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ANTIOXIDANT POTENTIAL OF THE LEAVES AND ROOTS OF *SOLANUM SURATTENSE*

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Abstract

Solanum surattense is phenotypically highly polymorphic species and extensively used traditionally by the tribal people as anthelmintic, diuretic, antiarrhythmic, hypotensive, expectorant and carminative. The present study was assessed to evaluate the *in vitro* antioxidant activity in the leaves and roots of *Solanum surattense*. The enzymic antioxidants such as catalase (CAT) superoxide dismutase (SOD), glutathione reductase (GR), glutathione S-transferase (GSH) and glutathione peroxidase (GPX) and non enzymic antioxidants (ascorbic acid, α-tocopherol, reduced glutathione, flavonoids and carotenoids) were found to be present. The free radical scavenging activity such as inhibition of DPPH radical, *in vitro* lipid peroxidation, inhibition of superoxide generation and nitric oxide generation and hydrogen peroxide scavenging activity of different extracts of *Solanum surattense* were also assessed. The results obtained in the present study indicated that the *Solanum surattense* might be a good source of natural antioxidant.

Key words : *Solanum surattense*, kandangatri, antioxidants, free radical scavenging activity, lipid peroxidation.

Introduction

Plants are the basis of life on earth and are central to people's livelihoods (Sajem and Gosai, 2009). Historically, plants have provided a source of inspiration for novel drug compounds, their role is two fold in the development of new drugs that they may become the base for the development of a medicine, as plant derived medicines have made large contributions to human health and well being (Iwu, 2009). Free radicals [superoxide (O_2^-), hydroxyl radicals (OH^-) and nitric oxide (NO^-)] and other inactive species [hydrogen peroxide, hypophorous acid and peroxynitrite ($OONO^-$)] produced during aerobic metabolism in the body, can cause oxidative damage to aminoacids, lipids, proteins and DNA (Fang *et al.*, 2009). Antioxidants, the free radical scavengers can prevent pathological conditions of human body namely ischemia, anemia, asthma, arthritis, inflammation, neurodegeneration and aging process (Ploterait, 2009). Medicinal plants are the basis of many of the modern pharmaceuticals used today for various ailments, as it has a good source of natural antioxidants for medicinal use and related to radical mechanism (Kumplainen and Salonen, 2009).

Solanam surattense belongs to family *solanaceae* is also called as yellow berried nightshade (English), kantakari (Sanskrit), nelamulaka (Telugu), bhej baugana (Oriya), kandangatri (Tamil) and kateli (Hindi) (The Ayurvedic Pharmacopoeia of India, 2009). It is a very prickly perennial herb with woody base, berry yellow, green-blotched and surrounded by enlarged calyx. Seeds are glabrous (Dagar and Chagtai, 2009). The plant is reported to contain glucoalkaloids (solasodin, diosgenin and apigenin), fatty acids, resins and mucilages (Gupta and Dutt, 2009). The literature survey reveals that various parts of *Solanam surattense* have been used as a folklore medicine for curing various ailments like asthma and cough (root), rheumatism (leaf), sore throat (fruit), anthelmintic (fruit), as a culminative and dropsy (plant) for relief in burning sensation in the feet accompanied by vesicular watery eruptions (plant) (Gupta, 2009).

The present study was assessed to evaluate the "Antioxidant potential of the leaves and roots of *Solanum suratttense*" with the following objectives (i) to evaluate the enzymic and non enzymic antioxidant potential of *Solanum surattense* (ii) to investigate the free radical scavenging effects of *Solanum surattense*.

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Materials and Methods

Collection of the sample

The leaves and roots of *Solanum surattense* were collected from the nearby village, Coimbatore and dried in shade. They were then powdered and stored in airtight container at room temperature until use.

