et al*., 2004). In this study the fruit extracts of *Solanum torvum* had shown the antioxidant and free radical scavenging activity, which revealed that the plants can be used as a potent source of natural antioxidant.

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CONCLUSION

The study revealed that the phytochemical analysis of *Solanum torvum*fruit extracts showed the presence of various phytochemicals such as Tannin, Quinones, Flavonoids, Alkaloids, Cardio glycosides, Phenols, steroids, Coumarin and Betacyanins. Presence of these bioactive compounds are responsible for the medicinal properties of the plant. The FTIR spectroscopic analysis also confirms the presence of various functional groups in *S.torvum* fruit extracts.

The high antioxidant activity of the fruit extracts are due to the presence of phenols and flavonoids. The study suggests that the fruits of the plant might be a potential source of natural antioxidants and the fruits can be a good candidate for novel phytomedicine which can be used to treat several diseases.

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