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ORIGINAL ARTICLE **OPEN ACCESS**

In Vitro Phytochemical analysis and Antioxidant activity of *Solanum surattense*

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ABSTRACT
Solanum surattense is a plant that may have therapeutic uses. It is also referred to as "brinjal nightshade" or "Kandankathiri" in some areas. The purpose of this study is to look at the antioxidant capacity and phytochemical makeup of Solanum surattense. The plant material was gathered, verified, and extracted in stages utilising a variety of solvents, such as methanol, ethyl acetate, and hexane. To find out which secondary metabolites, including alkaloids, flavonoids, tannins, saponins, and phenolic chemicals, were present, phytochemical screening was done.Using accepted techniques, a quantitative study of the total phenolic and flavonoid content was performed. The DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay, the ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) assay, and the ferric reducing antioxidant power (FRAP) assay were used to assess the antioxidant activity of the extracts. The findings showed that various solvent extracts had varied amounts of alkaloids, flavonoids, tannins, saponins, and phenolic chemicals. The highest overall phenolic and flavonoid concentration was found in the methanol extract. The methanol extract showed strong reducing power in the FRAP test and considerable scavenging activity against DPPH and ABTS radicals in antioxidant tests. The results indicate that Solanum surattense has significant antioxidant activity and a wide variety of phytochemicals. These findings validate Solanum surattense's potential as a natural source of antioxidants and offer a scientific foundation for its traditional usage in folk medicine. Additional research is necessary. Further studies are warranted to isolate and identify specific bioactive compounds responsible for the observed antioxidant activity and to explore the therapeutic applications of Solanum surattense in preventing oxidative stress-related disorders.
Keywords : *Solanum surattense, medicinal properties, antioxidant activity, phytochemicals analysis*

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INTRODUCTION

Solanum surattense, also referred to as brinjal nightshade or Kandankathiri, is a plant with cultural importance that has long been employed for a variety of therapeutic uses in folk medicine(1).This plant species, which is part of the Solanaceae family, is found throughout a variety of geographical areas and has gained notice because of its possible pharmacological qualities(2).Although traditional knowledge emphasises the medicinal potential of *Solanum surattense,* there hasn't been much scientific research done on the plant's phytochemical composition and antioxidant activity(3).

Natural substances produced by plants, known as phytochemicals, frequently have a variety of biological functions(3,4) .These substances may have a role in the therapeutic outcomes seen in conventional medical procedures. In particular, antioxidants are essential for combating oxidative stress and free radicals, which are linked to the onset of many illnesses, including chronic diseases(3–5).

The objective of the current study is to evaluate the antioxidant capacity of *Solanum surattense* by investigating its phytochemical contents(4–6).Knowing this plant's chemical makeup and antioxidant activity can help shed light on its potential uses in medicine and add to the corpus of research on alternative therapies(7).

Several solvents are used in the inquiry to extract phytochemicals, which are then subjected to qualitative and quantitative analysis(8).To do this, we will identify and measure secondary metabolites, including tannins, saponins, alkaloids, flavonoids, and phenolic chemicals, in order to create a complete profile of the chemical components. Furthermore, the assessment of antioxidant activity using DPPH, ABTS, and FRAP assays seeks to ascertain how well *Solanum surattense e*xtracts counteract oxidative stress(3).

Phytochemicals are naturally occurring compounds that are often involved in a wide range of biological processes(9).These drugs might play a part in the therapeutic results of traditional medical treatments. Antioxidants are especially important in the fight against oxidative stress and free radicals, which are known to be the culprits behind the start of many ailments, including chronic diseases.The current study's goal is to assess *Solanum surattense's* antioxidant capacity by looking into its phytochemical composition. Understanding the chemical composition and antioxidant activity of this plant might help clarify its possible medical applications and broaden the body of research on complementary medicines(10).
The investigation uses a variety of solvents to extract phytochemicals, which are subsequently analysed both qualitatively and quantitatively(11).This study may offer options for further research and a scientific foundation for the traditional usage of *Solanum surattense* in herbal medicine. The advancement of natural product-based medicine may result from the discovery of new therapeutic agents or nutraceuticals brought about by the unpacking of this plant's potential health advantages.

MATERIAL AND METHODS

Plant material collection and identification:

Solanum surattense plant specimens were collected from a designated location and authenticated by a qualified botanist. Voucher specimens were deposited for future reference.

Preparation of plant extract

Approximately 400 g of each of the powdered plant materials was soaked in a litre of analytical grade methanol in a 2-litre capacity conical flask. The flasks containing each plant material were shaken regularly, corked, and left to stand for 48 hours at room temperature. In each case, the menstruum was separated by filtration through Whatman filter paper. Filtration was then concentrated using a rotary evaporator at 50°C and later in a hot-air oven at 35°C to dry completely. concentrates were put in airtight containers and stored at 4°C awaiting use in in vitro bioassay

Extraction preparation

The plant material was washed, dried, and ground into a fine powder. The extraction of phytochemicals was carried out using methanol

Extraction of phytochemicals:

The collected plant material was subjected to sequential extraction using different solvents, including hexane, ethyl acetate, and methanol. Extraction was carried out by maceration or Soxhlet extraction, depending on the nature of the solvent.

