

CNS Acting Potential of Natural Products with Special Reference to Family *Solanaceae*

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ABSTRACT

Solanum species belong to the family *Solanaceae*, with over 1500 species, worldwide. This type of species also contains medicinal plants such as tomato, potato, eggplant, bell, chilli, peppers and many species such as tropical Mapple, aquatic soda apple and sea walnut etc. Plants in this type of species, the family are usually rough hairy and often prickly, with a distinctive part of plants like flower, seed and fruits, and these numerous types of plants occurring from *Solanaceae* made up of rich sources of biotin, minerals, vitamins, iron and potassium salts. Mainly *Solanum* species plants contain steroidal glycoalkaloidal constituents and they are responsible for the various effectiveness in disease and disorders, most of plants contain solasodine and

solamargine and both are possessing anticonvulsants effects. During the study of many review and research, most of *Solanum* plants contain steroidal glycosides and they exert the anti-seizure effect because of the solasodine, solmine, solamarginine etc. which inhibit the increment of sodium voltage ions which is responsible for the convulsion.

Key words: *Solanum* plants, Anticonvulsants, Solasodine

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INTRODUCTION

Solanaceae is economically and widely distributed family in worldwide. The *Solanaceae* plants having a great asset of glycoalkaloids like solasodine, solanine and solamargine; extensive chemicals are atropine hyoscine, nicotine and other alkaloids used in traditional medicine for the treatment of epilepsy have been scientifically shown to have promising anticonvulsants activities in various animal models (PTZ and MES) for screening for anticonvulsants activity and can be a source of new anti-epileptic drugs (Sandabe UK, *et al.*, 2003; Bilal A, *et al.*, 2005).

LITERATURE REVIEW

Solarium nigrum

Solarium nigrum is abroad and highest quantity plants and distributed in tropical area. The leaves of this plant have anticonvulsants property in chicks, mice and rats (Wannang NN, *et al.*, 2004; Wannang NN and Bichi LA, 2005). The aqueous leaves extract of *S. nigrum* was found to act against MES, pentylenetetrazole and picmtoxin-induced seizures models. The activity may study by the doparminergic pathway and neuronal activity (Wannang NN, *et al.*, 2008).

The ethanol extract of *S. nigrum* used in three different dose that are (100, 200 and 300 mg/kg body weight) to evaluate anticonvulsants activity by employing carrageenan paw edema and other Supra-maximal electric shock methods. Ethanol's extract of *S. nigrum* produced anticonvulsants ($P < 0.05$) effect in dose dependent. The flavonoid category present in the berries might be a responsible active constituent for anticonvulsants activity (Ravi V, *et al.*, 2009).

Solanum sisymbriifolium

The active constituent solasodine exhibit mechanisms for effects could be the move inside of chloride ions through GABA receptors and inhibition of voltage-dependent Na^+ channels (responsible for neuron excitation in GABA receptors). In this, the author review that the further future study should focus on identification of exact mechanisms of action of solasodine for the potential CNS and neuronal excitation activity and properties using different an-

imal model (Chauhan K, *et al.*, 2011).

Solanum trilobatum L

This plant is mostly involved for the production of steroidal glycosides. It could be more viable to relax convulsions due to its steroidal-glycoalkaloids, in these plants the rich sources of alkaloid are solasonine (Shilpha J, *et al.*, 2013).

Pipernigrum

The ability of plant extracts and their isolated each compound indicates an important role for medicinal plants in the treatment of neurological disorders. The penetration of plant extracts and their protective effect on the blood-brain-barrier are dressed plant extracts have further relate with subjected to mood and cognition behavioral studies in humans (Lundstrom K, *et al.*, 2017).

Solanum melongena Linn

This plant was mainly evaluated for its anti-epileptic activity against experimental seizures with including various methods. The root's ethanolic extract protected mice against tonic convulsion induced by maximal electroshock model, Pentylene tetrazole and Picrotoxin method. The researcher was found that ethanolic extract upto a dose of 300 mg/kg exhibit the excitation of neuronal activity or may be sodium voltage channel (Kumar S, *et al.*, 2010; Sayyah M, *et al.*, 2002; Vohora SB, *et al.*, 1984).

Solanum torvum

Solarium torvum (*Solanaceae*) was identified as having significant anticonvulsant activity in zebrafish larvae with seizures induced by chemical method pentylenetetrazol (the GABA antagonist) and decrease the excitation of neurons with the inhibition of sodium voltage channels. In various ethano-medicines, extraction of this plant in water and other non-polar solvents *Solanum torvum* contains rich number of potentially pharmacologically active constituents including sapogenin steroidal chlorogenin (Challal S, *et al.*, 2014).

Solanum tuberosum

Potato juice has an activity against convulsion induced in mice through the maximum electro shock seizure model *via* binding to GABA receptors. This study suggest that potato juice extract

as food may have the capacity of influencing brain GABA-ergic activity and other activities of CNS. Naturally occurring chemical benzodiazepines that inhibit neuronal excitation have been identified in regular food such as wheat and potato (rich quantity), but there is still no evidence to prove clearly and not further identification of the researches (Muceniec R, *et al.*, 2008).

