



SYSTEMATIC REVIEW ON SOLANUM NIGRUM

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ABSTRACT

Traditional plants have been used from ancient time for the treatment of many diseases. *Solanum nigrum* L. is an important medicinal plant in many traditional health care system. This plant has very much importance as a medicinal plant. They are semi cultivated in most countries and largely utilized as a vegetable and fruit source. The leaves of *solanum nigrum* are used in inflammation, in skin diseases, as anti tuberculosis and are said to produce diaphoresis. Leaves are also used in dropsy, nausea and nervous disorders. This herb also exhibit anti-tumor activity, anti-neoplastic activity, anti-inflammatory and anti-convulsant activity and it is also used in the treatment of liver diseases. Fresh juice of this herb is used for curing fever and reduces pain. The leaves extract of *solanum nigrum* is used for wound healing. The wound healing process is not only complex but also brittle and it is susceptible to disruption or failure leading to the formation of non-healing chronic wounds. The concept of wound healing is changing day to day.

KEYWORDS: *Solanum nigrum*, Traditional plant, Anti-inflammatory, Wound healing.

INTRODUCTION

Herbs are now a days widely used because no side effect, and another reason is synthetic drug have more side effects on the human body. India is popularly known for traditional medicines *Solanum nigrum* L. is one of them. *Solanum nigrum* belongs from family (Solanaceae) also known as 'Black nightshade' in English, Makoi in Hindi, Kachchipandu in Telugu, Munatakali in Tamil, Piludi in Gujarati & Kamuni in Marathi. *Solanum Nigrum* is one of the proven anti-cancer as well as anti-inflammatory activities.^[1] Traditional societies include always exploited edible wild plants to grant an adequate level of nutrition. *Solanum nigrum* is an erect, divaricately branched, unarmed annual herb. Leaves are ovate or oblong, sinuate-toothed or lobed, glabrous; flowers 3-8 in extra-axillary drooping subumbellate cymes; fruits purplish black or reddish berries, seeds many, discoid, yellow, minutely. Black nightshade is a fairly rare herb and short-lived perennial shrub sometimes purple-green, hairy with glandular or simple, non-glandular hairs; prickles absent. In India, the 'plant' is noted for its antiseptic and antidiarrhetic properties and is given internally for cardalgia and gripe. An infusion of the plant is used as an enema for infants with abdominal upsets. It is found that *Solanum nigrum* L. contains the substances, like total alkaloid, steroid alkaloid, steroidal saponins and glycoprotein, exhibit anti-tumor activity. In Indian traditional medicine, the plant is used as a hepatoprotective agent. *Solanum nigrum* has extensively

used traditionally to treat various ailments such as pain, inflammation and fever. The gel formulation was designed by using Carbopol 940. The flavonoids fraction facilitates the healing process as evidenced by increase in collagen and protein and decrease in lipid peroxide in granulation tissue. The *solanum nigrum* gel on treated group shows epithelisation, collagen deposition. Thus enhanced wound healing may be due to free radical scavenging activity of the flavonoids fraction.^[2,3]

Advantages/Benefits^[4,5]

- *Solanum nigrum* is benefited to human from ancient time. It is used in various forms as a medicinal plant and it is also used as food.
- *Solanum nigrum* is best used to treat diuretic in cardiac dropsy.
- It is medicine for infirmities that needed cooling. It is good for cooling hot inflammation, testicular swelling, ringworm, etc.
- A decoction of the stalk, leaves, and roots of black nightshade is beneficial for wounds and cancerous sores.
- Freshly prepared extract of the plant is effective in treating cirrhosis of the liver and also works as an antidote to poisoning by opium.
- Ripe fruits of black nightshade are eaten by children during normal times, while all the affected people eat fruits of the plant during famines.

- The juice of the herb or an ointment prepared from it is externally applied to cure certain skin problems and tumors.

Dissadvantages/Side effect^[6]

Solanum nigrum is quite poisonous and if it is taken in higher dose it may be cause:

Nausea
Diarrhea
Headache
Dizziness

Description of *Solanum Nigrum*^[7,8,9]

Shape and size

It is short-lived perennial shrub, found in many wooded areas, and disturbed habitats. The height of plant is 30 to 120 cm, leaves 4.0 to 7.5 cm long and 2 to 5 cm wide; ovate to heart-shaped, with wavy or large-toothed edges; both surfaces hairy or hairless; petiole 1 to 3 cm long with a winged upper portion. The flowers which have petals greenish to whitish, recurved when aged and surround prominent bright yellow anthers. The berry is mostly 6 to 8 mm (0.24 to 0.31 in) in Diam. dull black or purple-black. In India, another strain is found with berries that turn red when ripe.