Assessment of the activities of enzymic and non enzymic antioxidants

The leaf and root samples of *Solanum surattense* were analysed for the enzymic and non enzymic antioxidants such as catalase (Luck, 1974), superoxide dismutase (Misra and Fridovich, 1972), glutathione reductase (David and Richard, 1983), glutathione S-transferase (Habig *et al.*, 1974), glutathione peroxidases (Rotruck *et al.*, 1973), ascorbic acid (Roe and Kuether, 1953), α-tocopherol (Rosenberg, 1972), reduced glutathione (Moron *et al.*, 1979), flavonoids (Cameron *et al.*, 1943) and carotenoids (Zakaria *et al.*, 1979).

Free radical scavenging activity

The leaf and root of *Solanum surattense* powder were subjected to extraction with solvent like petroleum ether, benzene, chloroform, acetone, methanol and water in soxhlet apparatus for 18–20 h. The solvents were evaporated to dryness and resulting solid residue was dissolved in dimethyl sulfoxide (DMSO) and used for further studies. Each extracts were used for the determination of free radical scavenging activity such as DPPH (Mensor *et al.*, 2001), inhibition of *in vitro* lipid peroxidation (Okhawa *et al.*, 1979), inhibition of superoxide generation (Mc Cord and Fridovich, 1968), nitric oxide generation (Green and Hill, 1984) and hydrogen peroxide scavenging (Ruch *et al.*, 1989) activity.

Statistical analysis

Statistical analysis was performed according to student t-test procedure. The values ($P < 0.01$) were considered to be significant.

Results and Discussion

Enzymic and non enzymic antioxidants

Activities of various enzymic antioxidants like catalase, superoxide dismutase, glutathione reductase, glutathione S-transferase and glutathione peroxidase and non enzymic antioxidants such as ascorbic acid, α-tocopherol, reduced glutathione, flavonoids and carotenoids in the leaves and roots of *Solanum surattense* were tested and results obtained are depicted in table 1.

From the table, it is clear that the leaves of *Solanum surattense* exhibited the maximum activities of catalase, glutathione reductase and glutathione peroxidase when compared to root. The activities of superoxide dismutase and glutathione S-transferase were found to be higher in the roots. The table reveals that there is a significant difference in the levels of ascorbic acid, carotenoids and polyphenols content between the leaves and roots of *Solanum surattense*. The leaves of *Solanum surattense* was found to be a considerable source of α-tocopherol, reduced glutathione and flavonoids than that of roots. The aqueous extract of *Mentha arrensis, Polygonoum hydropiper, Eugenia polyantha* and *Sauropus androgynus*, found to contain high polyphenol content and thereby possess good antioxidant activity (Wong *et al.*, 2006).

Since, *Solanum surattense* contains significant levels of all the enzymic and non enzymic antioxidants analysed it may prevent the risk factor of serious disease caused by free radicals such as cancer, heart diseases, diabetes, aging and cataract.

Inhibition of *in vitro* free radical scavenging activity

The free radical scavenging activity of *Solanum surattense* was determined by DPPH assay, inhibition of *in vitro* lipid peroxidation, inhibition of superoxide generation, inhibition of nitric oxide generation and scavenging of hydrogen peroxide. The ability of *Solanum surattense* to scavenge free radicals is shown in table 2.

DPPH is used as a substrate to evaluate the antioxidative activity (Chang *et al.*, 2008). All the extracts of *Solanum surattense* were capable of scavenging 1,1-Diphenyl -2-picryl hydrazyl (DPPH). The benzene extract of the leaves and roots of *Solanum surattense* was found to have a strong inhibition (53 per cent) against DPPH radical, whereas the petroleum ether fraction showed only 12 per cent of inhibition when compared with other extracts. The acetone fractions were found to have 36 per cent of inhibition against DPPH radicals when compared to others.

The percentage inhibition of *in vitro* lipid peroxidation exerted by the leaves of *Solanum surattense* in the extracts of petroleum ether, benzene, chloroform, acetone, methanol and aqueous was 12, 2, 3, 15, 8 and 3 per cent respectively. Among the six extracts of leaves and roots, the acetone extracts was found to possess a strong inhibitory action against *in vitro* lipid peroxidation than that of others.