For curing the epilepsy disorder there are some medicinal plants such as a *figus sycomorus*, *sclercarya*, *Annona diversifolia*, and plants from *Solanaceae* family and solanum species, and many more used in traditional medicine and other crude drugs have found with anticonvulsant properties with effective action in animal models and may be a heat and novel source of newer antiepileptic drugs (Tyagi N, *et al.*, 2019).

Solanum indicum

The plant bulb extract of *C. jagus* and fruits extract of *S. indicum* protective against electrically induced convulsion with the former exerting greater anticonvulsant effect. Bulb extract of *C. jagus* and fruits extract of *S. indicum* possesses anticonvulsant effect and inhibition of GABA receptor and these findings collaborate with the ethno-medicine uses of this plant (Ohadoma SC, *et al.*, 2017). *S. indicum* also called *Solanum ferox* is an erect armed shrub and he with stiff yellow spines. It is commonly found in wet places in villages and sometimes planted near houses (Irvine FR, 1961).

Lycopersicon esculentum

Lycopersicon esculentum (tomato fruit) can protect from epileptic disorder. The petroleum ether and alcoholic extracts of tomato fruits shows antiepileptic effects. The chronic administration of tomato alcoholic extract significantly increased the GSH level and significantly decrease the MDA as well as protein concentration on MES induced biochemical changes in brain tissue, ether and alcoholic extracts of *Lycopersicon esculentum* fruits may contain the phyto constituents (solasdine) possessing anticonvulsant activity (Azharuddin M, *et al.*, 2013).

Solanum macrocarpon

The ethanolic root extract of *S. melongena* possess CNS activity and potential binding of GABA receptors. The effect of melongena in mice against tonic convulsion induced by maximum electroshock. The maximum dose of (300 mg/kg) drugs that inhibit voltage-dependent Na⁺ channels and voltage dependent chloride channel (Kumar S, *et al.*, 2010).

Solanum triflorum

Ethanolic extract of *Solanum trillorum* induced in mice to protect from tonic convulsion by experimental method. Convulsions produced by the chemical method by pentylene tetrazole and electrical method by maximal electroshock. The effect of extract was showed significant inhibition of lipid peroxidation in mice brain tissue as compared to control group of standard. Effects on reduced glutathion (GSH) level in mice brain tissue (Gowda G, *et al.*, 2012; Asuntha G, *et al.*, 2010).

Solanum surattense

Various extracts as alcoholic extracts of *Solanum surattense* used in medicine for treatment of various infections they cause by different organisms. The most effective activity shows the anticonvulsant activity due to its solanine active constituent. The plant shows anticonvulsants efficacy against maximum electro shock. The methanolic extract of this whole plant inhibit the GABA receptors voltage dependent channel (Gurunath HM, *et al.*, 2011; McDonald RL and Kelly KM, 1993).

Datura metal linn

Plant extracts which are used in prevalent traditional medicines for several years to treat epilepsy and other disease. Whole plant methanolic

extract show anticonvulsants effects on PTZ induced seizure. Due to the binding GABA receptors, decreased the intensity of seizures and reduced seizure duration with its synthesizing agents. Herbal medicines are very cheap in comparison to the conventional form of medication (Manchishi S, 2018).

Solanum lycocarpum

Ethanol extract and fractions obtained from leaves of *Solanum lycocarpum* were examined in order to determine their phenolic composition used as sedative of nervous system against epilepsy, antioxidant, antibacterial, anti-inflammatory, and cytotoxic potential. Particularly shown potent activity against oxidative stress (Morais MG, *et al.*, 2015; Munari CC, *et al.*, 2012).

Solanum macranthum

Solanaceae were remarkably prized for their alkaloid content which was used for poisoning and psychotropic effects, currently evaluation of the bioactive compounds of the *Solanaceae* family have gain great importance for their therapeutic application (Essien EE, *et al.*, 2012).

Solanaceae family is widely known to possess various bioactive phytochemicals such as solasodine, solasonine, solamargine, glycoalkaloids, sesquiterpenoids, cisplatin, doxorubicin, and docetaxel etc (Kalebar VU, *et al.*, 2019; Momin RK, Kadam VB, 2011).

Solanum procumbens

Ethanol leaves extracts of *Solanum procumbens* has activity against liver diseases, such as hepatitis, cirrhosis, high level of liver enzymes and anticonvulsant effect due to their isolated compounds (Hien TT, *et al.*, 2018). The crude extract remedy or dried materials of *S. procumbens* is considered as a major active ingredient in several tonic products and herbal teas for protection of liver and against conjunctivitis (Chi VV, 2012).

