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A review on the pharmaceutical activity of *Solanum surattense*

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Abstract

The traditional medicinal plants are believed to be an impotent source of phytochemicals with potential therapeutic effects, and caring for different diseases. The plant *Solanum surattense* has active phytochemicals like saponins, alkaloid, phenols, solamargine, solasurine, solasonine, gum, ascorbic acid, sterols, torvoside K, torvoside L, khasianine, glycosides, flavonoids, aculeatiside A, solamargine, glycoalkaloid, steroidal compound, steroidal alkaloids, polyphenol (caffeic acid), coumarins (esculentin and aesculin), steroids (carpesterol, campesterol, daucoesterol, stigmasterol, cycloortanol, and cholesterol), triterpinins, and sapogenin. This medicinal plant is widespread in pharmaceuticals and still presents a large source of active phytochemicals with different activity such as antimicrobial, anti-larvicidal, anthelmintic, antimalarial, antioxidant, antidiabetic, anti-asthmatic, and anti-cancerous. This review of the literature revealed new researches on the phytochemicals of *S. surattense* that how the active phytochemicals are performed different activities on the molecular level in vital aspects.

Keywords: *Solanum surattense*; Phytochemicals; Pharmaceuticals; Traditional medicinal

1. Introduction

Plants are used for the treatment of different diseases due to their potential source of phytochemicals. World health organization has been reported that 80% of the world's population is dependent on traditional medicine (1). Herbs are traditional medicine to alleviate that common ailment and to promote a healthy life. The advantages of plant-derived medicines are safety, efficacy, fewer side effects, and cultural acceptability (2). Plant extracts are more effective because they interact with specific chemical receptors within the body, and in a pharmacodynamic sense, drugs themselves (3). *Solanaceae* is a large family which has 2300 species and it includes herbs, shrubs, and small trees. This family is extensively known for the presence of natural products which have medicinal properties (4). The *Solanum surattense* belonging to the family *Solanaceae* is called kateli (Hindi), yellow berried or nightshade (English), kantakari (Sanskrit), kandangati (Tamil), nelamulaka (Tehgu), and bhejibaugana (Oriya) (5). This plant distributed in Malaysia, Ceylon, Australia, India, Southeast Asia, and Polynesia (6). *S. surattense* has a phytochemicals profile and various pharmacological properties. All parts of this plant, such as stem, leaf, fruits, flowers, and roots have medicinal properties. The present review of the literature aims to emphasize the different phytochemicals and pharmacological activities of *S. surattense*.

2. Phytochemistry

All plants have some specific phytochemicals. The investigations of phytochemical of *Solanum surattense* have several alkaloids (7). The phytochemical studies of *S. surattense* showed the presence of alkaloid, saponins, phenols (8), gums (9), solamargine, solasurine, solasonine (10), ascorbic acid (11), torvoside K, torvoside L, khasianine (12), sterols (13), flavonoids and their glycosides (14), aculeatiside A, and solamargine (15). Saiyed and Kanga, (16) have been

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investigated that fruit of *S. surattense* has bioactive components glycoalkaloid (solanosine), steroidal compound (carpesterol), and steroidal alkaloids (caffeic acid, coumarins, and triterpinoids). The fruits of *S. surattense* contain steroidal alkaloids like solanocarpine, solamorgine, and solanocarpidine (17). The other effective phytochemical which includes polyphenol (caffeic acid), coumarins (esculentin and aesculin), steroids (carpesterol, campesterol, daucosterol, stigmaterol, cycloortanol, and cholesterol), triterpinins, and sapogenin (lupeol and diosgenine) have also been reported (18, 19). The root of *S. surattense* has phytochemicals flavonoids, alkaloids, triterpenoids, saponins, tannins, glycosides, and steroids (20, 21). Heble *et al.*, (22) have been reported that β -sitosterol and diosgenin can be isolated from the callus tissue of *S. surattense*.