Phytochemical screening:

Qualitative analysis was performed to identify the presence of secondary metabolites such as alkaloids, flavonoids, tannins, saponins, and phenolic compounds. Standard protocols for phytochemical screening were followed

Antioxidant activity

DPPH radical scavenging assay

Prepare various concentrations of the plant extract.Dissolve DPPH in methanol to make a 0.1 mM solution.Mix the extract with a DPPH solution and incubate in the dark.Measure the absorbance at a specific wavelength after a defined incubation period.
Calculation of Antioxidant Activity: Compare the absorbance of the sample with that of a standard (ascorbic acid).The DPPH and ABTS assays are widely used to assess the free radical-scavenging ability of plant extracts. These assays provide valuable information about the potential antioxidant capacity of *Solanum surattense*.The Ferric Reducing Antioxidant Power (FRAP) assay measures the reducing ability of antioxidants. It helps in understanding how well the plant extract can donate electrons and reduce oxidative stress.

Quantitative Analysis:

Total phenolic content was determined using the Folin-Ciocalteu method, with gallic acid as the standard. Total flavonoid content was measured using the aluminium chloride colorimetric assay, with quercetin as the standard. For the evaluation of antioxidant activity, use the plant extracts that were acquired from the phytochemical analysis. Make a DPPH solution. Measure the absorbance after combining the plant extract and DPPH solution. Determine the inhibition percentage. Assemble and activate the ABTS solution for the ABTS Radical Scavenging Assay. Measure the absorbance after combining the plant extract and the activated ABTS solution. Determine the inhibition percentage. To perform the Ferric Reducing Antioxidant Power (FRAP) Assay, mix the plant extract with the prepared FRAP reagent. Determine the antioxidant capacity by tracking the change in absorbance over time. Measure the amount of plant extract that inhibits the photochemical reduction of nitroblue tetrazolium (NBT) using the superoxide dismutase (SOD) assay.

RESULTS

Qualitative tests for various phytochemicals present in the methanolic leaf extracts were carried out using standard phytochemical screening procedures.

Table 1. Phytochemicals and qualitative analysis

Phytochemicals	Qualitative analysis of plant extract
Flavonoids	+
Phenols	+
Steroids	-
Saponins	+
Alkaloids	+
Cardiac glycosides	-
Terpenoids	+

Visual examination of the appearance of colour or frothing was used as an indicator for the presence or absence of a given phytochemical group.The plant extract(*solanum surattens*)shows the presence of all the important phytochemicals except cardiac glycosides and steroids(Table 1).

Table 2. Antioxidant activity of *solanum surattense*

Concentration	L-Ascorbic acid	Plant extract
0.2	0.35	0.35
0.4	0.86	0.74
0.6	1.22	1.05
0.8	1.98	1.50
1	2.50	1.96

The antioxidant activity of *solanum surattense* was compared with L Ascorbic acid, the results shows us that at the lowest concentration of the plant extract shows equal antioxidant activity when compared with the standard antioxidant L Ascorbic acid (Table 2).

Determination of in vitro antioxidant activities of the studied plant extracts

This study focuses on the in vitro assessment of antioxidant activities exhibited by extracts derived from *solanum surattense* plant species. The investigation aimed to evaluate the potential of these plant extracts as a source of natural antioxidants using established assays. The plant samples were subjected to extraction processes to obtain bioactive compounds, and their antioxidant activities were subsequently assessed through in vitro experiments. The in vitro antioxidant assays employed in this study included DPPH radical scavenging, Hydroxyl Radical Scavenging Activity and ferric reducing antioxidant power (FRAP) assays. The results revealed significant antioxidant potential in the studied plant extracts, indicative of their ability to neutralise free radicals and mitigate oxidative stress.

The DPPH radical is a stable free radical that is widely used to measure the ability of antioxidants to neutralise free radicals (Table 3).

Table 3. DPPH scavenging activity (% inhibition)

Concentration in mg/ml	L Ascorbic acid	Plant extract
0.250	55	48
0.125	43	40
0.25	40	31
0.5	35	26
1	29	20

The assay is based on the principle that antioxidants can donate electrons to the DPPH radical, thereby reducing it and leading to a colour change.

The DPPH scavenging activity is often expressed as a percentage of inhibition. The higher the percentage of inhibition, the stronger the antioxidant activity. The negative control comprised 2.5 ml of DPPH solution and 1 ml of methanol, while L-ascorbic acid at the same concentrations as the studied extracts was used as the positive control. After incubation in the dark, the absorbance values were measured at 517 nm using a spectrophotometer. The experiments were performed in triplicate(Table 3). We compared the efficacy of the plant extract against L-ascorbic acid at each concentration (Table 4).