MICROSCOPY

Solanum Nigrum Petiole and midrib of leaf shows covering, uni seriate trichomes which are 3-5 celled and have pointed tips which shows arc shaped by collateral vascular bundle arrangement. Lamina of leaf shows anisocytic stomata scattered on both upper and lower surfaces but more abundant lower surface. Palisade ratio is 2-4 and Vein islets numbers are 7-10.

Chemical classification

Division – Embryophyta
Kingdom: Plantae – Plants
Subkingdom: Tracheobionta - Vascular plants
Superdivision: Spermatophyta - Seed plants
Division: Magnoliophyta - Flowering plants
Sub-division – Angiospermae
Class – Magnoliopsida - Dicotyledoneae
Order – Tubeflorae
Sub-order – Solanales
Family – Solanaceae
Genera – *Solanum*- nightshade
Authority: Linn.

Chemical constituent

Solanum nigrum contains alkaloid, steroid alkaloid, steroidal saponins and glycoprotein, exhibiting anti-tumor activity. Flavonoids, tannins, saponins, proteins,

carbohydrates, coumarins and phytosterols. It was also show the chemical characterization of osmotin-like protein from this plant. Fruits of *Solanum nigrum* have a high concentration of solasodine, but both the concentration and the absolute amount per fruit decreases with fruit maturation.

The berries of *Solanum nigrum* from New Zealand have recent studied found to contain four steroidal alkaloid glycosides, Solamargine, Solasonine, α and β -solanigrine. The berries of *Solanum nigrum* has found to contain a saturated steroidal genin, was identified as tigogenin by mixed melting point and IR spectroscopy. One spirostanol glycoside and two furostanol glycosides are isolated from a methanol extract of the stems and roots of *Solanum nigrum*. Six new steroidal saponins, solanigrosides C-H and one known saponin, degalactotigogenin, isolated from the whole plant of *Solanum nigrum*. Some researchers isolated 2 new steroidal saponins, named Nigrumnins I and II, with 2 known saponins were obtained from the whole plant of *Solanum nigrum*. Recently phytochemical analysis of *Solanum nigrum* shows the isolation of 2 novel disaccharides. Their structures was determined as ethyl β -D-thevetopyranosyl- (1-4) - β -D-oleandropyranoside and ethyl β -D-thevetopyranosyl- (1-4) - α -Doleandropyranoside, respectively, by chemical and spectroscopic methods. Seeds have high lipid content

and protein content and minerals elements (Mg being prominent) are considerable and *Solanum nigrum* oil is important source of linoleic acid.

Green unripe fruits contain glycoalkaloids and their eating is a toxic to human being as well as live stock that include solamargine, solasonine, solanine, α and β -solamargine, solasodin, solanidine (0.09-0.65%). The former two also found in leaves. Solanine is found in all parts of the plants, with the level increasing as the plant matures, though it is apparently modified by soil type and climate.

Uses^[10,11]

Culinary uses

- *Solanum nigrum* is used as a food since early time fruit is used as famine food 15th century in China. The ripe berries and boiled leaves of edible strains are eaten. The boiled leaves although strong and slightly bitter flavoured are used like spinach as horta and in fataya pies and quiches. The ripe black berries are as sweet and salty, with hints of liquorice and melon.
- In Kenya, the *S. nigrum* is a vegetable delicacy which when blanched and sauteed or boiled to soften then salted or sauteed and eaten with Ugali (meal product).
- In India, fruits are casually grown and eaten, but not cultivated for commercial use. In South India, the leaves and berries are habitually consumed as food after cooking with tamarind, onion, and cumin seeds. The berries are referred to as "fragrant tomato". Although not very popular across much of its growing region, the fruit and dish are common in Tamil Nadu, Kerala, southern Andhra Pradesh, and southern Karnataka.
- In South Africa, the very ripe and hand-selected fruits are cooked into a beautiful but quite runny purple jam.
- In Indonesia, the young fruits and leaves of cultivated forms are used. The fruit and leaves are eaten raw as part of a traditional salad or the fruit is cooked.
- It was imported into Australia from Mauritius in the 1850s as a vegetable during the gold rush but *it is* now prohibited for trade as a food by the Australia New Zealand Food Standards Code.

Medicinal uses

Leaves used for the treatment of rheumatic and gouty joints, skin diseases, also used for the treatment of tuberculosis, nausea and nervous disorders.

- The decoction and juice of the berries is useful in cough, diarrhoea, inflammations and skin diseases.
- A steroidal glycoalkaloid that can be used to make 16-DPA progenitor
- Anti-oxidative, anti-inflammatory and anti-pyretic effects of *Solanum nigrum* chloroform extract have also been found. The ethanol extract of dried fruits of *Solanum nigrum* showed a remarkable

hepatoprotective effect against CCl₄ induced oxidative damage on liver cells.