3. Pharmacology

The plant *Solanum surattense* is commonly used in Indian traditional medicine for curing various ailments such as gonorrhoea, rheumatism, respiratory diseases, asthma and fever (23), constipation, and diarrhoea (24). In the ayurvedic preparation of dashmularishta the constituent is the root of *Solanum surattense* which is used as a tonic for lactating mothers (25). The fruit of *S. surattense* traditionally uses for wound healing (26). The ethanol extract of *S. surattense* is exhibited pronounced wound healing capacity than other solvent extracts (27). Ahmed *et al.*, (28) have been reported that the fruit extract of *S. surattense* has diuretic and serum electrolyte regulation properties and significantly increased the urine output in a dose-dependent manner. Chauhan *et al.*, (29) have been reported that *S. surattense* is used for the treatment of urinary tract and kidney stone. The plant of *S. surattense* are also used in the treatment of cold, worms, insomnia (30), laxative, enlargement of the liver, aphrodisiac activities (31, 32), anti-nociceptive, molluscicidal (33) and antifungal activities (34). Pandey, (35) have been reported that the seed fumes of *S. surattense* were useful in the treatment of tooth pain and pain from gingival swellings. In India, Rajasthan Mukunda tribes traditionally use the root parts of *S. surattense* in the treatment of hernia (36). Alcoholic extracts of *S. surattense* leaf have significant antiulcer potentiality (37) than other solvent extracts. The pharmacological activities of *S. surattense* are antibacterial, antifungal, antinociceptive (38), antioxidant (39), antidepressant activity (40), hypoglycaemic (41), and larvicidal (42). Several scientific observations and evaluations of *S. surattense* show the following activities.

3.1. Antimicrobial activity

Several studies have been carried out that the plant products have effective antimicrobial activities. The ethanolic leaf extract of *Solanum surattense* has potential antimicrobial activity against *Staphylococcus aureus*, *Streptococcus species*, *Vibrio cholera*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Shigella dysenteriae*, and *Escherichia coli* (9). The ethanol and methanol extracts of *S. surattense* showed strong antibacterial activity against *Pseudomonas aeruginosa* (41). The fruit extract of *Solanum surattense* exhibited potential growth of bacteria *Micrococcus luteus*, *Staphylococcus aureus*, *E. coli*, *S. typhi*, *Pasteurella multiformis*, and *Vibrio cholera* (43). The extract of *S. surattense* has been evaluated for antifungal effectiveness against *Aspergillus niger*, *A. flavus*, *A. fumigates*, and *Trichoderma viride* (6). Mahmood *et al.*, (44) have been evaluated the antifungal effect of *S. surattense* against the growth of *Aspergillus fumigates* and *A. niger*. The methanolic seeds extract of *S. surattense* exhibited significant antifungal activity against *Aspergillus fumigates* and *Rhizopus oryzae* (45).

3.2. Anti-larvicidal activity

A large number of animals are vectors of different diseases in which the species of mosquito are also carriers of malaria, dengue, yellow fever, filariasis, and Japanese encephalitis. The population of mosquitoes can be controlled by the killing of mosquito larvae. The application of chemical and synthetic larvicides to control the larval stages of vectors resulted in the development of resistance and adverse effects on the environment and other non-target organisms. The fruit extract of *Solanum surattense* has larvicidal efficiency (46) against vector species of insects such as *Anopheles stephensi*, *A. culifaciens*, *Aedes aegypti*, and *Culex quinquefasciatus*. Mohan *et al.*, (47) has been investigated that, along with fruits and root of *S. surattense* also effective against larvae of *Culex spe* and *Anopheles stephensi*. Mahesh *et al.*, (48) have been reported that leaf extract of *S. surattense* possesses larvicidal efficacy against *Culex quinquefasciatus*.

3.3. Anthelmintic activity

World Health Organization (WHO) has been reported that more than two billion people were suffered from helminthiasis infection (49). Gunaselvi *et al.*, (50) has been reported that helminthiasis is a global and common disease in all age groups. The aqueous extracts of fruit powder of *Solanum surattense* have anthelmintic activities (5). Priya *et al.*, (51) reported that aqueous, hydroethanolic and ethanolic extracts of the whole plant of *S. surattense* have anthelmintic activity.

