

Pharmacological activities of *Solanum melongena* Linn. (Brinjal plant)

Mitali Das, Nilotpal Barua

Department of Pharmacology, Jorhat Medical College, Jorhat, Assam, India

Solanum melongena Linn. is a herbaceous plant, with coarsely lobed leaves, white to purple flowers, fruit is berry and are grown mainly for food and medicinal purposes. The plant contains flavonoids, tropane, glycoalkaloids, arginine, lanosterol, gramisterol, aspartic acid as important constituents. The plant is reported to have analgesic, antipyretic, antioxidant, anti-inflammatory, antiasthmatic, hypolipidemic, hypotensive, antiplatelet, intraocular pressure reducing, CNS depressant and anaphylactic reaction inhibitory activities. Traditional herbal medicine existed before the application of modern scientific method to health care and even today majority of the world population depends on herbal health care practices. This review gives an overview mainly on the medicinal uses, phytochemistry and pharmacological actions of *Solanum melongena*.

Key words: Brinjal, medicinal uses, pharmacological activity, phytochemistry, *Solanum melongena*

INTRODUCTION

The therapeutic efficacy of herbal medicines in India lead to the evolution of Ayurveda.^[1] Apart from Ayurveda, the traditional system of medicine, throughout the length and breadth of the country used many common plants/plant products as household remedies.^[2]

Solanum melongena is an economic flowering plant belonging to the family Solanaceae. The family contains 75 genera and over 2000 species.^[3] Members are mostly herbaceous plants, and the fruit is berry and seeds have large endosperm and are grown mainly for food and medicinal purposes.^[4]

It is widely distributed in India for its fruit.^[5] Various parts of the plant are useful in the treatment of inflammatory conditions, cardiac debility, neuralgias, ulcer of nose, cholera, bronchitis and asthma.^[6] Besides, having many traditional uses, *Solanum melongena* is reported to exhibit many important pharmacological actions.

Taxonomical Hierarchy

Kingdom: *Plantae*

Subkingdom: *Viridaeplanteae*

Infrakingdom: *Streptophyta*

Division: *Tracheophyta*

Subdivision: *Spermatophytina*

Infradivision: *Angiospermae*

Class: *Magnoliopsida*

Subclass: *Asteridae*

Order: *Solanales*

Family: *Solanaceae*

Genus: *Solanum* L.

Species: *Solanum melongena* Linn.

Vernacular Names

Sanskrit: Vartaku

English: Brinjal

Assamese: Bengena

Hindi: Baingan

Marathi: Vangi

Bengali: Begun

Malayalam: Kathrikka

Kannada: Badane

Telugu: Vankaya

Tamil: Kathirikkai.

Distribution

Solanum melongena is an important crop of subtropics and tropics and grown extensively in India, Bangladesh, Pakistan, China and Philippines.^[3]

MORPHOLOGY

The plant is herbaceous annual with erect or semi-spreading habits. It develops into bushy plant with large leaves that grow to a height of 60-120 cm.^[3]

Leaves

The leaf pattern [Figure 1] is opposite, large, single lobed and underside most cultivars, is covered with dense

Access this article online	
Quick Response Code:	Website: www.greenpharmacy.info
	DOI: 10.4103/0973-8258.122049

Address for correspondence: Dr. Mitali Das, Department of Pharmacology, Jorhat Medical College, Jorhat - 785 001, Assam, India.

E-mail: drmitalidas@gmail.com

Received: 25-08-2013; **Accepted:** 18-09-2013

woolly hair. The leaves may be with or without spines at the middle portion.^[3]

Flower

The flower [Figure 2] is complete, actinomorphic and hermaphrodite. Calyx five lobed; Corolla-five-lobed gamopetalous with margins of lobes incurved.^[3]

Fruit

The fruit [Figure 3] is fleshy berry borne singly or in clusters. The shape of the fruit varies from ovoid, oblong, obovoid or long cylindrical. The colour of the fruit is purple, purple black, yellowish, white, green variegated type of purple with white stripes, green with light green/white stripes or even combination of three colours.^[3]