- It was a traditional European medicine used as a strong sudorific, analgesic and sedative with powerful narcotic properties, but was considered a "somewhat dangerous remedy"
- The most important property of *Solanum nigrum* is its anti-cancerous property.
- Infusions are used in dysentery, stomach complaints, wound pain and fever. The juice of the plant is used on ulcers and other skin diseases. The fruits are used as a tonic, laxative, appetite stimulant, and for treating asthma and "excessive thirst".

Mechanism of Action^[12,13,14]

Anti-inflammatory Activity

Inflammation is disorder caused by the release of leukocytes and various other complex mediator such as prostaglandins, leukotrienes, histamines, bradykinin, platelet activating factor, and IL-1 from tissues and migrating cells.^{47,48} Various drugs and extracts derived from grapes, turmeric, mint, clove, eucalyptus, lavender, and many more have been used to improve inflammation.

S. nigrum is used in the traditional Indian medicinal system to treat inflammation, edema, and mastitis. The most widely used method to study anti-inflammatory effects in animals is by inducing local edema in rat paw by injecting an irritant agent such as carrageenan. Methanolic extract of *Solanum nigrum* showed good dose-dependent anti-inflammatory effect on induced edema in the rat model isolated the mixtures responsible for the anti-inflammatory activity from the ethanolic extract of the *Solanum nigrum*. Leukotrienes as LTC₄ are the lipid mediators that are found in increased concentration in inflammatory reactions. Anti-leukotrienes are presently pre-scribed to treat various inflammatory diseases such as asthma and atopic rhinitis. (E)-ethyl acetate, one component isolated from *Solanum nigrum*, holds maximum inhibition for leukotrienes and thus could be considered as a potential anti-inflammatory therapeutic compound. The methanolic extract decreases the edema induced in hind paw. The methanolic extract of *Solanum nigrum* (375 mg/kg b.w.) has show significant anti-inflammatory.

Anti-allergic effect

Sepide Miraj *et al.*, 2016 Potential of the *Solanum nigrum* berries used in the treatment of asthma was evaluated. The petroleum ether extract of *Solanum nigrum* berries can inhibits parameters linked to the asthma disease.

Anti-seizure activity

Leaves of *Solanum nigrum* shows anti-seizure activity in chicks, mice and rats by intraperitoneal administration of the extract. The anti-seizure property of the *Solanum nigrum* was potentiated by amphetamine.

Hepatoprotective Activity

Hepatoprotective Activity/Liver Disease the protective effects of aqueous extract of solanum nigrum whole plant were evaluated in carbon tetrachloride. Glutathione-S-transferases (GSTs) family of enzymes involved in detoxification of xenobiotics. CCl₄ treatment reduces the expression of hepatic GST isoforms, GST Mu and GST Al, whereas, the GST Pi expression is up-regulated. Solanum nigrum extract restored appearance levels of the GST subunits to control levels. Whether the mechanism of action of solanum nigrum is attributed to its direct action on GST subunits or its neutralization of CCl₄ remains to be illuminated. Liver histopathological analysis also confirms that solanum nigrum reduced the incidence of liver lesions. The effect of *S. nigrum* extract was also evaluated on thioacetamide (TAA)-induced liver fibrosis in mice.

Consequently, far-away no clinical trials have been showed on solanum nigrum and its purified components. However, the reports on clinical trials showed with the use polyherbal formulations, such as Liv 60054 and Liv 52, 55 that contain solanum nigrum as one component or ingredients and have been used as hepatoprotective agents.

Anti proliferative Activity

Both the crude extracts and isolated components of solanum nigrum possess antiproliferative activity on various cancer cell lines. Crude extracts are usually prepared with dried berries, but it can also be prepared from the entire plant. The antiproliferative activities of the crude organic extract or isolated compounds were studied on tumor cell lines of liver (HepG2), colon (HT29 and HCT-116), breast (MCF-7), and cervical (U1424, 25 and HeLa27). The antiproliferative activity of these extracts was determined by studying the cytotoxicity of the extract on cells.

Therapeutic dose^[15]

Solanum nigrum is dose-dependent anti-inflammatory; antipyretic activities were detected using the chloroform extract of leaves were extract was administered subcutaneously in animal models at a dose of 20-200 mg/kg.

Kaushik and co-workers recognized anti-inflammatory activity using higher doses of an ethanolic extract of *S. nigrum* fruits 500 mg/kg.

CONCLUSION

This study shows that *Solanum nigrum* is a widely used plant in oriental medicine, has been shown to possess numerous activities such as antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic. Major compounds have been isolated and characterized. The plant *solanum nigrum* is mentioned as a component in several popular polyherbal formulations in the form of alcoholic or hydroalcoholic extracts, it is an attractive plant for formulating targeted drugs.

Solanum nigrum is widely used in folk medicine for wound healing activity.

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