Solanum capsicoides

Its activities include anti-inflammatory, anticoagulant, antibacterial, antifungal, antiviral, anticancer, anti-hypertensive, antitubercular, anticonvulsant, anti-adipogenic, Cytochrome inhibiting, anti-hyperglycemic and neuroprotective (Dharman AK, Anilkumar M, 2018). Preliminary screening of phytochemical constituents of *S. capsicoides* as pharmacognostic tool for the raw drug industry (Akrouit A, *et al.*, 2010). The important ayurvedic formulations that use kantakari as a constituent (Sivarajan VV, Balachandran I, 1994).

Solanum fastigiatum

Researcher said that this plant has potential antioxidant and hepatoprotective properties. The extract showed inhibition against TBARS. The plant exhibited strong antioxidant activity in the DPPH (IC₅₀, 68.96 ± 1.25 µg/ml) assay (Sabir SM and Rocha JB, 2008).

S. asperum

S. asperum have potent and exist analgesic activity at moderate doses. Solanandaine is most important alkaloid and have neurological effects and inhibition of proliferation, it may also affect as anticonvulsant effects, because it contains glycosidal molecule that is Solanandaine (Pandithurai M and Murugesan S, 2018; Yadav R, *et al.*, 2016).

Solanum aviculare L.

It inhibited the production of reactive oxygen species as well as elastase release in human neutrophils model and should be considered as responsible for anti-inflammatory activity and aqueous extract of the plant shows antioxidant activity. This herb containing active constituent solamargine and it inhibits the process of increasing sodium voltage channels (Granica S, *et al.*, 2013).

***Solanum xanthocarpum* Schrad. and Wendl.**

Solanum xanthocarpum Schrad. and Wendl. commonly known as Yellow-Berried Nightshade (pili kateli), Steroidal alkaloid solasodine, present in fruits. Solasodine is very rich with a glycone property, and it exhibit the excitation of neurotransmitter (Kumar N, *et al.*, 2010).

S. xanthocarpum able to promote and increase epithelialization either by facilitating the increasing of epithelial cell (Dixit VP and Gupta RS, 1982).

Solanum verbascifolium

Solanum verbascifolium L. is used in prevalent traditional-medicine of East Asia contains highly beneficial active molecules which can be exploited beneficially in healthcare services and nutritional supplement. It is highly rich in protein and high amounts of carbohydrate, potassium, iron, sodium, calcium and phosphorus, vitamin A and vitamin C. *Solanum verbascifolium* L. (*Solanum erianthum*) is used in herbal medicines because their rich content of Solaverbascine (Roy A and Geetha RV, 2013; Sharma A, *et al.*, 2016).

Solanum aculeastrum

Leaves and berry methanolic extract of *S. aculeastrum*. Dunal (*Solanaceae*) is used in traditional medicine to treat various human diseases (antileishmanial) and LC50 (the concentration at which there was 50% inhibition of the growth of the test fungi) was calculated by extrapolation. This drug also grows up for our society to treat the epilepsy patient because it contain rich source of sugar and non-sugar molecules (Sharma A, *et al.*, 2016; Sharma A, *et al.*, 2017).

***Solanum betaceum* Cav**

Tree tomato is a neglected Andean crop considered as one of most important plant to affect neuroactivity. The active constituent of this plant as ethanolic alkaloids binding the site of glutamate (Adam G, *et al.*, 1980).

S. khasianum

Electrofusion has successfully been used for the production of somatic hybrid plants of *Solanum melongena* (eggplant) and *S. khasianum*. Both plants are rich in solasodine and solasodine are responsible for the inhibit exitment of sodium voltage gated channel (Koduru S, *et al.*, 2006).

Solanum anguivi

Three new glycosides named anguiviosides A-C were isolated from the fruits of *Solanum anguivi* and characterized as follows: solasodine, l-rhamnose, D-rhamnose, due to all these they are responsible for neurological activity and inhibit the excitation of channels that they are responsible for interference of normal neuronal activity (Cipollini ML and Levey DJ, 1997; Acosta-Quezada PG, *et al.*, 2011).

Solanum aethiopicum

The plant of *Solanum aethiopicum*, defence mechanism for inflammation, report has shown that *S. aethiopicum* possesses and exhibit ulcer protecting properties against experimentally induced ulcers in rats. The drug also reduces CNS depressants effects (Sihachakr D, *et al.*, 1988; Zhu XH, *et al.*, 2000). These can also be evaluated further for their anti-convulsant activity with the help of MES model (Walling LL, 2000; Anosike CA, *et al.*, 2012; Shrivastava N and Patel T, 2007; Prakash OM, *et al.*, 2013; Rani AS and Kumar A, 2014; Sharma A, *et al.*, 2019; Ajeet K, *et al.*, 2015).

CONCLUSION

During the study of many review and research, most of solanum plants contain steroidal glycosides and they exert the anti-seizure effect because of the solasodine, solmine, solamarginine etc. which inhibit the increment of sodium voltage ions which is responsible for the convulsion.

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