Phytochemical Constituents

Fruits contain arginine, aspartic acid, histidine, 5-HT, delphinidin-3-bioside (nasunin), oxalic acid, solasodine, ascorbic acid, tryptophan, etc., Leaves contain chlorogenic, hydrocaffeic and protocatechuric acids.^[7] Some of the alkaloids present are tropane, pyrrolidine, quinazolizidine, steroid alkaloids and glycoalkaloids.^[8] Two steroidal saponins - melongoside L and melongoside M, and three new saponins melongoside N, O and P, have been isolated from seeds.^[9] Catechol oxidase has been isolated and characterised from *Solanum melongena*.^[10]

A bioflavonoid glycoside named solanoflavone is present in the leaves and fruits of *Solanum melongena*.^[11]

PHARMACOLOGICAL ACTIONS

The medicinal properties of the plant are derived from its chemical constituents. The plant's antioxidant property is due to the flavonoids. The terpenes (steroids) make it useful for bronchitis. Analgesic property is because of the alkaloids.^[12]

Analgesic Activity

Vohora *et al.*, 1984 tested the effect of crude alkaloidal fraction isolated from leaves of *Solanum melongena* on the central nervous system. It exhibited significant analgesic effect.^[13]

Mutalik *et al.*, 2003 evaluated the analgesic effect of leaves of *Solanum melongena* in albino mice with the doses of 100 mg, 250 mg and 500 mg/kg body weight. It showed significant dose-dependant analgesic activity in acetic acid-induced writhing test.^[6]

Antipyretic Activity

Mutalik *et al.*, 2003 evaluated the antipyretic effect of leaves of *Solanum melongena* at doses of 100 mg, 250 mg and 500 mg/kg body weight. It was found to produce significant



Figure 1: *Solanum melongena* leaves



Figure 2: *Solanum melongena* flower



Figure 3: *Solanum melongena* plant with fruits

antipyretic effect in a dose-dependant manner in yeast induced pyrexia in albino rats.^[6]

Antioxidant Activity

Gazzani *et al.*, 1998 carried out a study on protective activity of water-soluble component of *Solanum melongena* fruit on rat liver microsomes. Antioxidant property was determined in terms of protective activity (PA%) against rat liver microsomes, lipid peroxidation induced by CCl₄

and measured by malondialdehyde release. The juice of *Solanum melongena* was found to have a protective activity of 80% against lipid peroxidation.^[14]

Sudheesh *et al.*, 1999 studied the antioxidant activity of flavonoids from *Solanum melongena* in normal and cholesterol-fed rats in the doses of 1 mg flavonoid from brinjal. In the test it was found that concentration of malondialdehyde, hydroperoxides and conjugated dines were lowered significantly. The activity of catalase was elevated. The concentration of glutathione was also elevated.^[15]

Anti-inflammatory Activity

Han *et al.*, 2003 studied the anti-inflammatory effect of the water extract of *Solanum melongena* (SMWE) in PAR-2-mediated mouse paw oedema, induced by injecting trypsin or transcinnamoyl – LIGRLO–NH (2) 1 hour after oral administration of SMWE at the doses of 1, 5, 10 and 100 mg/kg. It showed significant inhibition of both paw oedema and vascular permeability.^[16]

Anti-asthmatic Activity

Bello *et al.*, 2004 carried out a randomized double-blind placebo control, clinical trial of *Solanum melongena* fruit at a dose of 89 ± 0.6 g of fruit/day in moderate to severe asthmatics. It was found that after 2 weeks of daily intake, the fruit of *Solanum melongena* significantly improved asthma symptoms and signs and disease severity score. It was found to have a salbutamol sparing effect.^[17]

Action on Anaphylactic Reactions

Lee *et al.*, 2001 investigated the effect of water extract of *S. melongena* (SMWE) on immunological and non-immunological anaphylactic reactions. Non-immunological anaphylactic reaction induced by compound 48/80 injection was completely inhibited by oral administration of SMWE at a dose of 1 g/kg body weight. Immunological anaphylactic reaction generated by sensitizing the skin with anti-dinitrophenyl IgE was significantly inhibited by SMWE at doses of 0.01-1 g/kg body weight. It also reduced TNF- α secretion from mast cells.^[18]