Superoxide radical is the first product of oxygen univalent reduction and to generate other more reactive species (Ternay and Sorokin, 2008). The aqueous (root) extracts showed a strong inhibitory activity against superoxide radicals than the other solvent extracts. The

Table 1 : Effect of enzymic and non enzymic antioxidant in *Solanum surattense.*

Parameters analysed	*Solanum surattense*		
	Leaves	Roots	t value*
Enzymic antioxidants (U/g)			
Catalase[1]	41.3 ± 1.12	14.2 ± 1.0	21.32
Superoxide dismutase[2]	5.7 ± 0.72	46.2 ± 0.5	5.39
Glutathione reductase[3]	64.95 ± 0.65	0.90 ± 0.01	56.7
Glutathione-S-transferase[4]	1.82 ± 0.075	15.6 ± 0.47	75.98
Glutathione peroxidase[5]	144.9 ± 0.3	111.5 ± 0.9	41.23
Non enzymic antioxidants (mg/g)			
Ascorbic acid	3.4±0.2	7.1±1.2	2.52
α-tocopherol	3.0±0.6	2.23±0.37	2.47
Carotenoids	254±1.08	47.97±0.93	182.66
Polyphenols	15.9±0.3	22.2±1.95	46.9
Reduced glutathione	0.23±0.002	0.176±0.004	6.9
Flavonoids	2.22±0.07	1.09±0.14	4.2

Values are mean± SD of triplicates *- significant at 0.01 level

1. Amount of enzyme that brings about decrease in absorbance of 0.05 at 240nm
2. Amount of SOD that cause 50% reduction in the extent of NBT oxidation
3. millimoles of NADPH oxidized / min / g sample
4. millimoles of CDNB-GSH conjugates / min / g sample
5. millimoles of GSH utilized / minute

Table 2 : Inhibition of *in vitro* free radical scavenging activity of *Solanum surattense.*

% inhibition of free radicals / Extracts		DPPH	*in vitro* lipid peroxidation	Superoxide radicals	Nitric oxide radicals	Hydrogen peroxide radicals
Petroleum ether	Leaf	12	12	82	42	80
	Root	38	2	74	20	85
Benzene	Leaf	53	2	15	14	20
	Root	58	3	65	23	19
Chloroform	Leaf	18	3	78	53	14
	Root	48	4	48	21	8
Acetone	Leaf	45	15	82	4	12
	Root	36	25	56	18	17
Methanol	Leaf	30	8	35	25	6
	Root	44	13	19	40	3
Aqueous	Leaf	45	3	98	4	5
	Root	56	1	91	2	3

methanol extract of *Solanum surattense* roots exerted the leaf inhibition against superoxide radicals. A strong inhibitory action was observed against the superoxide generation in the aqueous extract of the leaves, whereas the least inhibition was observed in benzene extract of leaves of *Solanum surattense*. The chloroform extract of leaves shows more inhibitory (53 per cent) activity against nitric oxide radicals. The methanol extract of root shows high inhibitory activity. The acetone and aqueous extract of both the leaf and root was found to show least inhibition for nitric oxide radicals.

The result showed that the aqueous extract (80 per

cent) of leaf sample produce strong hydrogen peroxide scavenging activity. The scavenging effects of different extracts of roots were in the order of: petroleum ether> benzene>acetone> methanol> aqueous which were 85, 19, 8, 17, 3 and 3 respectively. H_2O_2 is the intracellular precursor for more reactive oxidants (Apostol *et al.*, 2009).

Since, *Solanum surattense* is exhibiting significant *in vitro* free radical scavenging activity, it may be effective to scavenge the free radicals and therefore reduce the risk for diseases caused by free radicals.

Conclusion

Hence, the leaf and root of *Solanum surattense* could serve as an effective source of enzymic and non enzymic antioxidants and a good free radical scavenger.

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