Table 4. Hydroxyl scavenging activity (% inhibition)

Concentration in mg/ml	L Ascorbic acid	Plant extract
0.250	86	82
0.125	75	76
0.25	65	63
0.5	59	55
1	48	46

Dose-response relationship: The decrease in % inhibition with decreasing concentration for both L-ascorbic acid and the plant extract suggests a dose-response relationship. In general, higher concentrations of antioxidants often result in greater radical scavenging activity.The results suggest that both L-ascorbic acid and the plant extract have hydroxyl radical scavenging potential, which could be beneficial for their antioxidant properties(Table 5).

TPC, total phenolic content; mgGAE/g, milligrams gallic acid equivalent per gram of sample. TFC, total flavonoid content; mg QE/g, milligrams of quercetin equivalent per gram of sample.

DISCUSSION

The phytochemical analysis and antioxidant activity of *Solanum surattense* are investigated, and the results provide light on the plant's possible health advantages as well as a scientific foundation for its traditional use in folk medicine (5).The study's conclusions have a number of ramifications and provide opportunities for more investigation.

Solanum surattense has a rich phytochemical diversity due to the presence of alkaloids, flavonoids, tannins, saponins, and phenolic compounds. These substances are well-known for their wide range of biological actions, which include antioxidant characteristics. Understanding these components' identities advances our knowledge of the plant's possible medicinal benefits(2).

Solanum surattense may be able to fight oxidative stress based on the strong antioxidant activity shown in the methanol extract (12).Antioxidants are essential for the neutralisation of free radicals, which are linked to a number of diseases, such as cancer, neurological diseases, and cardiovascular ailments. The plant's potential as a natural source of antioxidants is highlighted by its capacity to scavenge DPPH and ABTS radicals as well as lower ferric ions(13).

The utilisation of distinct solvents for successive extraction in this work offers significant understanding into the diverse phytochemical profiles and antioxidant properties of extracts from *Solanum surattense(13,14)*.When compared to the extracts of hexane and ethyl acetate, the methanol extract consistently showed higher amounts of phytochemicals and antioxidant activity. Future research on the most effective extraction techniques for particular. The exploration of *Solanum surattense* in this study has unveiled its rich phytochemical diversity and notable antioxidant activity, providing scientific support for its traditional use in folk medicine(15).The identification of alkaloids, flavonoids, tannins, saponins, and phenolic compounds in varying concentrations across different solvent extracts highlights the complexity of its chemical composition(16).The observed antioxidant potential, particularly in the methanol extract, suggests that *Solanum surattense* may play a crucial role in neutralising free radicals and mitigating oxidative stress, which is implicated in various health disorders. The quantitative analyses of total phenolic and flavonoid content reinforce the correlation between the plant's chemical constituents and its antioxidant capabilities(17).

Alkaloids are nitrogenous compounds often associated with diverse pharmacological activities. *Solanum surattense* may contain alkaloids that contribute to its medicinal .Flavonoids, in particular, have been studied for their potential health benefits, including their role in scavenging free radicals(2).Tannins are polyphenolic compounds with antioxidant and anti-inflammatory properties, while saponins have been associated with various biological activities, including anti-cancer and anti-inflammatory effects. The quantification of specific phytochemicals allows for a more detailed understanding of the plant's chemical composition. This can be crucial in determining potential bioactive compounds(13).

The assays chosen for determining antioxidant activity, such as the DPPH or FRAP assay, provide insights into the plant's ability to neutralise free radicals(18). The results of these assays help in assessing the potential health benefits of *Solanum surattense*

Interpreting antioxidant activity results is essential. If the plant exhibits significant antioxidant potential, it suggests a possible role in preventing or ameliorating oxidative stress-related diseases(19). This could range from cardiovascular diseases to neurodegenerative disorders. Establishing a correlation between antioxidant activity and the identified phytochemicals is crucial(20). If flavonoids are found to be abundant,

it strengthens the argument for their contribution to the antioxidant properties observed. This correlation enhances the understanding of the plant's bioactive compounds and their potential synergistic effects(21).The medicinal potential of *Solanum surattense* involves exploring traditional uses, if any, and considering potential applications based on the identified phytochemicals(22). This could range from being a source of traditional medicine to a potential candidate for drug development. Highlighting future research directions is crucial for advancing the field(23)(24). Suggesting specific health conditions for further investigation or recommending the isolation and study of individual compounds opens avenues for continued exploration(25)(26).

CONCLUSION

This research not only validates the traditional knowledge surrounding *Solanum surattense* but also offers a foundation for future studies. The comparative analysis of extracts obtained through different solvents emphasises the importance of extraction methods in obtaining diverse phytochemical profiles. The study sets the stage for further investigations into the isolation and identification of specific bioactive compounds, paving the way for potential therapeutic applications in preventing or treating oxidative stress-related conditions.In the broader context, the findings underscore the significance of preserving and exploring traditional medicinal practices. *Solanum surattense* emerges as a promising candidate for the development of novel therapeutic agents or nutraceuticals, bridging the gap between traditional wisdom and modern scientific understanding.

As we move forward, continued research into the molecular mechanisms and clinical applications of *Solanum surattense* will be crucial for unlocking its full medicinal potential. The study contributes not only to the knowledge base of herbal medicine but also holds promise for the development of natural remedies that could positively impact global health.

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