Hypolipidemic Action

Sudheesh *et al.*, 1997 tested the hypolipidaemic effect of flavonoids extracted from the fruits of *Solanum melongena*, administered orally at a dose of 1 mg/100 g body weight/day in normal and cholesterol-fed rats. It was found that flavonoids showed significant hypolipidaemic action.^[19]

Guimaraes *et al.*, 2000 carried out a clinical trial to observe the effects of *Solanum melongena* on the serum cholesterol and triglycerides of 38 hypercholesterolemic human volunteers, ingesting *Solanum melongena* for 5 weeks. It was observed that *Solanum melongena* significantly

reduced the blood levels of total and LDL cholesterol and apolipoprotein B.^[20]

Spasmogenic Activity

Mans *et al.*, 2004 studied the spasmogenic activity of methanolic extract of *Solanum melongena* leaves on guinea pig tracheal chains and its possible mechanisms of action using serial dilutions between 0.0025 and 2.5 mg/ml. It was found that the extract caused a dose dependant increase in the force of muscle contraction and concomitant use of histamine increased its spasmogenic action.^[21]

Action on the Eye

Igwe *et al.*, 2003 studied the effects of bolus consumption of 10 gm of *Solanum melongena* on visually active male volunteers to determine its ocular complications. Results showed miosis and lowering of intraocular pressure by 25%. It is suggested that *Solanum melongena* would be of benefit to patients suffering from raised intraocular pressure (glaucoma).^[4]

Antiplatelet and Calcium Channel Blocking Activities

Gul *et al.*, 2011 studied antiplatelet, calcium channel blocking activity of *Solanum melongena*. Different solvents were used to extract the fractions. Antiplatelet activity was monitored using dual channel Lumi aggregometer, calcium channel blocking activity was tested on guinea pig ileum using isolated organ bath assembly. The results showed that aqueous fraction, ethylacetate fraction and chloroform fraction potently inhibited platelet aggregation and calcium channel blocking activity.^[22]

CNS Depressant Activity

Vohora *et al.*, 1984 studied the effect of crude alkaloid fraction of *Solanum melongena* leaves on the central nervous system (CNS). The result showed that it has some CNS depressant activity.^[13]

Hypotensive Action

Shum and Chiu, 1991 investigated the cardiovascular action of *Solanum melongena* extract (SME) using *in-vivo* and *in-vitro* preparations. SME produced dose-dependent hypotensive responses in normotensive albino rats. The duration of response was also dose dependent.^[23]

CONCLUSIONS

Solanum melongena is a plant with many medicinal properties. Various parts of the plant are useful in the treatment of inflammatory conditions, cardiac debility, neuralgias, bronchitis and asthma.^[6] But detailed studies on chemical composition of the plant fractions, as well as different signalling pathways are not available. After

observing the pharmacological studies reported in the review it would be necessary to carry out further study to confirm the true potential of *Solanum melongena*, so that it may be clinically applicable and commercially viable.