3.4. Antimalarial activity

Synthetic antimalarial drugs are associated with some side effects and develop resistance against malaria. This necessitates searching the safe and effective antimalarial drugs alternative to the existing one (52). Traditional antimalarial medicine like quinine and artemesin are obtained from plants which stimulate new research to find similar effective antimalarial phytochemicals from the plant sources (53). *In vivo* and *in vitro* uses of *S. surattense* without any toxicity have antimalarial activity (54). The dichloromethane extract of *S. surattense* has the strongest anti-plasmodial activity (49). Kaushik *et al.*, (55) have been reported that ethyl acetate extract of aerial part of *S. surattense* is effective against larva of *Plasmodium falciparum*.

3.5. Antioxidant activity

Health problems can be improved by the use of antioxidants and they can isolate from traditional medicinal plants. Antioxidants are capable of damaging the reactive oxygen species, which cause oxidative damage. Free radicals are reacting with biomolecules such as proteins, lipids, and nucleic acid which cause adverse effects in the body. The synthetic antioxidants cause undesirable effects on human health (56), which led to an interest, in natural antioxidants. Therefore, the determination of natural antioxidant compounds of plant extracts will be helpful for the development of new drug candidates for antioxidant therapy (57). *Solanum surattense* has potential natural antioxidants and can be used as a medicine against disease caused by free radicals (58). There is no increased interest in natural antioxidants like polyphenols, present in medicinal and dietary plants, which might help to prevent oxidative damage (59). Meena *et al.*, (60) evaluated that methanolic and ethanolic extract of *S. surattense* have potential antioxidant properties. Some plants are rich resources of antioxidants which potential effects against the reactive oxygen/nitrogen species. Leaf extract of *S. surattense* enhanced (61) the level of antioxidants enzymes, superoxides dismutase, and glutathione peroxidase in alloxan-induced animal models.

3.6. Anti-diabetic activity

The fruit of *Solanum surattense* has hypoglycemic potential activity in diabetic rats (62). Sridevi *et al.*, (63) have been studied the effect of *S. surattense* in diabetic rats brought back the rate of increase in blood glucose and decrease in insulin level to normal. The scientific investigation revealed the hypoglycemic potential in diabetic rats (41). The fruit and leaf extract possesses significant antihyperglycaemic activity (41, 62, 64).

3.7. Anti-asthmatic activity

Asthma is a respiratory disease. This disease affects the airway by an obstruction, eosinophilia, and bronchial hyperresponsiveness (65). Asthma can be control by the use of anti-asthmatic compounds. Babu *et al.*, (66) have been investigated the traditional plant *Solanum surattense* in Ayurveda, and Siddha is very effective in cure respiratory disorders. The clinical efficiency of *S. surattense* is more (67) effective on bronchial asthma.

3.8. Anti-cancerous activity

Some phytochemicals are rich sources of anticancerous components. The medicinal plant *Solanum surattense* has anticancerous efficiency due to the presence of phytochemicals like apigenin, lupeol, solamargine, and diosgenin (68). Kumar and Pandey, (69) have been reported that fruit extract of *S. surattense* has anti-cancerous activity on human lung cancer cell lines (HOP-62) and leukemic (THP-1) cell lines.

4. Conclusion

Medicinal plants are believed to be an important source of new phytochemicals with potential therapeutic effects. The use of different traditional medicines is widespread and plants still present a large source of novel active phytochemicals with specific activities. Synthetic medicines have adverse and side effects on the body. Therefore, the uses of phytochemicals are playing a major role in primary health care as therapeutic remedies in developing countries. The review of the literature concludes that the traditional medicinal plant *Solanum surattense* has a potent source of phytochemicals and it can use as antimicrobial, anti-larvicidal, anthelmintic, antimalarial, antioxidant, antidiabetic, anti-asthmatic, and anti-cancerous. It's also rival towards the new researches that how the different phytochemicals of *S. surattense* active in the biological system.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest.

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