REFERENCES

- Chatterjee A, Prakashi SC. Introduction. In: The Treatise on Indian Medicinal Plants. Vol. 1. New Delhi: National Institute of Science Communication (CSIR); 1997. p. i-xxi.
- Satyabati GV. History of pharmacology of medicinal plants in India. In: Patil PN, Gulati OD, Balaraman R, editors. Topics in the History of Pharmacology. Ahmedabad: BS Shah Prakashan; 2006. p. 22-3.
- Biology of Brinjal. Series of Crop Specific Documents. New Delhi: Department of Biotechnology Ministry of Science and Technology and Ministry of Environment and Forests, Govt. of India. 2011. p. 4-14.
- Igwe SA, Akunyili DN, Ogbogu C. Effects of *Solanum melongena* (garden egg) on some visual functions of visually active Igboos of Nigeria. *J Ethnopharmacol* 2003;86:135-8.
- In: Kanjilal UN, Das A, Kanjilal PC, De RN, editors. Flora of Assam. Assam: Published under the authority of the Govt. of Assam; 1939. p. III.
- Mutalik S, Paridhavi K, Rao CM, Udupa N. Antipyretic and analgesic effect of leaves of *Solanum melongena* Linn. in rodents. *Indian J Pharmacol* 2003;35:312-5.
- Rai MK, Pandey AK. Folk medicines of Gond tribe of Seoni district, M. P. India. *J Non Timber Forest Prod* 1997;4:61-9.
- Evans WC. A taxonomic approach to the study of medicinal plants and animal derived drugs. *Trease and Evans Pharmacognosy*. 15th ed. Edinburgh: WB Saunders; 2002. p. 33-5.
- Kintia PK, Shvets SA. Melongosides N, O and P: Steroidal saponins from seeds of *Solanum melongena*. *Phytochemistry* 1985;24:1567-9.
- Sharma RC, Rashid A. Isolation and characterization of catechol oxidase from *Solanum melongena*. *Phytochemistry* 1980;19:1597-600.
- Shen G, Van Kiem P, Cai XF, Li G, Dat NT, Choi YA, et al. Solanoflavone, a new biflavonal glycoside from *Solanum melongena*: Seeking for anti-inflammatory components. *Arch Pharm Res* 2005;28:657-9.
- Shrivastava A, Srivastava N, Kumar N. Phytochemical screening and study of analgesic activity of brinjal leaves. *Pharma Sci Mon* 2012;3:3028-33.
- Vohora SB, Kumar I, Khan MS. Effect of alkaloids of *Solanum melongena* on the central nervous system. *J Ethnopharmacol* 1984;11:331-6.
- Gazzani G, Papetti A, Daglia M, Berte F, Gregotti C. Protective activity of water soluble components of some common diet vegetables on rat liver microsome and the effect of thermal treatment. *J Agric Food Chem* 1998;46:4123-7.
- Sudheesh S, Sandhya C, Saraj KA, Vijayalakshmi NR. Antioxidant activity of flavonoids from *Solanum melongena*. *Phytother Res* 1999;13:393-6.
- Han SW, Tae J, Kim JA, Kim DK, Seo GS, Yun KJ, et al. The aqueous extract of *Solanum melongena* inhibits PAR2 agonist-induced inflammation. *Clin Chim Acta* 2003;328:39-44.
- Bello SO, Muhammad B, Gammaniel KS, Aguye AI, Ahmed H, Njoku CH, et al. Randomized double blind placebo controlled clinical trial of *Solanum melongena* L. fruit in moderate to severe asthmatics. *J Med Sci* 2004;4:263-9.
- Lee YM, Jeong HS, Na HJ, Ku JY, Kim DK, Moon G, et al. Inhibition of immunologic and non immunologic stimulation-mediated anaphylactic reactions by water extract of white eggplant (*Solanum melongena*). *Pharmacol Res* 2001;43:405-9.
- Sudheesh S, Presannakumar G, Vijiayakumar S, Vijayalakshmi NR. Hypolipidemic effect of flavonoids from *Solanum melongena*. *Plant Foods Hum Nutr* 1997;51:321-30.
- Guimaraes PR, Galvao AM, Batista CM, Azevedo GS, Oliveira RD, Lamounier RP, et al. Egg plant (*Solanum melongena*) infusion has a modest and transitory effect on hypercholesterolemic subjects. *Braz J Med Biol Res* 2000;33:1027-36.
- Mans DR, Toelsie J, Mohan S, Jurgens S, Muhringen M, Illes S, et al. Spasmogenic effect of a *Solanum melongena* leaf extract on guinea pig tracheal chains and its possible mechanism(s). *J Ethnopharmacol* 2004;95:329-33.
- Gul S, Ahmed S, Gul H, Kaneez FS. Investigating the protective effect of *Solanum melongena*. *Asian J Health* 2011;1:276-94.
- Shum OL, Chiu KW. Hypotensive action of *Solanum melongena* on normotensive rats. *Phytother Res* 1991;5:76-81.

How to cite this article: Das M, Barua N. Pharmacological activities of *Solanum melongena* Linn. (Brinjal plant). *Int J Green Pharm* 2013;7:274-7.

Source of Support: Nil, **Conflict of Interest:** None declared.

Announcement

Android App



Download
Android
application

FREE

A free application to browse and search the journal's content is now available for Android based mobiles and devices. The application provides "Table of Contents" of the latest issues, which are stored on the device for future offline browsing. Internet connection is required to access the back issues and search facility. The application is compatible with all the versions of Android. The application can be downloaded from <https://market.android.com/details?id=comm.app.medknow>. For suggestions and comments do write back to us.